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Mobile Learning Futures – Sustaining Quality Research and Practice in Mobile Learning

15th World Conference on Mobile and Contextual Learning, mLearn 2016
Sydney, Australia, October 24-26, 2016
Proceedings
Preface

The 15th World Conference on Mobile and Contextual Learning – mLearn 2016 – was hosted by the University of Technology, Sydney, from October 24th to 26th, 2016, on the traditional lands of the Gadigal people of the Eora Nation. It represented a collaboration between the School of Education and the Faculty of Engineering and Information Technology. mLearn is the largest international conference on mobile and blended learning and this was the second occasion that it had been held in Australia.

The theme chosen for the conference was Mobile Learning Futures – Sustaining Quality Research and Practice in Mobile Learning. Sustainability and quality are the keys to mobile learning. Future mobile learning research needs to look beyond technological intervention per se. Instead, it must consider a more ecological approach, in which the conditions under which mobile technology contributes to learning are closely examined. The preconditions for sustainability in mobile learning may be broadly categorized as:

- Economic (financial considerations)
- Political (leadership, equity and policy)
- Social (community engagement)
- Technical (infrastructure, security, devices, applications) and
- Pedagogical (teaching and learning).

Issues to consider include teachers’ technological and pedagogic expertise when evaluating the effects of mobile technology on learning and the achievement of the goals of instruction. The subject matter is an important factor, as are also students’ attributes, background and age, and their mobile digital literacy. Authentic assessments that provide evidence of learning are needed. Other factors include institutional and expert leadership, the physical environment, resources, professional development, collegiality, and a commitment to mobile learning implementation and policy. This conference provided an international forum for researchers, mobile developers and educators from higher education, school education, vocational education, industry and international organizations to share knowledge, research and practice, and debate critical issues pertaining to sustainable futures for mobile learning. The keynote speakers – Mark Pesce, Susi Steigler-Peters and Professor John Traxler – all contributed their vision to this theme.

In addition to the keynote speakers, the 3-day conference program included the presentation of 39 full and short papers, 11 abstracts, a Doctoral Consortium, 12 posters, 4 panels, 1 workshop and several exhibitors. A key feature of the conference was the focus on pedagogy, with a special category for practitioners. These came from schools, higher education and industry. This provided a meaningful way of engaging with those who are responsible for mobile learning and teaching in the classroom. Their 20 often interactive, hands-on presentations were a new feature of mLearn, which we hope will be continued in future years.

mLearn 2016 was truly an international conference, with authors and delegates coming from a total of 17 countries: Australia, Canada, Costa Rica, Finland, Hong Kong, Ireland, Japan, Macau, Malaysia, the Netherlands, New Zealand, Qatar, Singapore, Spain, South Africa, the United Kingdom and the USA. Major themes of their papers and presentations included pedagogics which emphasized collaborative learning, student engagement, student interaction, situated and contextualized learning, experiential learning, blended learning, games-based learning and gamification, and learner-centred and personalized approaches. Technologies which featured included wearables, augmented reality, social media, tablets (iPads), student-owned devices (BYOD), student-generated multimedia, cloud technologies, mobile games and apps, enterprise-wide mobile platforms, the Internet of Things and sensors. Distance learning and responsive design, the digital divide and digital citizenship, workplace learning and academic professional development all featured. A notable feature of the program was the inclusion of several presentations on the topic of Indigenous people and mobile learning. Many disciplines were represented but particularly strong were language learning and the STEM disciplines, including science, the health sciences, IT and mathematics.

The diversity of authors was reflected in the International Review Panel represented by a total of 91 reviewers from Australia, Austria, Brazil, Canada, China, Fiji, Germany, Hong Kong, Indonesia, Ireland, Japan, Malaysia, the Netherlands, Palestine, Qatar, New Zealand, Singapore, South Africa, Sweden, Trinidad and Tobago, the United Kingdom and the USA. The Program Chair, on behalf of the Program Committee, would like to thank all the reviewers for donating their time and expertise to the reviewing process. This was
considerable, given that all submissions were double-blind refereed. All full and short papers were reviewed by a minimum of two, usually three or sometimes four reviewers. Other submissions were reviewed by a minimum of one, and often two reviewers. Several submissions were subject to a second round of reviewing, following required revisions.

In addition to the reviewers, we thank the authors and presenters for their interest in and dedication to mobile learning and for the excellence of their contributions, as evidenced in these Proceedings and during the presentations at the conference in Sydney. We would like to thank the sponsors from industry and the sponsoring institutions for their support, and all those who contributed to the success of the conference.

October 2016

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Papers
Faculty Attitudes towards the Use of Mobile Devices in EFL Teaching in a Saudi Arabian Setting

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Abstract. Faculty members at an English Language Centre in the Central-North of Saudi Arabia were surveyed on their skills and attitudes using mobile technologies in teaching English as a Foreign Language. Results indicated that Faculty members had a good level of skill and positive attitudes towards the use of mobile devices in EFL teaching. A number of statistically significant effects were identified for the independent variables age and teaching experience. Moderate positive correlations were found between Faculty members’ level of skill using mobile devices and both Faculty attitudes towards using mobile technology in English language teaching and intention to adopt mobile technology in English language teaching. Future use of ICT was predicted by attitudes towards the use of ICT. This relationship was moderated by a covariate: self-reported skills in ICT usage.

Keywords: teaching using mobile technologies, teaching English as a Foreign Language, attitudes towards mobile technologies

1 Introduction

Learning and teaching in the English language has become necessary because English is the global language for research, the Internet, trade, and business around the world (Almarwani, 2011). Learning English as a Foreign Language (EFL) is compulsory in many foundation or Preparatory Years at universities in Saudi Arabia (Ministry of Higher Education, 2013). With the growing numbers of students needing to study English at Saudi universities there is a lack of opportunities for students to practise their English language skills both inside and outside the classroom (Almarwani, 2011; Al-Shehri, 2012). Information and Communication Technology (ICT) initiatives are being implemented to support the learning and teaching of English in Saudi universities. Mobile technologies have the capacity to better support EFL instruction. However, the success of such initiatives can depend upon the attitudes of Faculty members towards mobile devices. Accordingly, it is important to explore Faculty perspectives of the use of mobile devices in language learning (Al-Shehri, 2012; Yang, 2013). This paper reports the partial results of research into Faculty attitudes towards the use of mobile devices in EFL teaching at a university in the central-north of Saudi Arabia.

2 Background

With the increase in use of mobile devices, students have come to use these devices for informal learning; especially for language learning (Abu-Al-Aish, 2014; Chen, 2013; Clough, Jones, McAndrew & Scanlon, 2008; Comas-Quinn, Mardomingo & Valentine, 2009; Gikas & Grant, 2013; Jantjies & Joy, 2013; Kukulska-Hulme, 2009). Among Saudi EFL students, the use of mobile devices is the most widespread means of communication outside of the classroom (Al-Shehri, 2012). Students sometimes use mobile devices in informal ways to support their learning of English, since mobile devices have diverse features that can be used for language learning. Studies have indicated that within the field of language education, mobile devices provide authentic opportunities to gain more language practice outside the classroom (Comas-Quinn, Mardomingo & Valentine, 2009; Fayed, Yacoub & Hussein, 2013; Godwin-Jones, 2011; Jantjies & Joy, 2013; Mahmoud, 2013). Despite the proliferation of mobile devices in the country, mobile learning approaches have not been formally adopted in Saudi universities.

The attitudes of educators towards technology can influence how technology will be used in the classroom. Educators who have positive attitudes towards technology are more likely to use technology in their
teaching. Negative attitudes constrain technology use (Gilakjani & Leong, 2012). In an English language learning context, Bordbar (2010) found that lecturer attitudes towards technology were influenced by competence in using the technology. Consequently, higher competence and positive attitudes would eventually result in higher use in the classroom.

Mueller, Wood, Willoughby, Rose and Specht (2008) identified two factors that predicted greater integration of computers into teaching: ‘experience with computers’ and ‘attitudes towards technology’. Previously, Albion (2001), had argued that ‘teachers’ self-efficacy for teaching with computers will depend, at least in part, on their self-efficacy for personal use of computers’ (p. 344). For this paper, we intend to validate this hypothesised relationship: Future use of computers as influenced by different predictors among which would be perceived skills in computer usage as well as attitudes towards the use of computers in teaching.

3 Study Context

The university study site is located in the central-north of Saudi Arabia. The university has a student population of 28,984 students and 1632 faculty members distributed across 15 colleges. The university offers both undergraduate and postgraduate degrees. All students attend on campus and there are separate campuses for male and females.

All Saudi universities have a preparatory year program to help bridge the gap between the public school system and the undergraduate system (Ministry of Higher Education, 2013). The main goal of a preparatory year program is to improve the knowledge and skills of secondary school graduates before they undertake their chosen majors at university. The preparatory year at the university aims to develop student skills across a range of subjects and prepare them for the world of university. One of these skills is proficiency in English. It is essential for students to develop their English because of greater demands on their English at the Tertiary level.

4 Method and Results

The study sample comprised 44 male Faculty members of the English Centre responsible for English language teaching at the university. For the purpose of this study, the required sample size for a confidence level of 95% with a margin of error of 5.0% was calculated to be 40 participants.

All Faculty members of the English Centre were invited to take part in a web-based survey. The web-based survey comprised eight sections:

1. demographics;
2. skill using computers;
3. skill using the Internet;
4. skill using mobile devices;
5. attitudes towards ICT;
6. attitudes towards using mobile devices in English language teaching;
7. current use of ICT in teaching; and
8. future intentions to use mobile devices in English language teaching.

The demographic section collected data on age, teaching experience, native English speaker, nationality (i.e., Saudi or non-Saudi) and the highest qualification of Faculty members. The remainder of the survey (sections 2-8) comprised items rated along a 7 point Likert scale. This paper presents partial results of this survey; in particular, sections 4, 6, and 8, which related specifically to mobile devices.

Demographics

In total, 40 Faculty members of the English Centre took part in the web-based survey out of a possible population of 44. This represented a response rate of 91%. The sample size was considered acceptable as it met the required sample size of 40 participants. The age range of survey respondents is presented in Table 1.
Table 1. Age Range of Respondents

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 29</td>
<td>7</td>
<td>17.5</td>
<td>17.5</td>
</tr>
<tr>
<td>30 - 39</td>
<td>15</td>
<td>37.5</td>
<td>55.0</td>
</tr>
<tr>
<td>40 - 49</td>
<td>9</td>
<td>22.5</td>
<td>77.5</td>
</tr>
<tr>
<td>50 and over</td>
<td>9</td>
<td>22.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

The teaching experience of respondents is presented in Table 2. The most commonly represented teaching range was 0-9 years (55.3%). The second most common was 10-19 years of teaching experience (26.3%).

Table 2. Teaching Experience of Respondents

<table>
<thead>
<tr>
<th>Teaching experience</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 9</td>
<td>21</td>
<td>55.3</td>
<td>55.3</td>
</tr>
<tr>
<td>10 - 19</td>
<td>10</td>
<td>26.3</td>
<td>81.6</td>
</tr>
<tr>
<td>20 - 29</td>
<td>4</td>
<td>10.5</td>
<td>92.1</td>
</tr>
<tr>
<td>30 and over</td>
<td>3</td>
<td>7.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Skill using Mobile Devices

Respondents were asked to rate themselves using a seven point Likert scale on their skill using mobile devices. These results are presented in Table 3.

Faculty members were considered to be reasonably skilled users of mobile technology and were capable of undertaking a range of tasks considered important for English language teaching. Skills associated with communicating with others had the highest overall mean scores (i.e., calling people, sending and receiving emails, and texting). Accessing information from the Internet was the next highest mean score, followed by sending pictures and movies to other people, and taking digital movies and applications from the Internet. Playing and uploading audio files and downloading and playing games and applications from the Internet were the two items with the lowest mean scores.

Table 3. Faculty skill using mobile devices

<table>
<thead>
<tr>
<th>Item</th>
<th>Never used</th>
<th>Not very skilled</th>
<th>Fairly skilled</th>
<th>Skilled</th>
<th>Moderately skilled</th>
<th>Highly skilled</th>
<th>Extremely skilled</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>To text/SMS people</td>
<td>1 (2.5%)</td>
<td>1 (2.5%)</td>
<td>5 (12.5%)</td>
<td>6 (15%)</td>
<td>5 (12.5%)</td>
<td>8 (20%)</td>
<td>14 (35%)</td>
<td>5.33</td>
<td>1.68</td>
</tr>
<tr>
<td>To call people</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (5%)</td>
<td>6 (15%)</td>
<td>2 (5%)</td>
<td>10 (26%)</td>
<td>19 (49%)</td>
<td>5.97</td>
<td>1.28</td>
</tr>
<tr>
<td>To download and play games or applications from the Internet</td>
<td>5 (12.5%)</td>
<td>2 (5%)</td>
<td>6 (15%)</td>
<td>3 (7.5%)</td>
<td>6 (15%)</td>
<td>12 (30%)</td>
<td>4.65 (21.3)</td>
<td>4.65</td>
<td>1.78</td>
</tr>
<tr>
<td>To send pictures or movies to other people</td>
<td>1 (2.5%)</td>
<td>2 (5%)</td>
<td>7 (18%)</td>
<td>3 (8%)</td>
<td>5 (13%)</td>
<td>9 (23%)</td>
<td>12 (31%)</td>
<td>5.15</td>
<td>1.78</td>
</tr>
<tr>
<td>To play, and upload audio files (such as MP3 or the radio)</td>
<td>4 (10%)</td>
<td>1 (2.5%)</td>
<td>8 (20%)</td>
<td>2 (5%)</td>
<td>8 (20%)</td>
<td>6 (15%)</td>
<td>11 (27.5%)</td>
<td>4.78</td>
<td>1.99</td>
</tr>
<tr>
<td>To access information/services on the web</td>
<td>1 (2.5%)</td>
<td>1 (2.5%)</td>
<td>8 (20%)</td>
<td>3 (8%)</td>
<td>5 (13%)</td>
<td>7 (18.5%)</td>
<td>13 (34%)</td>
<td>5.18</td>
<td>1.78</td>
</tr>
<tr>
<td>To take digital photos/movies</td>
<td>0 (0%)</td>
<td>3 (7.5%)</td>
<td>7 (17.5%)</td>
<td>5 (12.5%)</td>
<td>6 (15%)</td>
<td>6 (15%)</td>
<td>13 (32.5%)</td>
<td>5.10</td>
<td>1.73</td>
</tr>
<tr>
<td>To send or receive email</td>
<td>1 (2.5%)</td>
<td>4 (10%)</td>
<td>5 (12.5%)</td>
<td>9 (22.5%)</td>
<td>4 (10%)</td>
<td>17 (42.5%)</td>
<td>5.65 (4.25)</td>
<td>5.65</td>
<td>1.61</td>
</tr>
</tbody>
</table>

Attitudes towards Mobile Devices in EFL Teaching

Faculty members were asked a to rate themselves using a seven point Likert scale (strongly disagree, disagree, somewhat disagree, neither agree or disagree, somewhat agree, agree, strongly agree) on their attitudes towards using mobile devices in their English language teaching. The results are presented in Table 4.
Overall, Faculty members held positive attitudes towards the use of mobile technology in their English language teaching. When asked whether they would find mobile technology useful in their English language teaching, the majority of Faculty members were in agreement (64% somewhat agreed, agreed or strongly agreed). In response to statement whether mobile technology would be more convenient to access English language learning content than computers approximately half (48%) of Faculty members somewhat agreed, agreed or strongly agreed. However, 31% of respondents neither agreed nor disagreed to this statement. This suggests there is uncertainty over the convenience of mobile technology compared to computers. For ease of use of mobile devices, the majority of respondents (56% somewhat agreed, agreed or strongly agreed) believed they would be easy to use for English language teaching although 28% of respondents neither agreed nor disagreed. Nearly half of the respondents (47% somewhat agreed, agreed or strongly agreed) believed that it would take them some time to become comfortable in using mobile devices in English language teaching. The majority of Faculty members (56% somewhat agreed, agreed or strongly agreed) believed that they had the necessary skills to use mobile devices in English language teaching. The majority of Faculty members (54% somewhat disagreed, disagreed or strongly disagreed) that using mobile technology would be incompatible with the way they taught English. This suggests that for a majority of Faculty members mobile technology could be reasonably adopted into existing teaching practice.

The majority of Faculty members (54% somewhat agreed, agreed or strongly agreed) indicated they would be more willing to use mobile technology if there were adequate support. When asked whether they believed using mobile technology would be a good idea the majority of respondents (68%) somewhat agreed, agreed or strongly agreed with this statement. A similar proportion of Faculty members (62% somewhat agreed, agreed or strongly agree), that mobile technology would make the learning of English more interesting. Both of these can be considered an endorsement of the use of mobile technology in English language instruction.

Despite the positive attitudes towards mobile technology there existed anxiety around its use. For example, 29% of Faculty members somewhat agreed, agreed or strongly agreed that they would be anxious having to use mobile devices to support their English language instruction. Similarly, 31% of Faculty members somewhat agreed, agreed or strongly agreed believed that they would feel uncomfortable using mobile technology in class in case they could not work it properly. Despite such misgivings, the majority of Faculty members (68% somewhat agreed, agreed or strongly agreed) believed that overall mobile technology would be beneficial to their English language instruction and they would be willing to adopt it in the future. However nearly one quarter of Faculty members (24%) neither agreed nor disagreed. Again, this suggests some
degree of uncertainty amongst Faculty members of the utility of mobile technology in English language teaching.

**Intention to adopt mobile devices in EFL teaching**

Faculty members were asked to rate themselves using a seven point Likert scale (strongly disagree, disagree, somewhat disagree, neither agree or disagree, somewhat agree, agree, strongly agree) on their intentions towards using adopting mobile technology in their English language teaching. The results are presented in Table 5.

In general, Faculty members responded positively towards adopting mobile technology in their English language teaching. When asked whether they would like to see mobile technology incorporated into their English language teaching, the majority of Faculty members (60%) somewhat agreed, agreed or strongly agreed with this statement. Making English course materials available to students on mobile devices was also received positively with 79% of Faculty members somewhat agreed, agreed or strongly agreed. Using a Learning Management System was also endorsed by the majority of Faculty members (70% somewhat agreed, agreed or strongly agreed). However, quizzes and discussion forums were less positively received by Faculty members (55% somewhat agreed, agreed or strongly agreed and 47% somewhat agreed, agreed or strongly agreed, respectively).

<table>
<thead>
<tr>
<th>Item</th>
<th>SD</th>
<th>D</th>
<th>SwD</th>
<th>NAD</th>
<th>SwA</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would like to see mobile technology incorporated into my English language teaching</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>4.78</td>
<td>1.80</td>
</tr>
<tr>
<td>I would like my students to be easily able to view their English language course materials (syllabus, notes, assignments) on their mobile devices</td>
<td>(8%)</td>
<td>(5%)</td>
<td>(5%)</td>
<td>(22%)</td>
<td>(19%)</td>
<td>(22%)</td>
<td>(19%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like my students to be able to access Learning Management Systems (e.g., Moodle) for English language learning on their mobile devices</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>12</td>
<td>11</td>
<td>5.58</td>
<td>1.31</td>
</tr>
<tr>
<td>I would like my students to be able to take quizzes for their English language learning on their mobile devices</td>
<td>(0%)</td>
<td>(3%)</td>
<td>(3%)</td>
<td>(16%)</td>
<td>(18%)</td>
<td>(32%)</td>
<td>(29%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like my students to be able to participate in discussion forums for their English language teaching from their mobile devices</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>8</td>
<td>4.29</td>
<td>2.17</td>
</tr>
<tr>
<td>I would like my students to be able to view their English language teaching materials</td>
<td>(0%)</td>
<td>(18%)</td>
<td>(10%)</td>
<td>(13%)</td>
<td>(24%)</td>
<td>(10%)</td>
<td>(21%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean score of respondents in the 0-9 years age range (M=5.86, SD=1.07) was significantly different to respondents in the 20-29 years age range (M=5.32, SD=1.32) The mean score of 30-39 years age range (M=4.93, SD=1.21) was also was significantly different to respondents in the 40-49 years age range.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**One-Way Analysis of Variance (ANOVA)**

One-way Analysis of Variance was conducted to determine if there were any statistically significant differences between respondents’ attitudes towards the use of mobile device in English language learning and their age range. A statistically significant difference was identified for one item: *I believe it would be more convenient to access English language learning content via a mobile device over using a computer: F(3,35) = 7.02, p = .001*. Post hoc comparisons using the Bonferroni test indicated that the mean score of respondents in the 20-29 years age range (M=5.86, SD=1.07) was significantly different to respondents in the 40-49 years age range (M=3.00, SD=1.32) The mean score of 30-39 years age range (M=4.93, SD=1.21) was also was significantly different to respondents in the 40-49 years age range.

One-way Analysis of Variance was conducted to determine if there were any statistically significant differences between respondents’ attitudes towards the use of mobile device in English language learning and their years of teaching experience. Statistically significant differences were identified for two items. First, *I believe it would be more convenient to access English language learning content via a mobile device over using a computer: F(3,33) = 4.77, p = .007*. Post hoc comparisons using the Bonferroni test indicated that the mean score of respondents in the 0-9 years teaching experience range (M=5.10, SD=1.33) was significantly different to respondents in the 10-19 years teaching experience range (M=3.20, SD=1.69). The second item was *I feel that I would have the knowledge necessary to use mobile devices to support my English language teaching: F(3,33) = 3.56, p = .025*. Post hoc comparisons using the Bonferroni test indicated that the mean score of respondents in the 0-9 years teaching experience range (M=5.25, SD=1.41) was significantly different to respondents in the 10-19 years teaching experience range (M=3.70, SD=.95).
One-way Analysis of Variance was conducted to determine if there were any statistically significant differences between respondents’ intentions to adopt mobile device in English language learning and their age range. No statistically significant differences were identified for items in this category.

One-way Analysis of Variance was conducted to determine if there were any statistically significant differences between respondents’ intentions to adopt mobile device in English language learning and their years of teaching experience. No statistically significant differences were identified for items in this category.

**Pearson Product-Moment Correlation**

Pearson product-moment correlation coefficients were computed to assess the relationship between Faculty members’ level of skill using mobile devices and both their attitudes towards using mobile technology in English language teaching and intention to adopt mobile technology in English language teaching. There was a moderate positive correlation between both Faculty members’ level of skill using mobile devices with both Faculty attitudes towards using mobile technology in English language teaching \( (r = .440, N = 39, p = .005) \) and intention to adopt mobile technology in English language teaching \( (r = .480, N = 38, p = .002) \). These positive correlations provided us with the foundation to undertake the next level of analysis: hierarchical multiple regressions.

**Hierarchical Multiple Regressions**

Hierarchical Multiple Regressions, or regressions in general aim to derive a mathematical equation or an estimated regression line, that depicts significant relationships between independent and the dependent variables. This inquiry recognizes that multiple regressions are at best an indication of correlations that exist between the key variables of interest. Causal relationships, or whether or not the independent variables in this inquiry cause changes in the dependent variable can best be achieved by conducting experiments (or quasi-experiments). For this exploratory inquiry, what is being attempted is primarily a correlational study.

Hierarchical multiple regression analyses were used to explore the relationship between predictor and criterion variables of interest. Employing this type of analysis enables the careful investigation of various effects that occur between dependent variables and a host of independent variables including covariates. The use of hierarchical regression allows us to be able to measure the impact of these different variables (Raudenbush & Bryk, 2002).

**Variables of Interest**

There were three groups of variables of interest for our hierarchical multiple regression analysis: (1) the dependent variable; (2) independent variables and (3) covariates. FutureUse (intended future use of ICT) was the dependent variable for this study. This scale consisted of 5 items \( (\alpha = .872) \). One set of independent variables was composed of demographic indicators of the respondents (i.e. Age range, Years of Teaching and Educational Qualifications). The other set of independent variable PercUsefulICT referred to the Perceived Usefulness of ICT. This scale consisted of 9 items \( (\alpha = .948) \). The final variable ICTSkillTeach corresponded to the respondents’ self-reported measures of skills in using ICT for teaching. This scale consisted of 15 items \( (\alpha = .982) \). For this analysis, ICTSkillTeach was treated as a covariate. The basic descriptive Statistics and Cronbach Alpha for these items are presented in Table 6.

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Use of ICT (FutureUse)</td>
<td>5.065</td>
<td>1.317</td>
<td>.872</td>
</tr>
<tr>
<td>Perceived Usefulness of ICT (PercUsefulICT)</td>
<td>4.879</td>
<td>1.263</td>
<td>.948</td>
</tr>
<tr>
<td>Self-reported ICT Teaching Skills (ICTSkillTeach)</td>
<td>4.578</td>
<td>1.536</td>
<td>.982</td>
</tr>
<tr>
<td>Age Range</td>
<td>38.88</td>
<td>10.321</td>
<td></td>
</tr>
<tr>
<td>Years of Teaching</td>
<td>10.57</td>
<td>9.151</td>
<td></td>
</tr>
<tr>
<td>Educational Qualifications</td>
<td>3.26 (Higher Diploma)</td>
<td>.993</td>
<td></td>
</tr>
</tbody>
</table>
Preliminary Models

A multiple regression was performed utilizing future use of ICT (FutureUse) as the dependent variable and selected demographic variables (i.e., Age range, Years of Teaching and Educational Qualifications) and Perceived Usefulness of ICT as independent variables. The variable ICT self-efficacy was also included as a covariate. These three sets of predictors were analysed in order to determine how these impact the decision of lecturers to adopt future use of ICT.

Does ICT self-efficacy, identified in this analysis as a covariate, have an impact on the teachers’ decision as regards future use of ICT? Model I produced a statistically significant result $F (1, 34) = 11.722$, $p < .05$. Model I accounted for 24% of the variability, as indexed by the Adjusted $R^2$ statistic. The covariate ICT self-efficacy reported a statistically significant standardized coefficient of $B = .512$, $p < .05$.

What happens if demographic variables and the variable of Perceived Usefulness of ICT (reported in the literature as the strongest predictor of future ICT adoption) were included in the analyses? Model II produced a statistically significant result $F (5, 34) = 8.269$, $p < .05$. Model II accounted for 51.7% of the variability (a huge increase) as indexed by the Adjusted $R^2$ statistic. What is also notable is the standard error of the estimate decreased from 1.145 (Model I) to .913 (Model II). The demographic variables did not register statistically significant coefficients. However, the independent variable Perceived Usefulness of ICT registered a statistically significant standardized coefficient of $B = .530$, $p < .05$ while the covariate (ICT self-efficacy) adjusted to $B = .342$, $p < .05$.

One of the issues that could compromise the analytical power of regressions is the existence of multicollinearity. Statisticians and social science researchers caution about the need to detect “adverse effects of multicollinearity” and how these conditions prove highly unreliable and problematic (Mansfield & Helms, 1982, p. 158) One of the most common tests employed in detecting multicollinearity is the Variance Inflation Factor (VIF): Specifically, a VIF of “10 or even as low as 4 (equivalent to a tolerance level of 0.10 or 0.25)” indicate the presences of unwarranted or severe multicollinearity (O’Brien, 1994, p. 674) Tests to detect multicollinearity on Model II, reveal that the highest VIF recorded for the coefficients is 2.142 which corresponds to the Independent Variable “Age Range.” All other VIF statistics of the model coefficients were well below the 4.0 threshold.

5 Discussion and Conclusion

Our purpose in this paper was to engage in contemporary debates about factors that have been purported to explain how lecturers used ICT in their teaching. Delving into the most current literature, we intended to interrogate the ideas of Mueller et al. and Albion who have proposed theories in relation to factors that predict ICT usage by teachers in specific contexts. teaching. Using empirically collected data in a Saudi Arabian higher education context, we intended to validate the hypothesised relationship between future use of computers as influenced by different predictors among which would be perceived skills in computer usage as well as attitudes towards the use of computers. In order to do this we undertook an analysis of our data through a discussion of our main themes: (1) demographics; (2) One-Way Analysis of Variance; and (3) Hierarchical Multiple Regressions.

Our Key Findings: Demographics and One-Way ANOVAs

Our investigation of demographic information of respondents alongside the conduct of One-way Analysis of Variance (ANOVA) produced interesting results in relation to skills in using ICT as well as in regard to self-reported attitudes towards the use of technology:

Generally, our respondents are faculty members who considered themselves to be reasonably skilled users of mobile technology. They also confidently reported that they were capable of undertaking a range of tasks considered important for English language teaching. For educational leaders and policy-makers, this is welcome news, as it indicates that university lecturers manifest that they possess skills in ICT use. In an educational context, where ICT use becomes a premium, the respondents in this study can be described, we argue, as confident users of ICT.

Overall, our respondents saw themselves as faculty members who hold positive attitudes towards the use of mobile technology in their English language teaching. This particular piece of very relevant information also bodes well for educational leaders and policy makers: Our respondents comprising of lecturers in the
higher education sector located in a Saudi Arabian context identify themselves as skilled users of ICT, specifically mobile technologies. More importantly, they acknowledge possessing openness and positive aspirations towards the use of mobile technologies in teaching.

**Our Key Findings: Hierarchical Multiple Regressions**

With the empirical knowledge that our respondents report confidence in their skills in using ICT, specifically mobile technologies complemented by positive attitudes and openness towards ICT and mobile technologies, the next step is to see whether possible conceptual models can be identified to map these hypothesised relationships. Interrogating theories from Mueller et al and Albion, our study was able to validate one specific hypothesized relationship: Future use of ICT is predicted by attitudes towards the use of ICT. Moreover, this relationship is moderated by a covariate: self-reported skills in ICT usage. This particular validation can be very helpful for educational leaders, policy-makers and practitioners. In terms of investments in relation to professional development initiated by educational leaders and policy-makers, as evidence by our empirical findings, demographic variables of age, educational qualifications and years of teaching do not matter. What does matter is ensuring that higher education lecturers are able to gain an appreciation of the value of ICT, perhaps by establishing cultures and infrastructure in schools that support these. Doing these might improve their attitudes towards ICT use. For educational stakeholders in general, particularly practitioners: engaging with technology and deepening one’s skills, as proven by our study, is a positive moderator towards the decision of adopting technology use in teaching.

6 References


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The Use of Wearable Technologies in Australian Universities: Examples from Environmental Science, Cognitive and Brain Sciences and Teacher Training

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Abstract. Innovation and increased access to wearable technologies are poised to inspire a new generation of technology-enhanced learning environments. Wearables provide students and teachers with hands-free access to contextually-relevant knowledge, which can be displayed as a 3D virtual world or overlaid on smart glasses, accessed via a smart watch or wristband, or used for providing biofeedback through EEG monitoring. A wide range of wearable devices is available, and it is often difficult for educators to introduce these advanced techniques into higher education contexts. This paper presents three examples of the kinds of educational applications that have been delivered in Australia and indicate key considerations for educators aiming to develop their practice and embed wearable tools into the classroom.

Keywords: wearable technologies, technology enhanced learning, head mounted displays, brain imaging, augmented reality, virtual reality.

1 Introduction and Rationale

There has been a rapid increase in the range of wearable technologies available to educators. Australian universities have set out their first initiatives for using wearable technologies in higher education and related activities. For instance, the University of South Wales uses virtual reality (VR) head-mounted displays in engineering (UNSW 2014), the University of Canberra (Canberra 2014) and Macquarie University (Macquarie 2015) have hosted workshops on the use of wearable technologies in education and training, and the University of Western Australia has used Fitbits in their Self eHealth Challenge (Glance et al. 2016). These are only the first steps into a more comprehensive use of wearable technologies in a wide variety of fields and activities in Australian higher education in learning, health and awareness raising contexts.

Wearable technologies are now available for use in a variety of higher education contexts, but in order for educators to harness the learning and teaching opportunities of wearable technologies, it is crucial for them to develop an understanding of the pedagogical application and technological and logistical issues associated with the technology. However, the scarce examples of application in higher education together with the limited literature on the use of wearable technologies for learning and teaching indicate that the possibilities of wearable technology in higher education are not yet well understood. While there is a need for more comprehensive knowledge and understanding about the uses of wearable technologies in education, other factors affecting technology innovation in higher education need to be considered and addressed.

In particular, a new generation of mobile learning curriculum design and pedagogy provide teachers with new combinations of educational potential for wearable technologies, including the ability to enable provision of in-situ contextual information, recording, simulation, communication, first-person view, in-situ guidance, feedback, distribution and gamification (Bower and Sturman 2015). Many of these, such as re-experiencing learning activities from the first-person point of view, have been supported by other recent research (Fominykh et al. 2015).

In this paper we provide an overview of the current context and introduce three projects that investigate the use of wearable technologies in Australian universities. The insights gained from these examples allow us to examine and compare wearable applications addressing different educational goals, settings and target groups, and offer practical considerations for educators implementing similar efforts.
2 Context

Wearable technologies use devices that are worn on the body. Wearable devices have been available for around twenty years but have become increasingly popular as technology improves, prices reduce and access is opened via greater broadband coverage. The most popular wearable devices include head-mounted devices, smart watches and health-monitoring wristbands, but the number and type of devices is rapidly increasing. As at 21st of June 2016, the Vandrico Wearable Technologies database (Vandrico 2016) included 436 devices across a range of sectors including fitness, medical, entertainment, industrial, gaming and lifestyle sectors. Examples of already popular wearable devices include: Fitbit, Nike+, Misfit and Jawbone wristbands, Apple and Garmin watches, Oculus Rift, Google Glasses and Google Cardboard headsets, and “newcomers” such as Xiaomi bands, Samsung Gear, Epson Moverio, Microsoft HoloLens, Magic Leap’s lightweight AR, AMD Sulon and Meta One. Wearables are expected to expand their range into mind reading technology, hearables, wearable toys, smart clothing, smart coaching, lifesaving and even pet monitoring and GPS mapping (Wareable 2015).

While there is considerable literature investigating the development and use of wearable technologies across a range of fields other than education (for example, see Mahoney & Mahoney, 2010; Son et al., 2014), there is less research into the use of wearable technologies in education (exceptions include Coffman and Klinger 2015; de Freitas and Levene 2005; Wu et al. 2014; Yamauchi and Nakasugi, 2003, as discussed later in this paper). The limited literature on wearable technologies for learning and teaching indicates that the possibilities of wearable technology in higher education are not yet well understood. One of the reasons for this could be that educators are not familiar with the action potentials (Bower 2008) of wearable technologies. Another reason could be that the technology is so new that research has not yet been undertaken to inform applications. Few pedagogical models or frameworks can stimulate and inform their practice.

There are only a few empirical examples regarding the use of wearable technologies in education in the literature. In an early experiment, Yamauchi and Nakasugi (2003), used head mounted displays to provide street-view overlays of incidents from the past so that students could acquire a more experiential sense of history in the actual places of occurrence. More recently, Wu et al. (2014) used Google Glass during medical training role-play activities to provide a first-person viewpoint and recordings. In another recent trial by Coffman and Klinger (2015), teachers and students were provided with access to Google Glass to use during Educational Psychology and Organisational Behaviour classes. Outcomes from these trials include: students feeling a deeper connection with events and people (Yamauchi and Nakasugi, 2003), deeper student analysis and understanding of scenario-based practices (Wu et al. 2014) and seamless integration into student learning workflows (Coffman and Klinger 2015).

There is a current wave of enthusiasm and conceptual development from companies and institutions worldwide interested in making wearable technologies applicable to users. Examples include: using virtual and augmented reality to experience Earth as it was a hundred million years ago (BBC 2016), overlaying visual information of the Mars landscape for training purposes (NASA 2015) and seeing inside the work of Salvador Dali (Wired 2016), not to mention opportunities for disabilities, impairments and the provision of care or rehabilitation services.

3 Examples of Wearable Technology Applications in Australian Universities

In order to provide educators with models that exemplify the pedagogical potential of wearable technologies in higher education we present three examples from Murdoch University, Macquarie University and the University of New England in Australia. These projects detail the application and utility of using mobile wearable technologies in their particular domain: environmental education, cognitive and brain sciences and teacher training. In the following, we describe each one of the scenarios and experiences.

Conserv-AR - A Mixed-Reality Mobile Game to Promote Awareness of Wildlife Conservation in Western Australia.

Conserv-AR addresses the potential of using mobile, wearable, augmented and virtual reality technologies in natural environments for environmental education and community awareness. It is a serious game that engages students in a real-world experience to promote awareness of wildlife conservation in Western Aus-
tralia. The current version is developed for the Epson’s wearable smart glasses and it can also be run on Android smartphones and tablets.

The storyline of the game revolves around an excursion or field trip, where the player traverses a real-world course with the goal of gathering information about endangered species and their habitats, learning about wildlife-related risks and developing strategies to address conservation threats. The game includes a 3D virtual reality environment where users can review all the information collected during the excursion.

Figure 1. Conserv-AR: A Mixed-Reality and Wearable Game for Wildlife Preservation

Conserv-AR has been applied to environmental conservation at Murdoch University, specifically focusing on the Carnaby’s Black Cockatoo, an endangered WA bird species (Phipps et al. in press). Murdoch students are using the application to gain an awareness and understanding of the campus natural environment (Figure 1). Automatic tracking of the activity will be used along with interviews and surveys to evaluate the usability and didactic effectiveness of this application.

Portable Teaching Laboratory: Using a Gaming Headset to Monitor Brain Activity in the Cognitive and Brain Sciences.

This project was designed to promote research-based learning and leveraged the latest in consumer-grade gaming technologies to deliver highly interactive lab-based learning experiences for undergraduate students in the cognitive and brain sciences. Specifically, a fully portable and cost-effective human brain imaging teaching laboratory was developed that implements the Emotiv EPOC EEG system (pictured). The EPOC is an affordable, wireless gaming system that monitors electrical brain activity. The EPOC has recently been validated as a research tool in the cognitive and brain sciences by several members of the team involved in this project (Badcock et al. 2013, 2015).

Building on this platform, a number of scaffolded lab-based research activities were developed and incorporated in the curriculum of the core unit for the undergraduate major in Cognitive and Brain Sciences. During the lab sessions, students work collaboratively in small groups to use the EPOC to visualise and record their own brain activity during the performance of simple experimental tasks (Figure 2). The interactive learning tasks give students the opportunity to explore and deepen their understanding of foundational concepts and methods typically used in the field of cognitive and brain science, as well as foundational research steps. Illustrating how these activities compliment the other learning activities in the unit are the following quotes from our 2016 cohort in which they describe the lab sessions as giving them “The sensation of being a real scientist and actually seeing what my own brain was doing” as well as “being able to put what we had been learning about into practice so that we could gain a better understanding of what the content was based upon.”
This exemplar project demonstrated how the latest in wearable technologies could be leveraged to adopt a research-enhanced approach to learning and teaching and provide a novel learning experience for students—an initiative awarded the Faculty of Human Sciences Dean’s Citation for Innovation in Learning and Teaching. The successful implementation of this portable teaching lab in a first-year core unit has been vitally important as it has created a robust active-learning foundation for students pursuing a major in Cognitive and Brain Sciences. In addition, the project has provided a useful model for developing lab-based curricula that is extendable to other units in the Cognitive and Brain Sciences Program, as well as units in allied disciplines.

**Virtual Teacher: Enhancing Virtual Teacher Professional Experience using Wearable Devices**

This application uses wearable technologies in pre-service teacher education as a means of enhancing learning and engagement in virtual professional experience activities. This project builds upon the significant work by the case study leader in the creation of Virtual Practical Experience (VirtualPREX) activities (Gregory et al. 2013; Dalgarno et al. 2016) and the use of role-play activities in virtual worlds (Reiners et al. 2014) to examine how the Oculus Rift head-mounted virtual display can be used to enhance the presence and immersion of pre-service teachers practicing classroom management during virtual world simulation exercises.

Students undertake two 2-hour sessions in a 3D virtual world. The first session is an introduction on how to use the 3D virtual world using desktop computers, providing a context as to how it could be used as a teaching and learning tool. The second session utilises a VirtualPREX scenario (a 3D virtual world designed for teacher professional experience practice) for pre-service teachers undertake teaching role-play activities (Figure 3). For this second session there are two groups. Most students undertake the session in a normal context as described in the first workshop. The remaining students undertake the session using an Oculus Rift or similar wearable technology. Comparisons are then made between the two groups relating to their sense of presence, immersion and engagement. All students are invited to complete pre- and post-tests to gauge their perceptions of the impact of the wearable technology on their experiences. Open-ended responses relating to engagement, immersion and presence are also collected to see if there was a difference between those using the wearable technologies and those who were not.

These workshops are available to on campus or online students if they have access to the Oculus Rift. It provides insights into the use of wearable technologies to enhance immersion, presence and engagement in teacher education. Research undertaken by this case study leader has been ongoing since 2008, however, the inclusion of wearable devices is in its infancy.
4 Practical Considerations and Adoption in Education

The adoption of the use of wearables can be challenging, with costs of devices, technical support, pedagogic application and student readiness amongst some of the inhibitors to successful uptake in universities. We use a framework proposed by de Freitas and Oliver (2006) to allow comparison between studies and facilitate uptake. This ‘four-dimensional framework’ suggests that the four elements of context, pedagogy, representation and the learner need to be considered when evaluating the efficacy of game-based approaches. Similar considerations can be applied to wearable applications in learning settings.

The elements of the framework can be summarised as follows:

- The main purpose and use of the technology, including a consideration of the **context of use**.
- The **readiness of the student** cohort, including their technical abilities and comfort, age, subject of study and other demographics.
- The **pedagogy** to be used, including active learning, how the wearables will be used for teaching and learning.
- The **mode of representation** of the learning content (e.g. concepts, engines, mode of deployment, level of fidelity and interactivity).

Table 1 facilitates a critical and reflective understanding of the implementation and comparison between the three examples. Other benefits of using this framework include the provision of support for educators aiming to develop their practice and embed wearable tools into the classroom and reflection upon how wearable tools can support curriculum content most effectively.

In addition to the elements in the framework, the evidence from the three studies highlight the importance of other factors that need to be considered as part of the scheduling and planning of the case studies, such as quality and availability of resources, feedback and evaluation.

Wearable technologies provide a range of tracking mechanisms and their associated feedback processes and analytics. However the possibilities for capturing quantitative data are uneven, e.g. while devices such as sports and brain monitoring systems are specifically designed for biotracking and providing accurate and detailed data about the user in the context of the activity taking place, virtual reality headsets and smart glasses focus on the information that is displayed and require specific software programming in order to allow capturing quantitative feedback.
Table 1. Application Examples, including an Overview of the Technologies Used, Mapped against the Four-Dimensional Framework (de Freitas and Oliver 2006) and an Outline of the Pedagogical Affordances (Bower and Sturman, 2015).

<table>
<thead>
<tr>
<th>Example</th>
<th>Context (Where?)</th>
<th>Learner specification (Who?)</th>
<th>Pedagogic considerations (Nature of learning activities)</th>
<th>Mode of representation (Learning tools)</th>
<th>Pedagogical affordances</th>
</tr>
</thead>
</table>
| Conserv-AR Wildlife conservation ( Murdoch University, Western Australia) | • Outdoors (University campus and other outdoor locations)  
   • Real outdoor settings based activities | • University students and a range of differentiated learners  
   • Individually or in groups | • Authentic learning  
   • Active learning  
   • Learning outcomes: Increased empathy with animals, and consideration of how animals behave and act | • Augmented reality  
   • Virtual reality  
   • Smart glasses | • In-situ contextual information  
   • Simulation  
   • First-person view  
   • Distribution  
   • Gamification |
| Portable teaching laboratory (Macquarie University, New South Wales) | • University classroom  
   • Laboratory based research activities | • University students (First years enrolled in the introduction to Cognitive and Brain Sciences unit)  
   • Small groups (4-5 students) | • Research-enhanced and scaffolded activities  
   • Lab-based experimental tasks  
   • Structured group activity sheets | • Visualization and recording of brain activity  
   • Research role-play  
   • Gaming device | • In-situ contextual information  
   • Recording  
   • Simulation  
   • First-person view |
| Virtual teacher (University of New England, New South Wales) | • University classroom (blended and online)  
   • Professional experience activities | • University students (enrolled in teacher education)  
   • Groups | • Role-play training  
   • Enhanced immersion, presence and engagement | • Virtual reality  
   • Head-mounted display | • Simulation  
   • Communication  
   • First-person view  
   • In-situ guidance  
   • Feedback  
   • Distribution |

Central to the design of case studies, evaluation should include an examination of how the wearable technologies impact upon student outcomes and satisfaction. Qualitative feedback can include analysis of student feedback, teacher perceptions as well as video and audio transcripts in search of factors that impact upon wearable technology learning processes. The combination of the use of quantitative and qualitative methods will allow presenting a more detailed evaluation of the case studies and enable future cross-case analyses.

5 Conclusions

Recent developments in technology enhanced learning, and particularly mobile wearable devices, can facilitate learning opportunities built on new educational affordances. In this paper, we outline the potential educational, social and research impact, and discuss possible applications of wearable technologies in higher education.

We describe three projects conducted in Australian universities that explore the application of wearable technologies in a variety of learning scenarios. These examples are compared using a framework that draws on an understanding of the context, pedagogy, technology and learners’ needs for each case. In addition, we discuss other factors that can support evaluation, decision-making and uptake in educational settings.

This collaborative effort aims to improve understanding of the use of wearables in education and expand the opportunities for learning innovation within the academic and research communities in Australia and internationally. To that extent we call on any people interested in forming part of a community of practice relating to the use of wearable technologies to make contact with the authorial team.

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6 Acknowledgements

The portable teaching laboratory was funded by the Macquarie University Innovation and Scholarship Program (ISP) Grant (2016), awarded to Dr. De Wit and Dr. Kaplan (Macquarie University, Sydney, Australia).

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Ariane: A Web-Based and Mobile Tool to Guide the Design of Augmented Reality Learning Activities

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Abstract. Ariane is an authoring tool that guides the design of augmented reality (AR) learning activities. Developed to support instructional designers and practitioners in the design of AR learning experiences with a strong focus on learning design and student learning. In Ariane, users are encouraged to consider and specify factors including the use of context, task design and assessment criteria. In this work we present the rationale for the toolkit and we describe the software design and implementation. We provide an example of a learning activity design created using Ariane and discuss recent progress and future work.

Keywords: augmented reality, authoring tool, mobile learning, instructional design

1 Introduction

Augmented reality (AR) in education has been claimed as a highest-topic research field by the advisory board of the 2015 Horizon Report Australia Edition (Johnson et al. 2005). AR aims to enhance students experience by merging the real and virtual worlds, providing context-sensitive interaction (Alvarez et al. 2014) and offering a wide range of pedagogical affordances to educators (Bower et al. 2014). Examples in education include seeing a 3D visualisation and manipulating molecules in chemistry (Singhal et al. 2012), and overlaying and interacting with digital information in field trip activities (Fitzgerald and Adams, 2013). Furthermore, in areas such as visual arts (Di Serio et al. 2013) and biology (Tarng and Ou 2012), AR has contributed to increase students’ motivation and interest.

AR technology allows educators to create a scenario, provide context-specific information and embed virtual data seamlessly within the real world (Bower et al. 2014). In concordance with other areas of educational technology, there are two different but complementary approaches that have been attempted by researchers in this domain. One intimately related with the generation and use of technology, and a second more focused on pedagogical and learning aspects.

Ariane (http://www.pulso.uniovi.es/mobilelearning/) is a web and mobile-based application that combines innovative technology and novel learning strategies that emphasise the role of learners, the interaction with the physical environment and the importance of task-based learning design. Our model has been developed with the goal of providing teachers and instructional designers with a better understanding of the diverse elements and factors involved in designing an AR learning activity; and enabling them to elaborate and deliver their own tailored learning activities.

2 Rationale and Related Work

Augmented reality is a technology that has already presented significant advances in areas such as architecture and design (Wang 2009), art (Chang et al. 2014) and medicine (Nicolau et al. 2011). The application of mobiles and AR in education has been successfully tested in game-based learning, field-trips, 3D learning experiences and skill acquisition (Wu et al. 2013), where AR provides a medium for understanding concepts and phenomena in context (Fominykh et al. 2015) and contributes to increase students’ motivation (Bower et al. 2014).

The issues of AR in education are caused in large part by approaches focused on technology rather than on learning outcomes (Fominykh et al. 2015). This suggests the need for initiatives that guide and support the instructional design of AR learning activities. AR authoring tools that are oriented for programmers can
make it difficult for teachers and instructional designers to build and conduct efficient learner-adapted instructional procedures. From this educational perspective, it is important to focus on how to enhance the experience of learning without interfering with it (Beale 2006) and to contribute to the evolution of technology enhanced learning (TEL) into ‘seamless learning spaces’ (Looi et al. 2010).

There have been only a few examples in the literature on tools that allow instructional designers, teachers and students for a seamless design of AR-based educational activities. The STEP lab at MIT has developed an AR authoring tool (Klopfer and Sheldon, 2010) that allows designers or teachers to create AR science games with a drag-and-drop interface. ARLearn (Ternier et al. 2012), developed at the Open University of the Netherlands, is framework that allows defining an underlying instructional design for games. In (Jee et al. 2014) the authors introduce a user-friendly authoring tool that lets non-experts, typically engineers, create AR content quickly and effectively within a 3D modeling environment. ARIS (http://arisgames.org) is an augmented reality storytelling engine that can be used to create mobile games. ARLEM (http://arlem.kmi.open.ac.uk) is an ongoing initiative of the Open University (UK) to develop a model for AR-assisted learning.

While there is no standard for the description of AR activities in education, each authoring tool has its own set of characteristics, parameters as well as a proprietary data model and terminology, making it difficult to cover all the phases of the life-cycle of a learning activity and design new tasks. The web-based and mobile tool presented in this paper builds on previous work (Lobo et al. 2013; Valero-Simancas et al. 2011) to allow teachers easily to design, conduct and assess an AR-based learning activity, and make the resulting description of learning tasks compatible with other authoring tools and mobile clients.

3 Software Design and Implementation

Ariane models the life cycle of a learning activity in three phases: design (organization of knowledge and learning activities), instruction (facilitating a location-based and student-centred learning strategy) and assessment of the learning tasks. The web-based tool allows teachers to describe the context, learning tasks and assessment procedure (Figure 1). An activity created in Ariane can be exported to multiple formats and used with different authoring tools and clients (i.e. ARLearn). Our client application is developed to run on Android and iOS, the dominant operating systems for mobile and tablet devices (Netmarketshare 2016). During the class, learning tasks are displayed relative to their context. The descriptions of learning activities as well as students’ responses are synchronised with the server. Once the activity is finalised, the teacher can log back into the web-based tool to assess and mark the results (See video “Ariane, Augmented Reality in Education” (https://www.youtube.com/watch?v=Ds-t3TUidOo).

4 An Example of Application

Ariane has been used in an environmental course in secondary education. In this example we addressed the educational potential of using mobile and AR technologies in a natural environment. In this activity 49 students used Android tablets to interact with geolocated multimedia content and gain ‘in-situ’ knowledge about the local environment (geography, geology, natural materials and vegetation) on a class field trip in the woods. The teacher made use of Ariane’s authoring tool to design the route, points of interest and the exercises that were triggered. The geolocated multimedia contents (dynamic map, targeted locations, initial and final videos, images and questionnaires) were preloaded onto the tablets. The client was provided with a tracking system to collect information during the activity, as well as the results from the different exercises. This information was complemented with direct observation and the qualitative information obtained from conversations and formal interviews with the teacher. Although this particular assignment was not evaluable, this module allowed the teacher to review the results and reflect on the pedagogy and results of this activity.

The day before the class, the research team and the teacher recognised the field, tested the application and checked that everything was ready. Some problems were identified during this test. A gentle rain provoked a lack of precision in the touch interaction. It was required to wipe the screens regularly, but even then, it remained difficult to interact with the application. The day of the activity it didn’t rain. The students shared a limited number of tablets and worked in groups. Most students were enthusiastic about the activities and the use of tablets and the overall teaching and learning experience was reported as positive.
However, we also detected important pedagogical, hardware and usability issues. The school did not have enough devices for all students. Although a group-work design can be used, the limited availability of devices means that, in practice, the smart phone will be preferred for larger scale implementations, where students can bring their own devices (BYOD). The teacher perceived an increase in the motivation with the use of tablets, but not in all students and generally, the enthusiasm decreased gradually during the activity, mainly due to difficulties in using the interface and answering to the questionnaires. We also observed other issues such as low sound volume level, lack of precision in gps-location and difficulties to visualise the maps.

5 Current Status and Future Work

Technology is transforming learning and introducing new educational scenarios that take advantage of research areas such as augmented reality to enhance the impact of learning based on real-world experiences.

This paper introduces Ariane, an authoring tool that enables a flexible design of AR learning activities. An application example in a high school field trip serves to examine the benefits and challenges of using AR in secondary education. AR-based learning need to overcome a number of limitations and the integration of AR in education should be driven by pedagogical needs and supported by the effective use of technology.

Current developments of Ariane extend and elaborate on the pedagogical and technological characteristics to include game-based elements and improve the functionality, usability and user experience. Our recent mobile development, Conserv-AR (Phipps et al. in press) uses wearable technologies and addresses some of the limitations found in the previous version. Wearable technologies allow a much closer association with the user and a higher degree of freedom. As highlighted by Gartner (https://www.gartner.com/doc/3229717), mobile devices together with wearable and other electronic devices will expend the set of endpoints use to access information. In our view, this “device mesh” will also extend the current affordances of mobile learning in the near future.
6 Acknowledgements

This work has been partially funded by the Department of Science and Innovation (Spain) under the National Program for Research, Development and Innovation: project EDU2014-57571-P. We have also received funds from the European Union, through the European Regional Development Funds (ERDF); and the Principality of Asturias, through its Science, Technology and Innovation Plan (grant GRUPIN14-100).

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Survive with the VUVU on the Vaal: Eyetracking Findings of a User Interface Evaluation of a Mobile Serious Game for Statistics Education

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**Abstract.** This paper reports on an interface usability evaluation of the first level of a prototype serious game called *Survive with Vuvu in the Vaal*. The study investigated the initial conceptualization, design and development of the user-interface of the game. It also looked at whether the game was functional and whether it met the user’s expectations. The study sample comprised seventeen first year students (n=17) who were enrolled in a Statistics course at a local University. The study followed a fully mixed, sequential dominant, status design. The first phase involved the use of eyetracking measurement techniques, followed by individual interviews of the participants to obtain their perceptions of the game. The eyetracking measures comprised fixation count, dwell time, fixation duration and the average length of fixation. This was done for six areas of interest in the game. The qualitative usability codes comprised the game instructions; expectations of 3D graphics; game context; game challenge, and time pressure. We discuss seven areas to be considered for future development of the game. Two prominent recommendations include the use of eyetracking equipment for mobile devices which will contribute towards better evaluation of the students’ game proficiency, and the implementation of a participatory design for the next phases of the game.

**Keywords:** eyetracking, serious games, mobile games, usability evaluation.

1 Introduction

This paper reports on a user-interface evaluation of the first level of a prototype serious game, called *Survive with Vuvu in the Vaal*\textsuperscript{1}. The participants were sampled from a population of first year Statistics students, and their interactions were measured using eyetracking and usability interviews. The study aims to determine if the initial conceptualization, design and development of the interface of the game was functional. A formal evaluation of the serious game was necessary to continue with further sections of the game.

While empirical research has shown that serious games teach lower-level intellectual skills and improve physical skills, they also embody well-established principles and learning models. Serious games are an effective source of learning, partly because the learning takes place within meaningful contexts. The learning content encompassed in this serious game directly relates to the learning environment where learning is not only relevant, but is immediately applied and practiced within the context. Situated cognition (learning which occurs in meaningful and relevant contexts) is more effective than learning that occurs outside the context (Van Eck 2006). Killii (2005) reminds us that the aim of serious games is learning-while-playing and that technology does not substitute teachers.

“Lowering the barrier between education and real entertainment is an important challenge in order to better exploit the potential of computers and reach a demographic that is traditionally averse to learning” (Prensky 2003). This statement accurately describes our aim for designing a serious game for Statistics Education, as we focus on a generation of first-year students. The New Media Consortium pronounces games for learning as one of two ways that students learn outside of classrooms. Serious games are acclaimed for their application in the developing of inductive reasoning (Johnson et al. 2015). Increasingly higher education

\textsuperscript{1} *Vuvu de Vaal*\textsuperscript{TM} is the mascot of the Vaal Triangle Campus of the North-West University. Vuvu is a goose—quite fitting since the Campus is situated within a proclaimed nature reserve—and represents student life on Campus.
institutions adopt the bring-your-own-device (BYOD) option for students to access online learning environments (Johnson et al. 2016). Serious games provide compelling adventures while students acquire, practice and verify their knowledge according to pedagogical paradigms (Bellotti et al. 2009). This represents a significant opportunity for 21st century educators to enhance their educational toolkit to reach diverse students (Calkins and Kristen Vogt 2013). The idea of dedicated learning through games on students’ own devices, in their own time, was the reinforcement needed to develop a serious game for novice Statistics Education students at a rural university in South Africa.

Games played on mobile devices are becoming increasingly popular due to students’ reliance on mobile phones, their myriad uses beyond voice calling, and the technological advancements of mobile devices in general. Games and other applications on mobile devices also contribute to users’ meeting certain motivational needs like personal satisfaction, emotional and hedonic needs, social connections, context awareness, task performance, exploratory play, killing time and socializing (Goh et al. 2012). An added advantage is that these attributes are readily available on mobile devices found in the students’ pockets.

At the Vaal Triangle Campus (VTC) of the North-West University (NWU), introductory Statistics is presented across faculties as a service course for a variety of qualifications. Previously, the Serious Game Institute, South Africa (SGI-SA), conducted analyses amongst concerned students who revealed that their satisfaction with the traditional mode of classroom-based course facilitation rated low. The students experienced the content of the introductory statistic course as complex, the statistics examples and exercises as not relevant to their particular fields of study, or useful for their daily lived experiences as young people, and the prescribed textbook as unfriendly (Leendertz et al. 2015). The needs analyses aimed to identify suitable alternative modes for course facilitation, which would suit the needs of especially first generation students, their current level of academic development, with the set curriculum of the introductory statistics course in mind (Fitchat et al. 2016). A situational analysis, conducted amongst statistics lecturers, indicated that they were of the opinion that a serious game—a video game for learning fundamental statistics principles while having fun—could possibly address the teaching and learning needs of both students and lecturers (Fitchat et al. 2016). The consensus was that the intended serious game “should be a pre-survival, and also be a survival guide, for first year students…but with examples of positive risks. The game will be contextualized around the activities on campus and the surrounding areas” (Leendertz et al. 2015).

2 Background

As part of the longitudinal process of game design and evaluation, findings from a focus group interview defined the theme and story of the serious game, Survive with Vuvu in the Vaal. The focus group comprised statistics students, statistics lecturers, game designers and researchers. The students expressed the opinion that they would find the game motivating and captivating if the game related to their everyday lives and if it was divided into an assortment of mini-games—each with its own mini-story, but yet contributing towards better understanding of the statistics curriculum (Leendertz et al. 2015). The first prototype considered concerns that first-generation students, encounter on-campus, for the very first time in their lives and have to contend with during their adjustment to university life. The development team planned a series of mini-games which mimicked campus life; each with its own unique scene, content, and score board.

The first of a series of mini-games, which is the focus of this study, focuses on the students’ on-campus experiences in residences, relating to their electricity usage. Students buy prepaid electricity and therefore have to be mindful of electricity costs, in order to manage their limited budgets. The game focuses on the managing of pre-paid electricity accounts as data source. The foundational concepts of this introductory mini-game include: (i) sampling and data gathering, (ii) frequency distribution, and (iii) descriptive measures of location and spread.

The game mechanic requires players to tap on as many possible, randomly appearing artefacts within a limited time period. This mechanic was based on the mechanics used in the arcade game, Whack-A-Mole (Chittaro and Sioni 2012). In the prototype of our game, residences’ windows randomly lit-up for a short period of time, wherein the players must tap on a lit-up window to collect an electricity bill from the occupant. Figure 1 depicts the layout of the main game screen. The title bar (top of the screen) displays the number of bills collected (left-hand side), the current high score (middle), and the time remaining (right-hand side). The arcade playing takes place in center of the screen. At the bottom of the screen are baskets in which the occupants’ bills need to be placed (Figure 1).
When a player taps on a lit-up window, the occupant hands the player an electricity bill that displays a random amount between R150 and R450 (Figure 2).

The player must then assess the value of the electricity bill and drag it into the corresponding basket (range) at the bottom of the screen. In the case of Figure 2, the bill with a value of R153.87 belongs in the basket labeled [150 ; 200]. Once the player has dropped a bill into a basket, the game returns to the residences screen, where the player continues to tap on another lit-up window. When the time runs out, the game is over and the player is presented with a summary of his or her achievements (Figure 3). On this screen, the player is shown which baskets contain bills with the correct value. A check mark above a basket indicates that the bills placed into the basket matches the indicated range. A cross indicates that the bills inside a basket relate a value outside of the range of a basket. This feedback screen also displays the sample size—the number of collected bills along with the player’s final score. Depending on the value the player attained, s/he is rewarded with up to three stars. Players now have the option to play again or exit the game.
After investigating the possible technological platforms available on the VTC, the researchers developed the game for Android operating system on tablet devices (Leendertz et al. 2015).

3 Research Design and Methodology

This serious game was the first introductory mini game for *Survive with Vuvu in the Vaal*. The evaluation comprised only the first phase of the envisaged comprehensive collection of mini games designed as a tool for introductory Statistics Education. Nielsen and Molich (1990) advocate that usability evaluation be performed early in the development process; therefore we implemented the usability evaluations at this point.

The study followed “a fully mixed sequential dominant status design that mixes qualitative and quantitative research across the stages of the research process” (Leech and Onwuegbuzie 2009). The first phase of the study involved the use of eyetracking techniques as the quantitative phase which provided us with extensive decision data, and is therefore allocated dominant status. The second, followed qualitative strategies (individual focused interviews) as a usability evaluation, in order to obtain the research participants’ perceptions about the game aspects.

The study sample comprised seven female and ten male first-year students (n=17) enrolled for an entry-level Statistics course. Their ages varied from 19 to 22 years. They voluntarily participated in the study and gave consent for the use of the data (ethics clearance number ECONIT-2015-035). The study took place during the week sequencing the in-class presentation of the corresponding Statistics content. Molich and Nielsen (1990) point out that the results of usability evaluation improve when several evaluators, independently of one another, participate in the evaluation. Typical usability evaluations, in the context of serious games, comprise between ten to twenty evaluators (Nielsen and Molich 1990).

For the eyetracking evaluation, the SensoMotoric Instrument RED50 was used to monitor participants’ eye movements while they played the game. The remote eyetracking device (RED) system is a dark pupil system using the pupil or corneal reflex method. It has a sampling rate of 50Hz, and calculates the pupil position, pupil size and relative head movement. Minimum fixation duration was set as 80ms, with 100px as maximum dispersion. All participants were tested individually. The participants were seated comfortably in a sufficiently illuminated room, on a stable chair at a distance of 700mm from the stimulus screen. As soon as participants were seated, the electroencephalogram (EEG) was placed on their heads and checked for valid signal and data recording before starting with the experiment (we do not report on EEG data in this paper).

The participants had three opportunities to play the game and their high scores were captured for comparison. We captured the eyetracking data on different areas of interest (AOIs) in terms of fixation counts, dwell time, fixation duration and average length of fixation (Table 1).
Table 1. Definitions of Eyetracking Measures used in this Study

<table>
<thead>
<tr>
<th>Measures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwell time (ms)</td>
<td>Total time spent within an AOI, i.e. on the baskets</td>
</tr>
<tr>
<td>Fixation count</td>
<td>Total number of fixations in an AOI which indicate the degree of importance of the element, e.g. the title bar</td>
</tr>
<tr>
<td>Fixation duration (ms)</td>
<td>Fixation duration is often used as a metric reflecting difficulty of information extraction in the AOIs, i.e. on the electricity bills in the occupant’s hands</td>
</tr>
<tr>
<td>Average length of fixation (ms)</td>
<td>Measures the average duration of fixations on a specific AOI and is calculated by dividing the average fixation duration for an AOI by the average fixation count on that AOI</td>
</tr>
</tbody>
</table>

* Adapted from Lai et al. (2013)

The individual focused interviews with the research participants took place directly after the eyetracking measurements and completion of the game. The research participants answered eight questions. According to the guidelines of Nielsen and Molich (1990), questions should be simple and at the level of the participants’ understanding. They were: (i) How challenging was the game to play?; (ii) What did you learn from playing the game?; (iii) How would you describe the game to others?; (iv) Would you like to own the game?; (v) What was the story of the game?; (vi) Were the instructions clear on how to play the game?; (vii) What changes would you make to the game?; and (viii) Which games do you regularly play? The interviews were recorded, transcribed verbatim, and assigned to Atlas.ti™ version 7 (a computer-assisted qualitative data analysis system) as an integrated dataset for qualitative analysis according to the Boeije (2002) method of constant comparison where all codes and utterance are compared with one another. The usability analysis resulted in five categories, twelve codes, 183 quotations (groundedness—the number of times utterances relate to a specific code) (Table 2).

Table 2. List of usability Categories, Codes and their Groundedness

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Groundedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>User interface evaluation outcomes</td>
<td>Desire to own the game</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Familiarity of gameplay</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Game challenge</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Game progression</td>
<td>6</td>
</tr>
<tr>
<td>Game instructions</td>
<td>Game instructions</td>
<td>21</td>
</tr>
<tr>
<td>Expectations of 3D graphics</td>
<td>Expectations of 3D graphics</td>
<td>3</td>
</tr>
<tr>
<td>Game context</td>
<td>Identification of the relating basket</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Game context</td>
<td>31</td>
</tr>
<tr>
<td>Game challenge and time pressures</td>
<td>Game controller proficiency</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Game mechanic mastery</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Game reward mechanic</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Time pressure</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>183</td>
</tr>
</tbody>
</table>

4 Eyetracking Results and Discussion

The user interface evaluation through eyetracking measurements comprised fixation count, dwell time and fixation duration, and the calculation of the average length of fixations on six different AOIs (sample size, baskets, electricity bills, final score baskets, high scores and title bar) for all three times the participants played the game. The averages of the seventeen participants and the three repeats were calculated (Table 3). Table 4 gives the number of times a participant did not look at a specific area of interest, which gave us an indication of what they perceived as important to progress through the game.
Table 3. Eye tracking Data According to Grouped Areas of Interest (n=17)

<table>
<thead>
<tr>
<th>Area of Interest</th>
<th>Average Fixation Count per Person, per Turn</th>
<th>Average Dwell Time (ms) per Person per Turn</th>
<th>Average Fixation Duration (ms) per Person per Turn</th>
<th>Average Length of Fixation (ms) per Person per Turn</th>
<th>Total Fixation Count (3 Turns)</th>
<th>Total Dwell Time (ms) (3 Turns)</th>
<th>Total Fixation Duration (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>2.3</td>
<td>1775</td>
<td>1835</td>
<td>797.7</td>
<td>117</td>
<td>30176</td>
<td>31198</td>
</tr>
<tr>
<td>Baskets</td>
<td>15.1</td>
<td>16670</td>
<td>17030</td>
<td>1127.8</td>
<td>769</td>
<td>283390</td>
<td>289510</td>
</tr>
<tr>
<td>Electricity bills</td>
<td>8.6</td>
<td>9146</td>
<td>9435</td>
<td>1097.1</td>
<td>437</td>
<td>155481</td>
<td>160390</td>
</tr>
<tr>
<td>Final score baskets</td>
<td>4.7</td>
<td>4272</td>
<td>4241</td>
<td>902.3</td>
<td>242</td>
<td>72629</td>
<td>72090</td>
</tr>
<tr>
<td>High scores</td>
<td>4.2</td>
<td>3678</td>
<td>3773</td>
<td>898.3</td>
<td>216</td>
<td>62523</td>
<td>64148</td>
</tr>
<tr>
<td>Title bar</td>
<td>2.1</td>
<td>1592</td>
<td>1699</td>
<td>809.0</td>
<td>106</td>
<td>27056</td>
<td>28882</td>
</tr>
</tbody>
</table>

* Fixation duration divided by the fixation count

Table 4. Number of Times Participants did not Visit the AOI

<table>
<thead>
<tr>
<th>Area of Interest (AOI)</th>
<th>Total Number of Participants not Viewing AOI (3 turns)</th>
<th>Average Participant not Viewing AOI (per turn)</th>
<th>Percentage of Participants Skipping AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>12</td>
<td>4.0</td>
<td>23.5%</td>
</tr>
<tr>
<td>Baskets</td>
<td>5</td>
<td>1.7</td>
<td>10.0%</td>
</tr>
<tr>
<td>Electricity bills</td>
<td>1</td>
<td>0.3</td>
<td>1.8%</td>
</tr>
<tr>
<td>Final score baskets</td>
<td>4</td>
<td>1.3</td>
<td>7.6%</td>
</tr>
<tr>
<td>High scores</td>
<td>12</td>
<td>4.0</td>
<td>23.5%</td>
</tr>
<tr>
<td>Title bar</td>
<td>24</td>
<td>8.0</td>
<td>47.0%</td>
</tr>
</tbody>
</table>

The analysis of the eyetracking data focused on six AOIs: (i) **sample size area**: indicating the number of electricity bills the participants managed to select for placing in corresponding baskets; (ii) **the basket area**: the physical aspects of the baskets in which corresponding electricity bills should be placed; (iii) **electricity bills**: the randomly generated bills representing the electricity use of students living in on-campus residences with special references to font size on the collection baskets; (iv) **final score baskets**: displaying the final baskets as frequencies of the collected samples; (v) **high score area**: the total score the player achieved during gameplay; and (vi) **title bar area**: the top area of the screen providing information on samples collected, high score and time left for the round. We also looked at the number of participants who did not view a specific AOI. This was used to determine which AOIs required consideration in future versions of the game, and also provided us with information on what the participants deemed necessary for them to complete the task.

**Discussion of Eyetracking Results**

Data recorded by the eye tracker were used to analyze the viewing patterns of the participants and also to provide information on the perceived importance of the various AOIs that were identified, as well as the number of participants who did not view a specific AOI.

**Sampling Electricity Bills and Placing them in Corresponding Baskets**

Participants collected, at most, 7 electricity bills (M = 3.7, STD = 1.0) in the allotted sixty seconds given per turn of playing the game. This seems to indicate that the task was either more difficult for them to complete than they thought, or that the experimental environment (such as the added effect of having their eyes recorded by the eye tracking equipment) had a negative effect on them, or both. The participants also spent the least amount of time gazing at the sample size area—a content component of the game—when compared to the other AOIs. The sample size area was also the second most skipped AOI (along with the high score area), with almost 25% of the participants not looking even once at the sample size area, which may be an
indication that this area was not important to the participants. On average, each participant gazed only 2.3 times at the sample size area, with an average dwell time of 1775ms, and an average fixation length of 797.7ms. These fixation durations may indicate that the participants might have struggled to find meaning from the information as these durations are unusually long (average fixation duration should be between 333-500ms).

Heat maps (Figure 5) indicated that some participants grappled to identify the matching basket to place the electricity bills as their gaze shifted across various baskets before making a decision. During the interviews, participants mentioned that the font size on the baskets was too small for easy reading: “I just had to draw my eyes and see if the value is below or just above those interval there.” This may have also contributed to the difficulty of completing the task. The average fixation count (15.1), the average dwell time (16670ms) and the average fixation duration (17030) for the baskets, were the highest values for all the measured AOIs (Table 3). The long dwell time is an indication that the baskets were deemed valuable sources of information and were important to complete the task. Another conclusion may be that the participants grappled with placing the electricity bills in the correct baskets. However, further investigation is needed here.

The viewing of the electricity bills had the second highest values of an average fixation count (8.6), average dwell time (9146ms), and average fixation duration (9435ms) for looking at the electricity bills. Because the bill and its placement (along with the baskets), is of immense importance in continuation of the game and also for getting a high score, it is not unusual that the participant’s focus was spent most of the time in these areas. Although the average dwell time was lower than for the baskets, it does not mean that the bills were less important, as the basket area contained more focus areas (6 baskets) and was also visible on two separate screens (Figures 1 and 2). The electricity bill area was also the least skipped area (0.3 times): almost 8% less per participant than the baskets, which further highlights the area’s importance in the game.

On average, the participants spent less time gazing (dwell time) at the final score baskets (that indicated whether the bills were placed in the wrong basket) (Figure 3), than at the previous area (electricity bills), but more than at the sample size area, with values for average fixation count at 4.7; the average dwell time at 4272ms; the average fixation duration at 4241ms; and the average length of fixation at 902.3ms. These values also include the ticks and crosses that appear above the final score baskets after the collection of electricity bills (Figure 3). The low values for the final score basket area show that the participants are indeed interested in what they got wrong or right. It could, however, be that the focus was more on the ticks and crosses above the baskets than on the baskets themselves, but this will be determined at a later stage.

**Game High Scores**

Table 3 provides a summary of the average eyetracking measures, for all three attempts, on the high scores (Figure 3) which the participants achieved during gameplay. On average, the participants gazed 4.2 times at their high scores, dwelled there for 3678ms; the total fixation duration comprised 3773ms and their average
length of fixation was 898.3ms. Figure 6 indicates that only five participants improved on their high scores during subsequent attempts of gameplay (interval 1201-1500).

Figure 6. Frequencies of the High Scores the 17 Participants Achieved

The high scores (which were indicated by both numbers and stars) also contributed to the encouragement of the participants to do better in the next attempts. A participant commented on his progress: “I first scored maybe one star, then the second game moved to two stars.”

**Title Bar**

From all the AOIs, the title bar showed the lowest values for average fixation count (2.1/participant/turn), average dwell time (1592ms) and average fixation duration (1699ms). The average length of the fixations on the title bar was 809ms (Table 3). Although this is the traditional area of placing navigational aspects, they did not receive the attention they required in order to enhance gameplay. The information presented was not deemed necessary to progress in the game. A participant commented on the placing of the time remaining to play the game: “Notification of time left must be clearer” (Figure 1).

Because the average person makes two to three fixations per second (almost 1 every 333ms), the fixations on all the areas of interest measured here are unusually long, and may be an indication that the task was difficult, which then also contributed to the low scores they achieved (Findlay and Gilchrist 2003).

**Discussion of User Interface Evaluation Findings**

We grouped the twelve usability codes (Table 2) as the topics of (i) user interface evaluation outcomes; (ii) game instructions; (iii) expectations of 3D graphics; (iv) game context; and (v) game challenge and time pressures.

**User Interface Evaluation Outcomes**

From our observations made during the eyetracking experiment, we noticed that some participants clicked on the residence buildings, rather than on the lit-up windows. During the experiment, the students were also obliged to play the game on a personal computer with a mouse as game controller, instead of on a tablet. They lost valuable playtime while experientially finding the right place to click, instead of just tapping on the lit-up windows. They found this game mechanic difficult as they were not familiar with it. All the participants made comments on the clicking of the lit-up windows to collect electricity bills. They grappled with game controller proficiency, while trying to navigate with the mouse: “You just try to click the window; and then it just goes to another window; when you try to click on that side, it goes to this side.” Two participants had never used a mouse and they struggled with navigation: “I have not used a mouse before and it makes me too slow.” Although it may sound impossible that students enrolled for higher education are not computer proficient, one has to take into account the background of these black students from rural schools across South Africa where the use of computers is not essential. Yet, these participants belong to the millennial generation who are comfortable with touch screens and mobile devices.

The participants were not regular game players: nine had never played games before; eight seldom played games, and they mostly played games on their smartphones. However, when asked if they would like to own
the game, sixteen indicated that they would like to have the game on their smartphones. One participant candidly indicated: “No, I do not have a device to put the game on.” Six participants inquired about whether further mini games would be ready for play and one stated: “It needs more activities. The activities are just not enough!” Because a metric of a successful serious game is that players repeat-play it of their own accord, this was good news for us to continue with the rest of the game.

Game Instructions
The instructions to play the game were only available in the introduction section before the actual play of the game started. While twelve participants indicated that the game instruction were clear to them, nine indicated difficulties with understanding what they should do: “I didn’t understand before I started playing the game, and then after one try, that’s when I understood.” A participant requested the instructions to also be available throughout the gameplay. Adding an additional button, linked from each of the mini games screens to the instructions screen could solve some uncertainties.

Expectations of 3D Graphics
Three participants expressed their expectations for the inclusion of 3D graphics in the game. Although this is a predictable expectation from the millennium generation, at this point we will not be able to accede to this request. While there is some evidence that various mechanisms and modules can enhance story-driven serious games in terms of knowledge acquisition and test activities at relevant points in the story, the rendering of random 3D graphics remains a complex issue which requires state-of-the-art game engines and huge budgetary demands (Bellotti et al. 2009). It would be possible to use techniques, for example parallax scrolling and pre-rendering, to counter the resource intensive processes of creating fully 3D worlds which would give the illusion of a 3D environment (Bogdan 2014). Bellotti et al. (2009) point out that these gains mainly relate to test takers familiar to high-end commercial video games. With the requirement to integrate the use of BYOD across teaching and learning, it becomes a difficult task to design for the vast array of mobile devices in the pockets of students, and yet augment the game for Statistics Education with 3D graphics. These attributes do not fall within the means of a small academic serious games unit like SGI-SA.

Game Context
During the phase of conceptualization of the game, a previous cohort of students participated in framing the context and the story of the game. One of the aims of the game was to support students in their everyday experiences like electricity bills. While playing the Survive with Vuvu in the Vaal game, one participant remarked on the screen layout when she recognized the campus plan with the residences on the side, as depicted in the introductory section: “I saw a map of the campus; with the gate, lecture building, residences on the hill and the river.” From an integrated dataset we identified 31 utterances which related to their understanding of the statistics concepts which they have learnt about in class the previous week. One participant summarized the plot of the first mini-game as: “Arranging the electricity bills between the baskets, between the numbers given and the brackets, and the intervals.” This, however, does not tell us how much learning took place while the students played the game.

Game Challenge and Time Pressure
People play games to be challenged. The level of challenge should be individualized for and adjusted to the competencies of the players. Players should be properly challenged—games should not be too easy or too difficult. Game challenge can be maintained when the difficulty of the game increases as the player progresses through the game (Alessi and Trollip 2001). Game challenge was the aspect the participants most frequently mentioned (42 utterances). We divided their utterances into three groups: (i) the game was too easy (22 utterances); (ii) the game challenge was just right (13 utterances); and (iii) the game was too challenging (6 utterances). In general, it seems that the game flow was appropriately pitched. This was noteworthy “because flow tends to have a positive impact on learning” (Killii 2005). A participant shared that the game “requires concentration and attention.”

The game mechanic allowed sixty seconds for a participant to pick as many possible electricity accounts, by tapping on moving lit-up windows and placing them in corresponding baskets. In order to cater for the three sets of observed opinions relating to the game challenge, we propose three levels of difficulty in terms of time constraints: (i) hundred seconds for the easy level; (ii) eighty seconds for the second level; and (iii) sixty seconds for the competent level. With levels to match all students’ expectations of challenge, the game
would be: “A very good game to play. It’s fun!”, although time pressure is not the only way to increase game challenge. The Survive with Vuvu in the Vaal game encompassed gameplay aspects of dexterity (fast clicking of electricity bills) and cognitive aspects (learning of Statistics content).

5 Conclusions and Recommendations

Players should be unaware of the evaluative activities in which they are involved to optimally engage with gameplay (Hall et al. 2013). User interface evaluation of serious games with eyetracking devices and usability interviews cannot be labeled seamless; both these measures are obtrusive as they reduce players into subjects. The game evaluation context becomes complex as the evaluation has to demonstrate the learning that has taken place, as well as determining if the game was enjoyable to play. Although students were involved in the initial conceptualization of the game, they did not participate in the design of the first mini game. Attempts should be made to utilize of their expertise during the design of further mini-games, as they know what fun entails for them, while the content experts take care of pedagogical aspects (Danielsson and Wiberg 2006). However, in this case, these ideals could not be attained, and obtrusive eyetracking equipment and in-your-face interviews diminished a natural gameplay environment. Also, animating gaze to a high quality in an automatic manner remains difficult. The capturing of eye movements alone during free-viewing situations remains ideal, but challenging (Renshaw et al. 2009). In spite of these methodological difficulties, it was remarkable that we could attain such valuable findings from the small number of research participants (n=17).(Nielsen and Molich 1990) which could be used to improve the Survive with the Vuvu in the Vaal game.

We list the following conclusions and recommendations for future development of this serious game:

- Adding a button linked to the game instructions.
- Obtaining eyetracking equipment for mobile devices.
- Reallocating the indication of time left to play the game from the top right of the screen to a more prominent area.
- Changing the font size on the baskets which capture the electricity bills for easier identification of corresponding baskets.
- Creating a gaming club on-campus for novice students to become familiar with games and other digital multi-media learning.
- Creating more mini-games before the next round of evaluation.
- Planning for the evaluation of learning in following evaluations.

An aspect which we did not anticipate was the extent to which our research participants have embraced mobile devices, and the way they expected to interact with screens. We will have to align evaluation techniques to the expectations of the millennium generation students and their preferences.

Acknowledgements

This work is based on the research in part funded by the National Research Foundation (NRF) of South Africa. Any opinion, findings and conclusions or recommendations expressed in this material are those of the authors and therefore the NRF does not accept any liability in regard thereto.

6 References


Perceived Utility and Feasibility of Wearable Technologies in Higher Education

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Abstract. With the capacity to provide hands-free access to contextually relevant information, wearable technologies have the potential to transform many aspects of learning and teaching. Yet to date the uptake of wearable technologies in higher education has not been fully realised. This study examined the perceptions of educators (n=202) regarding the utility and feasibility of applying wearable technologies in tertiary education contexts, in an attempt to understand their under-utilisation. Results indicated significant differences between the perceived utility and feasibility in most of the use-cases examined, with the utility significantly exceeding the feasibility in the four wearable technology use cases deemed of greatest potential benefit. The impediments to achievability included cost, technological issues, distraction, privacy, and resistance to change. Implications for educators and higher education institutions are discussed.

Keywords: wearable technologies, utility, feasibility, higher education.

1 Wearable Technologies and Their Under-Utilisation

Wearable technologies can be defined as wearable digital devices that often incorporate wireless connectivity for the purposes of seamlessly accessing and exchanging contextually relevant information (Bower and Sturman 2015). As at 21\(^{st}\) of June 2016 there were 436 devices in the Vandrico Wearable Technologies database (Vandrico 2016) across a range of industries including fitness, medical, entertainment, industrial, gaming and lifestyle sectors. Examples of already popular wearable devices include: Fitbit, Nike+, Misfit and Jawbone wristbands, Apple and Garmin watches, Oculus Rift, Google Glasses and Google Cardboard headsets, and “newcomers” such as Xiaomi bands, Samsung Gear, Epson Moverio, Microsoft HoloLens, Magic Leap’s lightweight AR, AMD Sulon and Meta One (Wareable 2015). It is predicted that in a few years the wearable technology market will be several times larger than it is currently (Page 2015).

Early examples of wearable technology usage in education include rendering 3D objects for mathematics and geometry education (Kaufmann et al. 2000), supporting situated learning in authentic contexts, e.g. field trips to natural environments (Rogers et al. 2002), learning history in the actual places that it occurred (Yamauchi and Nakasugi, 2003), and students as agents in participatory simulations (Colella 2000). More recently, universities have commenced investigating how wearable technologies could be integrated into the curriculum through introductory workshops (Macquarie University Learning Technology Research Cluster 2015; University of Canberra 2014). However, there are generally few examples of uptake in actual courses (exceptions are discussed below). One of the reasons that wearable technologies may be under-utilised is because educators do not deem their use to be of sufficient pedagogical value. Another reason that they may be under-utilised is that educators feel that it is not feasible for them to implement wearable technologies in their classes.

This study examined university educators’ (n=202) perceptions of the utility and feasibility of deploying wearable technologies in specific contexts. Qualitative data was also used to explore why wearable technologies might be under-utilised in tertiary education.

2 The Potentials and Limitations of Wearable Technologies

Wearable technologies can incorporate a wide range of sensors for measuring mechanics (position, displacement, acceleration, force), acoustics (volume, pitch, frequency), biologies (heart rate, temperature, neural activity, respiration rate), optics (refraction, light wave frequency, brightness, luminance) and atmospher-
ics (temperature, humidity) (Barfield & Caudell, 2001). Using captured data enables wearable devices to be ‘aware’ in so far that they can recognise, adapt and react to their owner, their location and the activity being performed (Viseu, 2003). This constitutes a paradigmatic shift from digital simulation (replication and separation) to digital augmentation (connectivity and responsiveness) (Viseu, 2003).

Outside education wearable devices have been used in health care to support medical diagnosis, movement disorder therapy, and drug administration (Son, et al., 2014), for care of the elderly by tracking people with Alzheimer’s disease (Mahoney & Mahoney, 2010), and to enable face recognition and subsequent overlay of personal information using augmented reality (Kim, 2003). However, there is a scarcity of recent research into the use of wearable technologies in education (exceptions include Coffman & Klinger, 2015; Wu, Dameff, & Tully, 2014, as discussed later in this paper).

Yet, wearable technologies offer a wide variety of potentials (or ‘affordances’) to educators. Pedagogical affordances of wearable technologies include the ability to offer in-situ contextual information, recording, simulation, communication, first-person view, in-situ guidance, feedback, distribution and gamification (Bower and Sturman 2015). Wearable technologies offer other affordances in terms of educational quality (engagement, efficiency, and presence) and logistical implications (hands-free access, and freeing up spaces) (Bower and Sturman 2015).

The use of wearable technologies in higher education has been claimed as a high interest research field by the advisory board of the 2014 NMC Horizon Report Australia Edition (Johnson et al. 2014). There are a few instances where universities are already using wearable technologies in their curriculum. Google Glass has been used during medical training role-play activities to provide a first-person viewpoint and the ability to record activity (Wu, Dameff and Tully. 2014). In another recent trial teachers and students were provided with access to Google Glass during educational psychology and organisational behaviour classes in order to take pictures of student work, video record class activities, access the Internet and poll students for responses to questions (Coffman and Klinger 2015).

Universities in Australia are starting to integrate wearable technologies into their curriculum. The University of NSW has started using virtual reality (VR) head-mounted displays in engineering (UNSW Engineering 2014), and the University of Western Australia has used Fitbits in their Self eHealth Challenge (Glance et al. 2016). Other Higher Education examples include using virtual reality headsets to create a serious game that promotes wildlife conservation awareness, using the Emotiv EPOC EEG system to learn cognitive and brain sciences, and using Oculus Rift to provide pre-service teachers with a virtual practical experience (Alvarez et al. in press). These examples demonstrate the potential to help students learn in new and more effective ways.

However, these examples notwithstanding, wearable technologies are far from entering the mainstream of learning and teaching. To that end we investigate the extent to which low perceived utility or perceived difficulties in implementing wearable technologies may exist amongst tertiary educators.

3 Methodology

In order to ascertain the perceived usefulness and feasibility for various educational affordances of wearable technologies, an online survey was designed to elicit the insights of Higher Education experts in the learning technology field. The first part of the survey included demographic items relating to the respondents' institution, country, teaching areas, age, years of teaching experience, and gender. This section also asked respondents to rate their ability to use computers and the Internet for learning and teaching, as well as to rate their knowledge of wearable technologies. Both of these were answered on a 5-point Likert scale ranging from ‘very poor’ to ‘very good’.

Respondents were then asked to rate the usefulness of eight specific use cases as well as the ease with which the use cases would be achieved. Specific use cases were provided so that participants could clearly imagine and rate the utility and feasibility of wearable technology usage. The selection of cases was based on the discussions between members of the research team, based on their knowledge and experiences with wearable technologies in order to represent a wide range of generally applicable learning and teaching possibilities. Google Glass and Oculus Rift were used as examples in order to provide respondents with concrete examples of what is meant by ‘wearable technologies’. The following use cases were presented:
• Demonstrations from the first-person perspective from locations that are difficult for students to access.
• Simulated experiments or situations that would otherwise be potentially hazardous for students.
• Students being able to text questions during classes, which then appear in teachers’ field of vision.
• Being able to control lecture slides during a lecture via voice command or other unobtrusive means.
• Having students wear Google Glasses or similar during practicum placement so that they can be advised discreetly in real-time.
• Quickly accessing references, stored data and information from the Internet during classes.
• Providing remote students with wearable technologies so that they can participate and be more involved in live classroom situations.
• Offering wearable technologies to students with sight or hearing difficulties so that they can receive live audio or text translation of resources or conversations.

For each use case, respondents indicated their agreement to two direct statements; “this would be useful” (utility) and “this would be easily achieved” (feasibility). Level of agreement was measured on a 6-point Likert scale ranging from 0 ‘strongly disagree’ to 5 ‘strongly agree’, with an alternative ‘unsure’ option also available. Respondents were also given the option to clarify any of their ratings with a written response.

Calls to participate in the survey were distributed to the members of the following scholarly organisations via their respective websites and/or electronic mailing lists: Australasian Society for Computers in Learning in Tertiary Education, Open and Distance Learning Association of Australia, Higher Education Research and Development Society of Australasia, European Distance and E-learning Network, Asia-Pacific Society for Computers in Education, International Forum of Educational Technology and Society, Professional and Organization Development Network in Higher Education, Society for Teaching and Learning in Higher Education (Canada), and Association for Learning Technology (UK). The Call was also posted to several other online learning and educational technology networks and communities such as ITFORUM, MirandaNet, WWWEDU, and DEOS (Distance Education Online Symposium), as well as shared with various special interest groups of the American Educational Research Association, EDUCAUSE, and the Joint Information Systems Committee (UK). Additionally, a number of smaller professional societies focused on specific areas relevant to or associated with the topic of the present study (e.g., mobile learning, virtual/augmented reality in education) were targeted. In all, over 30 national and international channels were used to disseminate the call.

The survey was opened from the 29th of September 2014 to the 24th of November 2014. It resulted in 322 responses from 16 different countries. Participants that did not provide complete demographic data were removed from the sample, as were those that did not complete at least a pair of utility-feasibility ratings for one of the eight cases. This resulted in a sample of 202 participants. This included 110 females and 92 males with a mean age of approximately 45 years old. On average the respondents had been teaching in Higher Education for approximately 11 years and had been using the Internet for learning and teaching for 14 years.

Quantitative data were analysed using Microsoft Excel. Descriptive statistics were examined and paired-samples t-tests were carried out. In order to facilitate comparison of ratings responses were removed if they did not form part of a utility-feasibility pair, as were responses of ‘unsure’. A Bonferroni adjusted significance level of 0.05/8 = 0.00625 was used to account for the fact that eight tests were being conducted. Qualitative data analysis techniques were applied to analyse any clarifications or explanations provided by respondents.

Qualitative analysis was performed using the NVivo 10 Computer Assisted Qualitative Data Analysis Software (CAQDAS) system using thematic analysis techniques in accordance with Neuman (2006). An initial open coding phase focused on classifying any key themes. This was followed by an axial coding phase, which incorporated a refinement of categories through repeated revision of the data, and also provided the opportunity to consolidate consistency of coding and category demarcation. Lastly, in a selective coding phase, the categories were once again revisited to select epitomic responses, as well as pertinent responses that may not have been representative but held insight with relation to the category or theme in question. The selective coding phase provided a further opportunity to revisit the categorisations to uphold consistency of
classification. Both the quantitative results and the results of the coding process are presented. Quotes are used when describing key themes in order to promote accuracy of reporting.

4 Results

The quantitative results from the survey are shown in Table 1, in descending order of average perceived utility. The results are also shown below in graphical form to visually represent the differences between average ratings (see Figure 1). It can be seen from the graph that educators on average ‘agree’ to ‘strongly agree’ that wearable technologies would be useful to provide support to those with sight or hearing difficulties, to perform demonstrations from the first person perspective, to simulate hazardous experiments, and to promote greater participation in live classroom situations. However for each of these use cases, participants provided a significantly lower rating of the feasibility (between ‘mildly agree’ and ‘agree’). Having students use wearable technology to receive advice was perceived as less useful (between ‘mildly agree’ and ‘agree’) but was still considered significantly more useful than it was feasible. Educators felt that having students text questions that appeared in the teacher’s field of vision was the least useful use case, but also one they felt was significantly more achievable than it was useful. Using wearable technology to quickly access web-based information or controlling lecture slides via unobtrusive means were considered relatively less useful, with no significant difference between their perceived utility and feasibility.

Across the use cases anywhere between 13 and 29 people out of the 202 respondents (between 7% and 15%) were unsure of the utility or feasibility, or did not provide a response to the use case. The qualitative feedback is helpful in understanding why people expressed different preferences or may not have been sure about the utility and feasibility of using wearable technologies for education.

Table 1. Tertiary Educator Perceptions of the Utility and Feasibility of Wearable Technology Use Cases

<table>
<thead>
<tr>
<th>Use case</th>
<th>Utility</th>
<th>Feasibility</th>
<th>Paired t-test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{x}$</td>
<td>$s$</td>
<td>$\bar{s}$</td>
</tr>
<tr>
<td>Offering wearable technologies to students with sight or hearing difficulties so that they can receive live audio or text translation of resources or conversations</td>
<td>4.55</td>
<td>0.73</td>
<td>3.46</td>
</tr>
<tr>
<td>Demonstrations from the first-person perspective from locations that are difficult for students to access</td>
<td>4.36</td>
<td>1.06</td>
<td>3.63</td>
</tr>
<tr>
<td>Simulated experiments or situations that would otherwise be potentially hazardous for students</td>
<td>4.30</td>
<td>1.13</td>
<td>3.38</td>
</tr>
<tr>
<td>Providing remote students with wearable technologies so that they can participate and be more involved in live classroom situations</td>
<td>4.10</td>
<td>1.11</td>
<td>3.24</td>
</tr>
<tr>
<td>Quickly accessing references, stored data and information from the Internet during classes</td>
<td>3.87</td>
<td>1.28</td>
<td>3.82</td>
</tr>
<tr>
<td>Having students wear Google Glasses or similar during practicum placement so that they can be advised discreetly in real-time</td>
<td>3.70</td>
<td>1.34</td>
<td>3.17</td>
</tr>
<tr>
<td>Being able to control lecture slides during a lecture via voice command or other unobtrusive means</td>
<td>3.48</td>
<td>1.40</td>
<td>3.76</td>
</tr>
<tr>
<td>Students being able to text questions during classes, which then appear in teachers’ field of vision</td>
<td>3.30</td>
<td>1.48</td>
<td>3.66</td>
</tr>
</tbody>
</table>

** Denotes significant result using a significance level of 0.05/8 = 0.00625
The most frequently raised issue with relation to the use of wearable technologies for learning and teaching amongst the use cases was **cost** (n = 19 respondents). Several respondents indicated that they felt cost presented the largest hindrance in terms of feasibility ("my biggest concern with the achievability issue across the board is cost"). Respondents also indicated that cost was an equity issue in so far as it would "make ubiquitous access difficult", and particular use cases might be particularly labour intensive ("translation or transcription is labour intensive and too costly for us to achieve in live events").

**Technological issues** were also a frequently cited impediment to implementation (n = 17). In general terms the approaches were seen to push the boundaries of what was currently achievable, for instance as one participant expressed "I feel that current technology would be challenged in terms of 'realistically' providing an immersive, seamless virtual presence". Interfacing old systems with new was also seen as an issue, for example "it becomes complicated when systems such as proxy servers come into play, do the existing technologies play well with these new technologies?". Streaming of information represented a specific challenge, as one person articulated "I know how difficult it could be to then stream back to the wearer the classroom as we do this just with streaming back to computers and we run into obstacles".

The potential **lack of pedagogical benefit** of wearable technologies within the use cases was also raised by some (n=12). Often this related to particular use cases. For instance in response to controlling presentation slides through audio directives on wearable devices, "why replace the click of a remote with a voice command". In terms of providing remote students with wearable technologies, another participant noted "I don't see why they can not continue using their desktops, worst case, tablets". The quality of information representation on wearable devices was also challenged, for instance when quickly accessing stored data "we can do this with phones and even then this is sometimes very difficult to read/view on a small mobile device - this would be harder on a watch or glass device".

Some respondents thought that the wearable technologies could be **distracting or disruptive** in some of the use cases (n=10). For instance, one participant indicated that "it may be distracting to students if they attempt to access too much info in a lecture/tutorial". On the other hand one respondent expressed that "I think it would be distracting for me as a teacher to see text questions from the class popping up while I'm teaching". One concern was that the wearable devices themselves "may hinder student engagement as the novel technology and not the content becomes more of the student focus".

For a few respondents part of the reluctance to utilise wearable technologies seemed to stem from a **resistance to change** (n=7). As one participant put it "there will be some mild to moderate tech aversion (resistance) from both students and tech-averse staff". Part of the resistance from staff was seen to be due to workload as reflected in the comment that "many university employees, particularly lecturers, are often unwilling to make the time to learn about new technologies".

**Privacy and legal issues** were also raised by some respondents (n=5), particularly with relation to collaboration during field-work and recording. For instance, in the discipline of education, one participant ex-
pressed “wearing technology in the field will be difficult because of privacy concerns… each school district hosting one of our education students would need to form policies about this… it is already difficult and in some districts impossible to take pictures or video”. Similarly in health one respondent felt “it would be helpful, but is very unlikely to work due to the confidentiality of health situations - e.g. hospitals”. Audio recording was also seen to constitute problems: “there may be legal issues as there is with recording voice conversations”.

5 Discussion

Generally speaking the 202 tertiary educators who participated in this study felt that there is utility in using wearable technologies for learning and teaching. Average ratings of utility for four of the use cases lay between ‘agree’ and ‘strongly agree’, and for the other four use cases lay between ‘agree’ and ‘mildly agree’. Participants generally had a lower rating of the feasibility of the use cases, with the average achievability rating lying between ‘mildly agree’ and ‘agree’. Importantly, participants on average provided a significantly lower feasibility rating as compared to utility for the four use cases that were deemed to be of most value: offering wearable technologies to students with sight or hearing difficulties, providing a first-person view of demonstrations, simulating hazardous experiments, and promoting greater participation in live classroom situations. Thus it appears support may be required in order for educators to implement many of the most useful applications of wearable technologies.

Based on qualitative feedback respondents provided several reasons that might inhibit the use of wearable technologies for learning and teaching amongst the use cases. Cost, technological issues, lack of perceived pedagogical benefit for some cases, distraction, resistance to change, and privacy concerns were all seen to propose obstacles to implementation. We note that some of these issues were only raised by a small proportion of the overall sample, but that the concerns generally concur with the broad limitations of wearable technologies found in other research (Bower and Sturman 2015).

Given educators clearly perceive benefit in many wearable technology uses but have concerns regarding achieving these uses in the classroom, we propose the following institutional and systemic strategies for supporting the use of wearable technologies in education:

1. Provide funding to support the use of wearable technologies in education based on cost-benefit analysis
2. Offer technical support that enables educators to offer high quality student experiences
3. Conduct professional development that allows educators to understand the potential benefits and limitations of utilising wearable technologies within courses, including how to address issues of student distraction
4. Reflect upon issues relating to privacy and confidentiality and be proactive in forming policy around these matters.

There were limitations to this study. The survey instrument used Google Glass and Oculus Rift as examples of wearable technologies, and this may have biased people in their responses. To temper this concern, we do note the existence of references to other wearable technologies within participant responses, for instance smart watches. Also, comparing Likert scale responses to ordinal utility and feasibility ratings using t-tests could potentially be challenged by researchers. However, we note that this is a common practice within the field, and see this approach as a mathematical (objective) way to provide a measure of difference rather than as a means to absolutely determine whether or not a course of action should be accepted or rejected. We also note that the survey was conducted in late 2014 and the wearable technologies field has changed markedly in that time. The questions were designed to be technologically agnostic so as to be resistant to developments in the fields, however we acknowledge that people’s perceptions of wearable technology utility and feasibility may have shifted since the survey was conducted.

6 Conclusion

In this paper we show that tertiary educators generally recognise the value of utilising wearable technologies for learning and teaching in many instances, but factors such as cost, technological issues, distraction,
privacy and resistance to change impact on the extent to which implementation is seen to be achievable. The significant gap between utility and feasibility is most evident in the use-cases that are perceived to be most useful, which highlights the importance of support for implementation. We suggest that in order to harness the promise of wearable technologies institutions and systems should provide funding, technical support, professional development, and constructive policy to create an environment where innovation and development can flourish.

In order to fully harness the potential of wearable technologies we also propose that a collaborative approach needs to be adopted. To that extent we call on any people interested in forming part of a community of practice relating to the use of wearable technologies to make contact with the authorial team. In this way we will be able to pursue the goal of enhanced learning and teaching through the use of wearable technologies in a coordinated and constructive fashion.

7 References


Nurturing Collaborative Networks of Practice

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Abstract. In this paper we present the development of a framework for supporting and facilitating collaborative networks of practice using mobile social media. The framework was developed throughout a two-year collaborative mobile learning project #NPF14LMD. The #NPF14LMD project was a national project comprised of three universities and three polytechnics across New Zealand. One of the goals of the #NPF14LMD project was to create a collaborative network of practice across the six institutions participating in the project. The network provided a support and communication structure linking the six institutional communities of practice, enabling sharing of their experiences and a sense of belonging to a wider national and international community. This paper outlines the use of mobile social media to facilitate the #NPF14LMD network.

Keywords: mobile learning, communities of practice, social media, collaboration

1 Introduction

The project drew upon the authors’ experiences of reimagining professional development as communities of practice (Cochrane et al., 2013b, Cochrane and Narayan, 2013, Cochrane and Narayan, 2012, Cochrane et al., 2012), and the wider literature surrounding establishing and nurturing collaborative networks and communities of practice (Jameson, 2011, Learning and Skills Network, 2009, Wenger et al., 2005, Wenger et al., 2002, Wenger et al., 2009). The development of supporting communities of practice (COP) was identified as a critical success factor for transforming pedagogy via mobile social media (Cochrane, 2014, Cochrane, 2012, Cochrane, 2010), and thus the project was initially framed around creating a network of COPs from six tertiary education institutions across the country.

The #NPF14LMD project was predicated upon the growing ubiquity of mobile device ownership, forecasted in International Telecommunications Union statistics (2014). In 2015 undergraduate student ownership of smartphones (92%) exceeded student ownership of laptops (91%) (Dahlstrom et al., 2015). These statistics were confirmed for the New Zealand context through the #NPF14LMD project student survey completed in 2015. Participation in the #NPF14LMD project involved lecturers integrating the use of mobile social media within the courses they were teaching over 3 semesters in 2014 through to the end of 2015. Participants were encouraged to ground their mobile learning project designs on relevant learning theory. Key learning theories and frameworks that informed the project design included, but were not limited to:

• Connectivism (Siemens, 2004): i.e. linking a national network within a global network of mobile learning researchers and practitioners.

• Social constructivism (Head and Dakers, 2005, Vygotsky, 1978): i.e. basing the wider project around collaborative curriculum design, and learner-generated team projects.

• Rhizomatic learning (Cormier, 2008): i.e. utilising a decentralized structure and designing the network activities around ‘triggering events’ to facilitate participant discussion and sharing.

• Conversational framework (Laurillard, 2001, Laurillard, 2007): i.e. encouraging discussion between learners and more expert peers.

• Authentic learning (Herrington et al., 2009): i.e. designing project shared activities around real world pragmatic scenarios.

• Constructive alignment (Biggs, 2003): i.e. aligning the design of the network activities with the goal of modeling the educational use of mobile social media.
• Heutagogy (Hase and Kenyon, 2007, Luckin et al., 2010): i.e. building learner capacity rather than merely competence through a focus upon supporting learner self-determination.

• Creativity (Kaufman and Sternberg, 2007, Sternberg et al., 2002): i.e. building upon the concept of three levels of creativity that move along a continuum from replication, incrementation, and reinitiation.

The project was grounded upon the wide body of research literature surrounding mobile learning. We drew upon the work of leading mobile learning researchers such as: Sharples et al., (2007) – connecting mobile learning practice to learning theories, Traxler (2010) – focusing upon BYOD approaches, Cook (2009) – exploring the mobility of the learner, Pachler et al. (2010) – exploring the socio-cultural impact of mobile learning, and Kukulska-Hulme (2010) – exploring mobile learning as a catalyst for new pedagogies.

Throughout the development of the project participants were encouraged to explore the unique affordances of mobile devices to enable innovative pedagogical strategies within their own discipline contexts. We agree with Bannan, Cook and Pachler (2015) that “The nature of learning is being augmented and accelerated by new digital tools and media, particularly by mobile devices and the networks and structures to which they connect people” (Bannan et al., 2015). Bannan, Cook and Pachler (2015) highlight eight mobile device affordances, to which we provide examples of the types of applications the project participants were encouraged to explore:

• Collaborative and communicative potential; for example Twitter, Skype
• Interactivity and nonlinearity; for example Google Now, Virtual Reality
• Distributed knowledge construction; for example Google Plus, Google Docs
• Multimodal knowledge representation; for example YouTube, Vine, Vyclone
• Authentic/contextualized/situated material, interaction, tasks and settings; for example Augmented Reality
• Multi-functionality and convergence; for example speech recognition such as Siri
• Portability, ubiquity, personal ownership: for example Smartphones
• User-generated content and contexts: for example ePortfolios (Behance)

As the project was a collaborative network of diverse communities of practice, mobile social media was used to facilitate collaboration and communication, and curate user-generated content. Thus similar to Cormier’s concept of rhizomatic learning the project coordinators focused upon designing triggering events throughout the life-span of the project to create discussion and sharing of practice between the project COPs.

2 Methodology

Our project aimed to create a collaborative partnership between tertiary researchers and practitioners in several Polytechnics and Universities throughout New Zealand, establishing a network of communities of practice (COP) sharing their experiences of exploring the potential of mobile learning within their own local discipline contexts. The project was co-funded by AKO Aotearoa and the participating institutions, with a combined budget of NZ$300,000 over two years. The project was predominantly practice-based aiming to inform improved student learning outcomes.

Research Questions

Two overall project research questions formed the basis for the foundational concepts underlying the #NPF14LMD collaborative network.

RQ1. Will learners’ mobile devices deliver innovation, inclusion, and transformation—the main potential benefits for learners? If so, how?

RQ2. What is the ‘framework for enhanced learning and institutional change’ that will deliver these benefits?
Research Question 1

The mobile learning research literature indicates that innovation (Parsons, 2013, Sharples, 2010, Kukulska-Hulme et al., 2009), inclusion (Attewell et al., 2009, Traxler, 2010, Unterfrauner and Marschalek, 2010), and transformation (Lindsay, 2015, Pachler et al., 2010, Puceptedura, 2006) are key benefits of mobile learning. The network was designed to allow sharing of practice that explored these benefits from a variety of contexts and approaches. Sharples (2013) summarises the range of approaches taken by mobile learning initiatives as a scale from enhancing curriculum-led classrooms to informal highly mobile learning environments (Figure 1).

![Figure 1. Mobile Learning Dimensions from Classroom-led to Informal Highly Mobile (Sharples, 2013).](image)

Cook and Santos (2016) describe three aspects of state of the art mobile learning research: (1) the ability to use social media and apps to enable new patterns of connected, social, learning and work-based practices; (2) design research around the transformative possibilities of mobile learning; (3) a focus upon user/learner generated content and contexts. Basing the #NPF14LMD collaborative network around the use of mobile social media was one way to approach innovation (facilitate new pedagogies), inclusion (facilitate open access to all participants), and transformation (from the social use of mobile social media to the educational use).

Research Question 2

The collaborative network was developed as part of a model framework for practice and institutional change that we envisioned that the project practitioners might apply within their own contexts. Facilitating lecturer professional development and providing a supporting technological infrastructure were core elements of the framework. We borrowed concepts from Puentedura’s (2006) educational technology adoption framework (SAMR – Substitution, Augmentation, Modification, Redefinition), and all the participating researchers and practitioners were supplied with an iPad mini and an iPhone each to personalise and facilitate access to the use of mobile social media in their own contexts. We did not remotely manage or image participants’ devices to simulate a BYOD (Bring Your Own Device) environment. Jameson (Jameson et al., 2006, Jameson, 2014) emphasises the critical nature of developing trust within networks and communities. Building trust within a new collaborative network of researchers and practitioners who did not know all of the other participants was a key goal of the use of social media within the #NPF14LMD network.

The research sub-question related to both of the two main project research questions that this paper explores is: How can we use mobile social media to facilitate and sustain the #NPF14LMD network?

Participants

The selection of project participants was a three-stage process. The first stage involved the invitation of project local coordinators from the six institutions by the project co-leader. Potential participants were identified by their previous experience of mobile learning research and practice within the New Zealand tertiary education sector. Participants who accepted the invitation to participate then gained institutional approval to sign the collaborative project fund application. Upon acceptance of the project proposal by the national funding body (AKO Aotearoa) the second stage involved the invitation of local practitioners (lecturers) from each institution to participate in the project by the local coordinators. All of the project coordinators and local practitioners were then supplied with an iPhone 5S and an iPad mini2. The final participant selection stage involved the local practitioners inviting their own students to participate in the project through implementing the integration of mobile learning in their courses. Students used their own devices (BYOD) when participat-
ing in the project. Ethics consent for the participating lecturers was approved through the lead institutions ethics committee consent process. Each institution was responsible for acquiring local ethics consent for the participating students. The project participants were drawn from a wide range of discipline contexts, including: Paramedicine, Game Development, Public Health, Communication Studies, Occupational Health, Performance for Screen, Computing, Pre-service Teacher Education, Carpentry, Business, Zoology, and Early Child Care Education. Two of the project COPs were based within a single discipline, while four COPs were interdisciplinary. This gave the project a wide base of participant experiences.

**#NPF14LMD Network Formation**

The #NPF14LMD project spanned two years from 2014 to 2015. The timeframe of the formation and development of the collaborative network was as follows:

- October 2013: Initial expression of interest with invited coordinators from the 6 institutions
- December 2013: Acceptance of project proposal for AKO Aotearoa funding
- February 2014: Initial meeting of project coordinators and administration team
- February 2014: Mobile social media Ecology of Resources introduced (Google Plus, Twitter…)
- May 2014: Local COPs established at each institution
- August 2014: First iteration of mobile social media projects in practitioners courses
- September 2014: Webinar series introduced
- November 2014: Sharing of project progress with the MINA2014 and Ascilite2014 conferences
- March 2015: Project coordinator roadshow – meeting with all local COPs
- March 2015: Launch of the Mosomelt cMOOC as an optional COP framework
- March 2015: Second iteration of integrating mobile social media in practitioner courses
- July 2015: Virtual Symposium
- July 2015: ISATT2015 Conference
- August 2015: Third iteration of integrating mobile social media in practitioner courses
- November2015: TERNZ2015 Conference
- December2015: Ascilite2015 Conference
- February 2016: Wrap-up of #NPF14LMD project

A key strategy was to model the use of the mobile social media tools we were exploring throughout the project, and create an environment that could facilitate sharing of ideas and practice across the geographically disperse participants. We based the design of the #NPF14LMD social network around the concepts of social constructivism (Vygotsky, 1978), nurturing communities of practice (Wenger, 1998, Wenger et al., 2009, Wenger et al., 2002), connectivism (Siemens, 2004), and rhizomatic learning (Cormier, 2008). The #NPF14LMD network connected teams of researchers/practitioners across six institutions nationally. Cormier’s concept of rhizomatic learning decentralises learning environments and refocuses the role of the teacher from deliverer of content to a designer of an ecology of resources and triggering events that enable learner discussion and creativity. Cook et al., (2013) argue that mobile social media can bridge the socio-cultural milieus of everyday life and education. We attempted to model these concepts in the #NPF14LMD collaborative network. There were five main elements of developing an ecology of resources to support the project: (1) a community-driven hub and discussion forum, (2) collaboration and communication channels, (3) opportunities for sharing practice, (4) a way of linking the local communities of practice into the wider network, and (5) a repository for project documentation. An ecology of resources was developed consisting of a core suite of mobile social media tools including:

- A Google Plus Community with 60 members http://bit.ly/1zP2S0T
- A social media hashtag #NPF14LMD
• Twitter – generating a network of 126 users and almost 700 conversations
• A collaborative participant Google Map
• A Google Drive folder of project documents
• Google Plus Hangouts
• A series of open access Webinars broadcast live and archived on YouTube (http://bit.ly/1HAKpWv)

Other key collaboration strategies included face-to-face meetings, and participation in presenting at a variety of symposia and conferences across New Zealand and Australia (Frielick et al., 2015, Cochrane et al., 2015, Cochrane et al., 2014, Heap et al., 2015). Participation in these symposia and conferences also served to generate a broader network of interest in the project and conversations on social media that linked a global network of interested followers of the project. Figure 2 illustrates the #NPF14LMD project ecology of resources (EOR).

![Figure 2. #NPF14LMD Project Ecology of Resources](image)

3 Analysing the #NPF14LMD Collaborative Network

The #NPF14LMD project network EOR provided multiple channels for sharing and collaboration, including an email list serve. This ecology of resources provided participants with several options for collaboration to choose from, with the Google Plus Community serving as a central hub from which to find the various project resources and collaboration channels. The ability to create calendar events and schedule reminders
for upcoming events such as webinars with G+ Community was very useful for helping to coordinate interaction within the network of the project. Because we wanted to model open practice and allow for project interaction from a potentially global community of mobile learning experts we decided to make all of the project social media platforms public, but contribution was by invitation only. The email list serve and project documentation folder were kept closed to the participants only. Within the first three months of establishing the project there were over 80 posts on the Google Plus Community, with 35 comments on these posts, and 44 #NPF14LMD Twitter hashtag users active creating 182 tweets. Twitter interactions using the #NPF14LMD hashtag were graphically analysed via TAGSEExplorer (Hawksey, 2011). TAGSEExplorer utilizes a Twitter hashtag search to tabulate a Google Spreadsheet from which various data analysis functions are automated, with the live data available at http://bit.ly/1OQkB2s and a network diagram screenshot as at December 2015 shown in Figure 3. In Figure 3 individual Twitter users are represented as individual nodes, with conversations between the individuals represented by dashed lines for mentions, and retweets represented as solid lines.

Figure 3. #NPF14LMD TAGSEExplorer Analysis

The density of twitter conversational interaction is shown by the visualisation of Twitter replies, mentions and retweets that is illustrated as a growing network of conversations recorded in a time-lapse video https://youtu.be/XFeKrAXbgIA. The time-lapse video illustrates the growth of the Twitter network around
the project, highlighting that the network grew in reach and confidence around specific critical incidents such as conference and symposia where project participants shared their experiences and practice. Twitter was also a key tool to nurture the network— as practitioners joined Twitter (mostly for the first time as a result of the project) they were welcomed into the network, and peer feedback was given through likes and retweets of ideas and practice shared via the Twitter hashtag. A snapshot of the TAGSEXplorer visualization after almost two years of the project (December 2015) is shown as a cumulative network diagram in Figure 4, where the largest nodes are the most prolific twitter conversationalists using the project hashtag #NPF14LMD. Figure 4 shows the growth of the #NPF14LMD hashtag user network over the two years of the project, from an initial 44 users (Figure 3) to 122, and 182 conversations (Figure 3) to 662.

Figure 4. #NPF14LMD TAGSEXplorer Replies Mentions and Retweets
Analysis of the key network nodes indicated by TAGSEplorer shows that the top Twitter conversationalists for the project include not only the project coordinators, but also several practitioners within the top 20, as shown in Figure 5. The project leaders feature prominently through modeling the use of Twitter throughout the project, encouraging and generating conversations around the project activities and sharing resources between the six project teams.

The Google Plus Community formed a hub for linking the mobile social media EOR activity around the project. The use of the Google Plus Community was optional for the project participants although all participants were encouraged to contribute at some level. Significant activities included a weekly project coordinators video Hangout (for example: http://bit.ly/20zcErM), a series of webinars with invited guests, a series of
project report webinars, a virtual symposium, shared links to project resources and research, and sharing of conference presentations related to the project. A collaborative Google Doc was used to create the Webinar and project report schedules (http://bit.ly/1K4eGsh), these were live-streamed as Hangouts On Air, and archived on YouTube for asynchronous viewing. The webinar series topics included:

- Collaborative mobile film production
- The affordances of the open web
- Being an open educator
- Qualitative research approaches
- A journey from skeptic to digital ninja
- Maori learners and pedagogies
- Mobile pedagogies

The series of mid-2015 project report Hangouts were collated in a YouTube playlist. In July 2015 we convened a virtual symposium (http://bit.ly/1SSxSup), whereby project participants collaboratively created a map of their local project locations across New Zealand, and embedded project presentations and reflective VODCasts into this map (http://goo.gl/maps/c09S0), as shown in Figure 6.

Figure 6. #NPF14LMD Participant Google Map
The map is arranged as several layers, including a layer for the project coordinators, and a layer for each participating institution. There are 39 contributors to the collaborative project map, with 32 videos embedded within it, creating a geolocated multimedia overview of the various educational contexts explored throughout the project. Created and shared in July 2015 the #NPF14LMD participant Map has had 534 views between July 2015 and December 2015.

Two examples of the discipline based case studies within the #NPF14LMD project network include the use of mobile technologies within a Performance for Screen course (Brannigan et al., 2015), and the integration of mobile social media within a Game Development course (Kenobi and Cochrane, 2015). The Performance for Screen case study explored the use of mobile screen mirroring displays within a live performance space to create new forms of interaction, and also to enable students to rapidly record and critique one another’s performances using their mobile devices to capture the performance and then play back the performance for instant critique and evaluation via the large screen. These large mobile screens were developed to support the infrastructure of the projects by enabling the small personal screens of mobile devices to become collaborative group presentation tools via wireless screen mirroring. We nicknamed these custom designed screens MOAs: Mobile Airplay Screens (Cochrane et al., 2013a, Cochrane and Munn, 2016). This case study also explored the potential of mobile augmented reality to enhance live performances. The Performance for Screen students created individual Wordpress.com blogs as online journals of their learning and eportfolios, and their lecturers curated these blogs using the mobile application Flipboard on their iPads. In the Game Development case study MOAs were used for screen casting to model and demonstrate game designs from students’ laptops and mobile devices. Third year students modeled their design and development processes to first year students using these screen-mirroring technologies. The game design project also evaluated and implemented the use of social media project management apps (for example: Trello, Slack, and Basecamp) and Google Plus Communities to stream-line Game Development project timelines, goals, student team management, resource sharing, discussion forums, and lecturer feedback. The instant notification of updates and announcements via the mobile apps on their own devices facilitated a faster and more effective team environment.

Table 1 summarizes the social media activity around the project.

<table>
<thead>
<tr>
<th>Mobile social media</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAGBoard <a href="https://tagboard.com/npf14lmd">https://tagboard.com/npf14lmd</a></td>
<td>Over 1200 posts from Twitter, Facebook, G+, Vine, Instagram &amp; Flickr</td>
</tr>
<tr>
<td>Collaborative Google Map participants <a href="http://goo.gl/maps/c09S0">http://goo.gl/maps/c09S0</a></td>
<td>39 participants, 32 embedded videos</td>
</tr>
<tr>
<td>Participant eportfolios</td>
<td>Google Plus Communities, Wordpress blogs, Mahara etc….</td>
</tr>
</tbody>
</table>

The global reach of the project is illustrated by a map of Twitter geotagged tweets ([http://bit.ly/1Qbjn5b](http://bit.ly/1Qbjn5b)), shown in Figure 7.
4 Discussion

The project participants were drawn from a wide variety of discipline contexts and represented a wide range of prior mobile learning experience. It took significant time for many project participants to gain confidence with using and interacting actively with the project social media EOR. One of the key initial barriers for many participants was the use of publically viewable social networks and protocols around the use of social media within educational contexts. A series of project roadshows in March 2015 at each participating institution was effective at mediating the concept of the mobile social media EOR supporting the network (http://bit.ly/1KwFYHP). The introduction of a project email listserv was aimed at providing a foundational communication and discussion forum for the project participants, however it was only ever used as an announcement channel for project administration purposes. A core group of project coordinators and practitioners made regular active use of the mobile social media channels, while others lurked passively on the periphery of this core group, with some preferring to keep their project activity private to themselves and their students via institutional systems such as Mahara and Moodle. However, as participant confidence with the educational use of mobile social media grew throughout the project we began to see several practitioners create their own social media ecology of resources to support their students and classes. Each of these ecologies was made up of a unique blend of social media and institutional tools that were suitable for each context. Based upon their experiences throughout the project, participants theoretically grounded their use of mobile social media from a variety of learning theories and frameworks, including: social constructivism, connectivism, rhizomatic learning, activity theory, e-tivities, situated learning, conversational learning, and socio-cultural theories. These theoretical perspectives provided a rich foundation from which to build the educational use of mobile social media within the various curriculum contexts, described within the case studies covered by the following chapters in this ebook.

There were different institutional and infrastructure barriers and enablers experienced within each institution, however working with the institutional IT support services to provide a robust wifi network for the project participants was a common theme. For example: there were many posts shared in the G+ Community with ideas and hints from the participants regarding ways of implementing wireless screen mirroring from mobile devices. While initially part of the project plan, the provision of MOAs: Mobile Airplay Screens (Cochrane et al., 2013a), for each institution exceeded the available project budget and practicalities of sup-
ply and transportation to each institution, hence each institution explored their own wireless screen-mirroring solution.

The use of a common social media hashtag (#npf14lmd) enabled a sense of connectivity and conversation between the six geographically disperse groups. Twitter and the Google Plus Community proved to be the key conversational connecting threads. Critical incidents in the use of social media to support the collaborative network included the development of the weekly webinar series, practitioner reports via Google Plus Hangouts, a virtual symposium with presentations linked via a collaborative Google Map, and collaborative presentations at several conferences throughout the project. Individual case studies and outcomes will be available at http://mobilelearners.nz/.

Future Directions

The #NPF14LMD project is now completed, but the impact of the collaborative network that has resulted is ongoing. In particular, many of the core #NPF14LMD participants have been invited to become members of the newly established Ascilite mobile learning Special Interest Group (Asilite mobile learning SIG). The Ascilite mobile learning SIG aims to bring together interested researchers and practitioners across the Australasia region and globally, to deepen our understanding of the impact and potential of mobile augmented reality and mobile virtual reality in higher education (https://ascilitemlsig.wordpress.com/about/). Thus the Ascilite mobile learning SIG links a broader range of participants within a specific mobile learning research interest. The Ascilite mobile learning SIG applies and refines many of the elements of the support framework developed out of the #NPF14LMD project. The key difference with the Ascilite MLSIG is that there is no local face-to-face community of practice: as the participants are geographically dispersed the COP is sustained and nurtured virtually. Another key difference between the #NPF14LMD project and the Ascilite MLSIG is the specific focus upon research as an outcome of the Ascilite MLSIG. To this end Ascilite MLSIG participant eportfolios are based around creating and sharing an ORCID, the Open Researcher and Contributor Identity (https://ascilitemlsig.wordpress.com/member-orcid-portfolios/). The ecology of resources supporting the Ascilite mobile learning SIG include:

- A network community hub via a Google Plus Community linked to the official Ascilite website
- A social media hashtag #ascilitemlsig
- Twitter
- A portfolio of participant ORCIDs (https://ascilitemlsig.wordpress.com/member-orcid-portfolios/)
- A Wordpress site for SIG updates and archiving SIG outputs (http://ascilitemlsig.wordpress.com)
- Google Plus Hangouts for regular SIG member virtual meetings
- A series of open access invited guest Webinars broadcast live and archived on YouTube
- Google Docs for collaborative research articles

The collaborative network support framework is also being used to support the development of further mobile learning research projects based around exploring the impact of mobile AR and VR in the specific contexts of Paramedicine education, Journalism education, and New Media Design. This project aims to link the exploration of mobile VR within these three discipline contexts across two globally disperse universities (in New Zealand and in the United Kingdom), and thus the collaborative network supporting framework will also be applied to this context.

5 Conclusions

In this paper we have explored the impact of the use of mobile social media to facilitate and sustain the #NPF14LMD network over the two years of the collaborative project. The use of mobile social media to support the #NPF14LMD collaborative network enabled both active and passive participation as an opt-in form of facilitating sharing and collaboration throughout the two years of the project. Four of the six participating groups became regular contributors to the national collaborative network, while the other two groups lurked on the periphery of the network. A significant benefit of the use of social media to support the project network was the ability to create a global impact and awareness around the project and to link global experts
in mobile learning into the network. This allowed the core members of the project to broker the activities and outcomes of the project to a wider global network through conference publications and presentations and the option of following or participating in the project via the project social media hashtag. Another significant benefit was the development of participants’ confidence in becoming mobile social media users and the development of professional and educational practices that they could then model to their own students, and explore integrating into the curriculum.

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Location-Based Mobile Learning Games: 
Motivation for and Engagement with the Learning Process

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Abstract. This concise paper reports on research to identify benefits of playing location-based mobile games across different disciplines in higher education programs. Location-based learning games delivered as a mobile app integrate storytelling, augmented reality and rich media with GPS, maps and gamification methodologies. Games were developed in four discipline areas, introduced to students during lectures and played subsequently in a tutorial or field excursion. The project team made observations of students as they played and used an online survey to discover satisfaction rates, engagement and learning outcomes. Findings indicate that location-based mobile learning games provide an authentic and meaningful pathway to teach and learn with mobile technology and can make learning pleasant and engaging. To be effective, games require narratives that deliver meaning, location-interaction tasks to engage and motivate and gamification methodologies for converting tasks into ‘play’ to capture attention, retain interest and keep students active as they play. There were no significant integration issues while maintaining benefits of LBMLG’s across disciplines.

Keywords: location-based mobile learning, mobile learning, game-based learning

1 Introduction

Location-based learning is substantially extended by the integration of mobile devices that can use location awareness features to guide students to physical locations for learning to occur (Ardito et al., 2010; Priestnall et al., 2010). The term used to describe this is location-based mobile learning. Introduce the application of gamification methodologies where tasks are converted into ‘play’ and the outcome is location-based mobile learning games (LBMLG’s). Delivered as a mobile app they integrate storytelling, augmented reality and rich media with GPS, maps and gamification methodologies. Their benefits to learning as discussed by Wijers, Jonker and Drijvers (2010) include their potential to enhance and extend the way students interact with locations, mobile content and communicate with each other. There are design challenges however to make them effective for teaching and learning. Arouirs and Yiannoutsou (2012) have commented on how the use of narratives and interaction modes impact on user experience and learning and Alnuaim et al. (2012) suggested that a significant challenge for designers would be their successful integration into educational activities that are relevant to a student’s work.

In addressing the above challenges our study has attempted to build on this research and has focussed on the:

- benefits of playing LBMLG’s by higher education students
- impact that their design has on the motivation for and engagement with learning
- issues of integrating LBMLG’s in different courses across different disciplines

2 Design Approach and Research Method

The same action research methodology undertaken by Cochrane (2014) was undertaken to create, play, manage and share location-based mobile games across four disciplines (Business, Education, Arts, Science). A team of academics and online educational developers used a process of analysis, design, development, implementation and evaluation, first developed by Visscher-Voerman, Gustafson and Plomp (1999). It fo-
cused on the needs of the users and not just on the possibilities of mobile technology. During the analysis phase an online educational designer worked closely with course coordinators to interpret their needs into requirements about what their LBMLG should deliver to ensure relevance and integration into courses. The requirements were then translated into a conceptual model to capture what the game would do, how it would behave, its ‘look and feel’, interaction tasks, gamification style and the appropriate inclusion of rich media.

The focus was to deliver active learning to enrich the student experience in a meaningful and authentic context. All games used varying narratives and physical locations, rich media and simple gamification methodologies. We integrated storytelling, augmented reality and compelling multimedia (e.g. video, images, audio) with maps and GPS to deliver meaning, persuasion and an emotional connection to the experience. Gamification methodologies (e.g. completing challenges and gaining points) were introduced to convert tasks into ‘play’ to capture a students’ attention and retain their interest.

The Mobile Learning Academy platform was selected to develop the LBMLG’s due to its applicability to higher education, ease of use, strong customer support and popularity. An overview of the courses, description and numbers of student players is shown in Figure 1.

<table>
<thead>
<tr>
<th>Course</th>
<th>Game</th>
<th>Student Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business &amp; Society Core undergraduate business course</td>
<td>The Colour of Custard <a href="http://bit.ly/1mp5vYw">http://bit.ly/1mp5vYw</a>  A mystery trail to discover enterprises and their contribution to society around the West-End</td>
<td>450</td>
</tr>
<tr>
<td>Earth Systems Undergraduate science course</td>
<td>The Geology of Hallett Cove <a href="http://bit.ly/1QgLVVf">http://bit.ly/1QgLVVf</a> Designed to complement a field excursion and to use as a geotourism asset for the public</td>
<td>30</td>
</tr>
<tr>
<td>ICT in Learning and Teaching Undergraduate education course</td>
<td>The Protectors <a href="http://bit.ly/1SOzFS2">http://bit.ly/1SOzFS2</a> Introduces LBMLG’s to student teachers. Captures history and heritage of the UniSA Magill Campus</td>
<td>40</td>
</tr>
<tr>
<td>Australian History Undergraduate humanities course</td>
<td>Mystery of the Colonel’s Ghost <a href="http://bit.ly/1PXLoMw">http://bit.ly/1PXLoMw</a> An urban game taking students on an experiential walking trail to find the ‘secret message’ hidden in the design of Adelaide.</td>
<td>18</td>
</tr>
</tbody>
</table>

Figure 1. Undergraduate Location-Based Mobile Learning Games (n=538)

Games were introduced to students in a lecture, then played outdoors soon after as part of a tutorial or field excursion. Students had the opportunity to visit real places at real destinations and learn about real content at each place. Data collection began with the observation of students as they played and was followed with a voluntary online survey in the form of a structured questionnaire created in Qualtrics™ software which was open for two weeks after playing the game. Its completion rate across all four games was 21% (n=112). The survey included questions on demographic characteristics, support provided to students, mobile app functionality and contribution to teaching and learning. Analysis of the data collected in the Qualtrics™ reports was then exported into Excel spreadsheet to display user experiences related to satisfaction rates, engagement and learning outcomes. Focus group discussions facilitated by independent student leaders followed to complement the online survey and provided a better understanding of the game’s impact on student’s motivation for and engagement with the learning process. The administration console in the Mobile Learning Academy Platform provided data on participation/completion rates, GPS traces and answers to quiz questions. Uploaded photos and notes were used to validate student visits to places in the games.
3 Results

Demographic/Accessibility Context

80% of students were 18-25 years old, 11% over the age of 25 and 9% under 18. 72% used iPhones, 25% Android phones and 3%, other devices. We encouraged students to play in teams, but this was an option and not a necessity. They could choose the members and it was common for students to play the game in small teams of 2-3 sharing one mobile phone between them despite nearly all students owning a smart mobile phone.

Student/Staff Support

Students needed little help to play the games. Only 6% needed a great deal of support whereas 61% needed only a little help or none at all. Staff and student expectations, adoption, support and guidance were managed through information sessions, quick reference guides, instructional videos accessed through the course website and face-to-face support while playing.

Mobile App Functionality

74% found it easy to download the app, 76% found it easy to use but only 53% found it easy to add photos and notes. “Narratives being suitable and helped to frame the game” was highly rated (75% either strongly agreed or agreed). The content of the game was highly rated too in terms of suitability, easiness and quality. “Text was easy to read” received the highest rate (88% either strongly agreed or agreed), “images and videos being suitable” (82% either strongly agreed or agreed), “quiz questions used appropriate and easy to understand” (85% either strongly agreed or agreed whereas; “location interaction tasks were suitable” received the lowest rate (69% either strongly agreed or agreed).

Enriching Teaching and Learning Experience

The main findings shown in Figure 2 are encouraging in that the great majority of the students (80%) enjoyed the authenticity of learning in the real world and either strongly agreed or agreed that their experience was engaging (86%), an ice-breaker activity (71%) and team building (86%). For many students the LBMLG was part of their first tutorial together. Most enjoyed being outdoors (86%), and considered the LBMLG was a fun way to learn (77%). These findings did not vary significantly among the four games or in the four disciplines they were developed in indicating generalization of the results.

Overall, only 49% of the students reported that playing the games helped them learn about the topic. The result however did vary significantly across games, responses being as high as 100% and as low as 39% (Figure 3). This indicates design factors as described by Ardito et al. (2010) (viz. duration, level of difficulty,
the location, tasks, competiveness) and implementation strategies may both influence the impact of LBMLG’s on learning. Research is required to investigate these factors further.

![Figure 3. Per Game Analysis of Online Survey Results for Teaching and Learning (n=112)](image)

During focus group discussions, students mainly highlighted the problems they encountered during play, viz. GPS failure, uploading photos and extreme weather conditions. They also mentioned that, even though they enjoyed working in teams, the game was more appealing for those using the phone, due to its small screen size. They suggested that games would be more engaging if they were designed to be more competitive (i.e. by strengthening questions, initiating a sense of urgency such as time limits or bonus points for completion in certain time) or if they were being assessed in their course.

### 4 Conclusions

Location-based mobile learning games provide an authentic and meaningful pathway to teach and learn with mobile technology. Playing them can make learning pleasant and an active, engaging educational experience for higher education students. Their impact on engagement did not vary significantly among the games or in the four disciplines. They did vary significantly though, regarding their impact on learning. This indicates that factors such as narrative, duration of the game, level of difficulty, the location, gamification elements and implementation strategies may all influence their impact on learning. Future research is required to investigate these factors. The study revealed no significant integration issues while maintaining these benefits across disciplines and indicated that there exists generalizability in the adoption of LBMLG’s in higher education. We can therefore have confidence in the ability to develop institution wide deployment frameworks in the future.

Furthermore, the narratives used in the LBMLG created an emotional connection that provided meaning to each game. This confirms Avouris and Yiannoutsou (2012) findings that learning potential is related to the strong interconnection between the narrative supported by the virtual world and physical action in the real world. Including appropriate location-interaction tasks and simple gamification methodologies kept students active as they played. They also shifted the focus of student’s attention from the mobile device to the physical world around them as described by Eliasson and Ramberg (2012).
5 Future Directions

Additional interviews with key course coordinators, tutors and students are planned in 2016. Several LBMLG’s are currently being designed and developed by postgraduate students of a course in International Tourism, as a product for tourists to prepare for their trip, get the best out of their stay and share their travel experiences. This task is offering students an opportunity to practice varying technology related skills and implement their own ideas in a completely new way. The research team is keen to identify if data from this activity supports one the key findings of Slussareff and Boháčková (2016) who observed a positive effect on acquisition of knowledge from students responsible for the active (designing) of a LBMLG.

Several academics across disciplines have begun designing and developing LBMLG’s as self-guided excursions using content created by the research project with little direct support from team members. In this way they are beginning to inform the development of a contextually based mobile learning framework for the university that will expand our flexible teaching and learning arrangements.

6 Acknowledgements

This research received funding from a teaching and learning grant from the University of South Australia Digital Learning Strategy 2015-2020.

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Investigating Children’s E-Reading Behaviour and Engagement using iPads in First and Second Grade

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Abstract. The advent of digital devices and the presentation of reading materials on new platforms have increased the need of children’s reading for pleasure experience as they are surrounded by multimodal reading materials. The actual behaviour of children when using touchscreen devices will assist in understanding their engagement with these devices during reading activity. This paper reports on research in progress regarding children’s screen-based reading behaviour and engagement when using iPads. This research paper investigates the prominent conditions that assist in engaging children whilst utilizing reading applications, and the reading behaviour children exhibit when they read for pleasure via iPads. Data collection was conducted at a primary school using observations and interviews. Participants were selected by teachers and included first and second grade students that excelled in English as a subject. Participants took part in individual and shared reading sessions. Research findings indicate that children’s e-reading experience encompasses four conditions during their engagement with reading applications by means of touchscreen devices, namely effort, enthusiasm, identified regulation, and environment. Also, reading behaviours include reading aloud, reading in silence, and skimming along with screen manipulation were identified.

Keywords: screen-based reading, reading behaviour, reading engagement, iPad

1 Introduction

The electronic era now has created a platform of devices commonly known as tablets or iPads for the use of children in their everyday life. A tablet can be described as a portable device whose context of use is different from that of non-tablet reading systems (Pitt, Berthon, and Robson, 2011). Reading behavior and reading engagement may differ when children read using electronic devices such as tablets and iPads. Generally, educators have reported that children develop deep comprehension skills in reading during the primary school (Giacomo, Vincenza, Mascio, Daniela, Rosella, & Pierpaolo, 2014).

In a country like Malaysia where the national language is the Malay language while English language is an important second language, the ability to read in the English language is seen as crucial for academic purposes and also for one’s upward mobility in the job market (Maarof & Yaacob, 2011). Hence, the Malaysian government has implemented new curriculum to help boost the English language learning as a means of equipping the younger generation to be able to compete with the global electronic era (“The Malaysian Times,” 2012). The aim of this study is to understand the characteristics of reading behavior and reading engagement behavior of children which can influence children’s e-reading experiences when using reading apps such as tablets and iPads.

Electronic Reading

Reading from an electronic book/app is an act defined by vision where readers read with eyes, word by word while sound, pictures, and videos are medium of perception. Where the impact of appealing electronic books has an influence on early literacy development Roskos, Burstein, and You (2012) highlighted the impact of appealing electronic books on early literacy development and referred lack of current knowledge on literacy instruction. In addition, (Cubelic, 2013) stated that although literacy skills are critical elements of early instruction, it is not clear in what format or with which approach, these skills are most appropriately taught.

Reading Behavior

Reading behavior is usually seen as a potential mediator on the effect of reading motivation on reading achievement (Schiefele, Schaffner, Möller & Wigfield, 2012). Reading behavior can be altered through bet-
ter ergonomics and text design which may influence a reader’s eyes, comfort, reading efficiency, pleasure, and the ability to learn to read (Wang, Bao, Ou, Thorn & Lu, 2013). It has been reported that reading for pleasure is on the decline because of lack of motivation to read (Clark, 2005; Cremin, 2007) and that the motivation to read declines as children grow older (Guthrie and Wigfield, 2000).

Reading Engagement

Reading engagement is an important component in a child’s literacy development where the level and amount of time that a child spends engaged in literacy activities interpret his or her motivation to read including gains in reading achievement (Wigfield, Guthrie, Perencevich, Barber, Klauda, McRae, & Barbosa, 2008). A study by Massimi, Campigotto, Attarwala and Baecker (2013), characterized reading for enjoyment as concentration and high emotional involvement with the text. Meyer and Rose (1999) defined engaged readers in the way they approach reading with enthusiasm and confidence. However, there is a lack of research on development of e-books/reading apps targeting children’s e-reading behavior particularly their e-reading engagement for tablet readers (Franckel, Bonisignore, & Druin, 2012; Huang et al., 2014). It has been warned that a state of boredom or disengagement may appear following a certain period of interaction with digital devices (Vicente & Pain, 2002). These negative feelings may create motivational problems and cause less engagement with the learning content among the readers who use these systems to learn.

2 Theoretical Model

The review of literature suggests that there is a need to understand how reading apps can engage children and how their e-reading experiences motivate them to choose reading from tablets and iPads in their leisure time. This understanding can assist teachers and parents to identify and provide well-designed reading apps which support literacy development during the early stages. In this study, the conceptual framework on engagement model of reading development was adopted from Guthrie, Wigfield and You (2012). The reading engagement model is shown in Figure 1.

For this study, behavioral engagement is employed to form the foundation to understand children’s e-reading experiences when engaging on reading acts for pleasure using screen-based devices like tablets and iPads. The reading engagement of children when using tablets and iPads to read for pleasure constitute the components of behavioral engagement such as effort, enthusiasm, and persistence.

3 Methodology

This study employed a qualitative research approach through observations and interviews to understand the children e-reading engagement behaviour. The settings of collected data are summarized in Appendix 1.

Participants

A total of 12 students participated; 5 male and 7 female. There were 5 first-graders (seven years old), and 7 second-graders (eight years old). The first-graders consist of 2 male and 3 female students, the second graders consist of 2 male and 3 female students from a primary school in the north of Wilayah Persekutuan Kuala Lumpur and 1 male and 1 female student from an International school in Bukit Petaling, Wilayah Persekutuan Kuala Lumpur. The children were identified by the teachers and were selected from those who performed good/moderate in their English literacy achievement tests. The selected children met the following criteria: i) students who could read on or above average level according to their English subject grades in the class, ii) students who could speak and communicate in English language and with bilingual families, and iii) students whose parents allowed them to participate in this study.
Procedure and Setting

This qualitative study was conducted to investigate first and second grade children’s behavior and their engagement with reading apps. The main source of data collection was observations followed by interviews. Prior to data collection, consent letters from parents were obtained. The data collection was conducted in a computer room and meeting room inside the primary school. For those students from International schools, the data collection was conducted in a common room, at Wisma R&D, University of Malaya where their parents are pursuing a higher degree in the university. Observational data captured the children’s interaction with tablets and iPads and their reading behaviors using video camera, as they engaged with reading apps in individual and shared settings. Reading apps were selected according to apps rating scores and popularity (well-known storybook topics or children’s TV programs). Children were examined on both Read to Me and Read it Myself mode (with and without narrator). Interviews were conducted to capture the children’s reading and e-reading experiences. A voice recorder was used to record the interview sessions.

All observations and interview data were transcribed using Nvivo software (qualitative software analysis). Responses to the research question were triangulated from interviews and observations. Data analysis consist of coding and categorizing as described by (Miles, Huberman, & Saldana, 2014). Participants were analysed separately at first, and the results were compared to identify commonalities and differences in response patterns. After several reviews of the interviews and video transcriptions, recurring words, phrases and patterns were highlighted and coded. Through inductive approach, codes emerged progressively. Identified pattern codes were used for explanations and inferential findings.
4 Results

The analysis of data revealed four categories of conditions when children engage with reading apps. The categories are based on the following notions: i) Effort (physical/mental); ii) Enthusiasm (entertainment/spending time/emotional awareness); iii) Identified regulation; and iv) Environment.

Effort

Physical Effort: In Read to Me mode, reading aloud included enouncing words either along or before narrator, or repeating after narrator. The engaged reader’s eyes were always following the highlighted text and moving from left to light on the line, although sometimes readers would look at the animation/pictures. Reading in silence included word enouncement in silence (unheard voice along with lip movement) and looking at the highlighted text as the narrator reads them. Skimming included only eye movement on the line and listening to the narrator.

In Read it Myself mode, reading aloud included integration of enouncing words and using fingers to point to the highlighted words. Readers’ voice were mostly moderate and sometimes low. Observational data showed that the voice might get lower or even remain silent as reader enounces difficult words. It could be the act of concentration on content. Faster readers enounced words properly and linked them all in a sentence. Slower readers enounced words almost properly but read pausing, word by word (cut-off). Skimming acts included eye movement on words with the direction from left to write. Readers stated that the page turning function made it easier for them to read in readings app; using only one tap on the screen to flip the pages.

Mental Effort: Engaged readers would ask questions and make comments to get more information about the characters or events in storybooks or subjects in educational reading apps. Observational data showed that most of the participants were still looking at animation/illustration even after the narrator had finished the page. In shared reading, participants agreed to either listen or take turn and read one page each. In the case of listening, all participants had more focus on text and multimedia elements. The reading acts included only listening to the narrator and looking at the multimedia elements. However, in the case of reading by themselves, as the participant reads the text, the partner(s) would have less focus on the story/text. Partner(s) would talk or laugh or just look at multimedia elements. Furthermore, they became competitive in taking turns to apply touch-based gestures on the screen when needed (i.e. swiping the page, tapping on play/ pause button, or tapping on the interactive objects). They engaged less in shared settings, but they exhibited much excitement on the activity itself.

Enthusiasm

Entertainment: In general, participants showed amusement when engaged in reading acts. Having tablets and iPads as reading mediums increased their intention to attend all reading sessions. It was evident that they had fun and enjoyment, as they always asked about the next reading activities at the end of each session. They exhibited interest to share their previous reading experiences and retold some part of that story. Moreover, shared reading setting was also fun for them as they engaged in reading acts with their friends or classmates. According to the interview data, they prefer to read alone if they want to know about content while they prefer to read together if it is all about spending time and having fun.

Spending time: In this electronic era, children spend considerable time reading using the electronic media (Chen & Chen, 2014). This was confirmed in interviews with participants who expressed previous reading experiences using tablets. They reported enjoyment of spending time to select and install a reading app and then read it. Participants stated that they choose reading as one of the activities in their free time for the mere pleasure to try new apps, for both storybooks and educational apps. Additionally, according to interview data children are more drawn to characters or storybooks like Frozen, Jungle Book, Three Little Pigs which are among the popular TV programs.

Emotional awareness: Basic emotional intelligence abilities include expressing, understanding, and managing emotions (Ulutaş & Ömeroğlu, 2007). The findings from this study indicated that participants were able to understand character’s feelings and connect themselves to whatever that happened to the characters with those apps with illustration and text. It is in tandem with the study of Guijarro (2011) that emphasized the combination of words and images in picture books; “images seem to contribute more than words to the
identification of the viewer with the main characters in the story”. However, participants showed more connections to reading material in individual setting than shared setting. They expressed themselves better in individual setting, although, they exhibited more excitement in shared setting.

**Identified Regulation**

A Study by Grolnick, Gurland, Jacob, & Decourcey (2002) defined that individuals identify with the value or worth of the behavior and engage in it accordingly. Participants in interviews highlighted the importance of reading activities based on what they heard from their parents about the benefits of reading to gain cognitive achievements and reading ability developments. In Malaysia, English as a second important language requires bilingual families to contribute to their children’s level of English learning process at the early stage of reading in primary school.

**Environment**

The component of environment revealed that participants shared about their home literacy practices in interview sessions. They reported individual or shared reading routines with parents or siblings. Also, participants pointed out cases of the parents providing different reading materials to help them learn to read in the English. This finding echoed the study of (Guthrie, Wigfield, Jamie, & Cox, 2009; Kim, 2004) that suggested reader’s get better as they spend more time in reading outside of the school.

**5 Conclusion**

This study attempted to understand how children engaged with reading apps and what reading behaviour they exhibit as they engaged with reading apps such as tablets and iPads. Undoubtedly, tablets and iPads being popular electronic devices, played important role in children’s motivation to use it as a reading medium. It was found that engaged readers made effort to get more information about the characters or events in storybooks or subjects in educational reading apps. Also, their selective attention indicated cognitive curiosity towards character or object movements and background noises in which supported the events on the screen. The results of this study confirmed previous findings from literature that stated that all children exhibited enthusiasm engaging with reading apps which have embedded multimedia elements.

Additionally, the importance of reading in English for bilingual readers was recognized through the parent’s encouragement and support by providing variety of reading materials in English for their children at the early stage of reading. The value of learning English in Malaysia affects the type of resources parents provide for children’s activity times at home. The role of media, indirectly, influenced participants’ choice of reading topics/content and their intention to read. Obviously, participants were more drawn to choose those reading apps that were currently popular on recent TV shows or kids movie/programs. Furthermore, in this study it was found those participants who had their parents to encourage reading and provided them reading materials exhibited better self-efficacy in reading. These outcomes suggests that for future research, the children’s reading comprehension has to be investigated as they may or may not stay engaged with reading apps when using tablets and iPads.

**Acknowledgement**

This research was funded by the University of Malaya High Impact Research Grant (No: UM.C/625/1/HIR/MOHE/FCSIT/16/H-22001-00-B00016).

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Negotiating Cultural Spaces in an International Mobile and Blended Learning Project

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Abstract. This paper explores the cultural spaces that had to be negotiated by a team of North American and Ghanaian partners when designing, developing and implementing a mobile and blended learning solution to train physician assistants in Ghana. In addition, it examines how these cultural spaces correspond to five mobile and blended learning spaces: temporal, physical, transactional, technological and pedagogical. Employing qualitative narrative inquiry and paradigmatic analysis procedures, we analyzed six types of data to determine the cultural spaces that emerged. Results indicate that cultural spaces were most often negotiated in the transactional mobile and blended learning space and included: identity negotiation, power, status and authority, communication, relational, resource sharing, and organizational spaces. Learning and instructional cultural spaces corresponded with the pedagogical m-learning space while the technology adoption, and technology affordances and interface space corresponded with the technological m-learning space. In addition, negotiation of cultural spaces occurred in the physical and temporal spaces. This study has significance for future international partnerships that plan to provide education and training in emerging economies, and for those who plan to design mobile and blended learning solutions for diverse audiences.

Keywords: Cultural Spaces, Mobile and Blended Learning Spaces, International Partnerships, Cross-cultural Learning Design

1 Introduction

With the global spread of the Internet and wireless telecommunication systems, distance learning, which can transcend national, political, and geographical boundaries has become a viable option for providing higher education in many developing countries. International partnerships and collaborations often funded by Western countries or international banks are established to provide distance learning solutions to address acute education and training needs in developing regions, including many African countries. These partnerships to implement technology solutions are increasingly taking place in a cross-cultural and global context. But, a continuing concern has been determining how to design and implement technology-mediated learning environments that accommodate differences in sociocultural contexts, and the values, needs, and expectations of diverse learners and educational systems. Madzingira (2001) observed that the “The greatest challenge for Africa’s Internet connectivity is not access, but content because there is a dearth of information for Africa from Africa” (p. 12).

An opportunity presented itself to explore this challenge when a leader of a physician assistant (PA) program at a Ghanaian university requested assistance from a faculty member in a Southwestern U.S. university to develop a distance education solution to offer a bachelors degree to practicing physician assistants who were serving rural communities spread throughout Ghana. These physician assistants (PAs) shoulder responsibility for the health care of a large percentage of the rural Ghanaian population.

A Ghanaian university, hereafter referred to as GU took up the challenge to train PAs and became one of the pioneers in developing an accredited Bachelor of Science in Physician Assistant Studies program. However, it was limited to only 50 students per year who had to come on campus to follow the program. The program accommodated not only Ghanaians, but also participants from neighboring African countries.

When the request for assistance to develop a distance learning component to the existing PA program came from the leader of this PA program at GU in 2010, the Southwestern U.S. university began a collabora-
tive relationship to determine the most appropriate distance learning solution for the sociocultural context. A blended learning program, including online learning using Moodle (an open access Learning Management System), mobile learning, and face-to-face clinical practice was considered the most appropriate solution. During a period of three subsequent years, the U.S. institution worked with the Ghanaian Lead to develop and test distance learning course prototypes in Moodle. When a distance learning solution became a viable option, an international, interdisciplinary project team consisting of Ghanaian, Canadian, and U.S. partners was formed with the Ghanaian institution as the lead to secure funding for a blended learning solution to training PAs. The project team was successful in securing funds in 2013 from a Canadian organization to implement this blended learning solution in Ghana using mobile interface friendly courseware that resided in the university’s Moodle platform, which could be accessed through mobile tablets and phones.

The North American partners included a senior faculty member and graduate students specializing in eLearning and instructional design at the Southwestern U.S. University and two Canadian faculty members, whose expertise was in mobile learning. The North American partners represented diverse cultural heritages, including American, Canadian, South Asian, African, Eastern European and South American. The main goal of the volunteer North American partners was to assist in the design and development of the online and mobile learning component, hereafter referred to as the blended learning program, that was centered on content developed by Ghanaian physicians, the subject matter experts (SMEs), so that it could be an educational program relevant for the Ghanaian sociocultural context. The Ghanaian partners consisted of the Lead physician, the Head of the PA program and his faculty, Information Technology (IT) staff in charge of the Moodle platform, and Administrative Assistants.

2 Purpose

The purpose of this paper is to explore the cultural factors that emerged and had to be negotiated when we worked cross-culturally to design, develop and implement a blended learning project. In addition, we examine how these cultural factors, conceptualized as cultural spaces correspond to the five mobile and blended learning spaces identified by Palalas (2013). The context of this study is the PA program in Ghana. Addressing the conference theme, “Sustaining quality research and practice in mobile learning” we attempt to look beyond the nature of technological intervention to consider the cultural spaces within which mobile and blended learning projects are implemented.

3 Research Questions

The main research question that guided our study was:

What cultural spaces had to be negotiated by a team of Ghanaian and North American partners when designing, developing and implementing a mobile and blended learning solution to train physician assistants (PAs) in Ghana?

A sub-question we explored was:

How do these cultural spaces correspond to the five mobile and blended learning spaces identified by Palalas (2013)?

We approach the main question from a “social embeddedness perspective” rather than a “transfer and diffusion perspective” as defined by Avgerou (2010). A social embedded perspective highlights distinctive features of a cultural context, such as attitudes to hierarchy, sense of space, and cross-cultural interactions; while a transfer and diffusion perspective implies transferring technology applications from a western to a non-western culture often using Hofstede’s (1980) dimensions of national culture. Avgerou observes that the transfer approach oversimplifies cultural differences and cites Walsham (2001) who noted that such an approach will “sweep the subtleties of cultural difference under the universal carpet.”

Given this social connectedness approach, we discuss our findings from the perspective of North American partners who have become aware of important cultural lessons when planning and implementing international blended learning projects, and discuss them from a position of cultural humility well aware of our own need for more perceptive cultural awareness.
4 Method

A qualitative research design utilizing narrative inquiry (Creswell, 2013) helped us to reflect on and study our own experience throughout the project from the initial stages of planning to evaluation of the first blended learning course offering. Narrative inquiry helps to think about and study experience. Our narrative inquiry followed a recursive, reflective process moving from the initial planning stages using collaborative technologies such as Skype, Wiggio, and Dropbox to implementation of the project online, and subsequently to examination of interview data gathered from Ghanaian PA students during the initial needs assessment and a focus group during the latter stage of implementation of the first blended learning course. Data sources included: (1) minutes of meetings conducted with project partners through Skype; (2) memos of meetings conducted on site with administrators, faculty and staff at GU, and wireless service providers; (3) course design documents from Ghanaian and North American partners retrieved from the drop box and the collaborative Wiggio space, (4) the Moodle course, (5) interviews with students who volunteered for the needs assessment and acted as cultural informants, (6) focus group interviews conducted with 22 students, ages 22-54, from the first student cohort, and (7) our own storyline of the project. We gathered stories from our data sources and used paradigmatic analytic procedures (Polkinghorne, 1995) to produce a framework of cultural spaces that emerged across our data. In the Results and Discussion section, we synthesize and organize our story and narrative analysis into this framework of cultural negotiation spaces. These negotiation spaces were evident from the inception of the project and throughout the project implementation phases.

5 Conceptual Framework

We begin our narrative with a definition of culture. Edward T. Hall (1959) declared “Culture is communication and communication is culture” (p. 217), and we adopt this definition as it focuses on both culture and communication and includes nonverbal communication where many of the cultural nuances are generated. This definition also accommodates the notion that culture can be negotiated in space through a communication process mediated by technology interfaces. Hall further observed, “culture hides much more than it reveals and, strangely enough, what it hides, it hides most effectively from its own participants.” (1959, p. 53). With this conceptualization of culture in mind, which accommodates both manifest and tacit culture, we discuss our conceptual framework below.

Cultural Spaces

St. Clair and Williams (2008) have noted that the concept of culture as a unit of knowledge shared by all individuals within a nation state no longer holds relevance, and one way to conceptualize culture is to examine cultural spaces where culture is negotiated. St. Clair and Williams (2008) modify Foucault’s (1969) metaphor of cultural spaces as the sedimentation of knowledge layers over time and change it to the sedimentation theory of time in space which envisions time as the accumulation of social practices layered in cultural space. It differs from the linear model of time and presents time as embedded in space: the present is embedded in the cultural past and the future is embedded in the cultural present. Martin and Nakayama (2010) extend these conceptualizations and define cultural space as the particular configuration of the communication (discourse) that constructs meanings of various places: “A cultural space is not simply a particular location that has culturally constructed meanings. It can also be a metaphorical place from which we communicate” (p. 287). Cultural spaces are places that are defined by cultural practices, such as the languages spoken, identities enacted, and rituals performed, and they often change as new people move in and out of these spaces. The discourses that construct the meanings of cultural spaces are dynamic and ever-changing.

We use the conceptualization of cultural space to discuss the various cultural factors that emerged in our project as we view cultural spaces to be symbolic entities where cultural negotiations take place. Negotiation is the process of searching for an agreement that satisfies various parties; it is not one party dictating or imposing terms on another. To obtain agreement, one must generally sacrifice or yield something in order to get something in return (Negotiation Techniques, 1998). We then examine how negotiations in cultural spaces correspond to the mobile and blended learning spaces discussed by Palalas (2013).
Mobile and Blended Learning Spaces

Crompton (2013) defined mobile learning as “learning across multiple contexts, through social and content interactions, using personal electronic devices” (p. 4). Palalas (2013) observed that mobile learning with the inherent affordances of mobile tools, its ubiquitous nature and the nomadic tendencies of mobile learners, has the potential to transform learning spaces and go beyond the traditional physical and conceptual boundaries of education. Graham (2006) defined blended learning as combining multiple instructional methods and instructional modalities (or delivery media), as well as mixing face-to-face (f2f) and online learning. Integrating the concepts of mobile learning and a redefinition of blended learning, Palalas (2013) in her discussion on expanding learning spaces with mobile technologies, identifies five conceptual spaces of mobile learning that make up the m-learning ecosystem as demonstrated in Figure 1: (1) Temporal (mix of within and outside schedules, time-flexible and time bound, brief event and a series of learning episodes); (2) physical (mix of location-based and location-flexible practice, context dependent and context independent learning, formal, informal and non-formal, physical and virtual learning); (3) transactional: intrapersonal, interpersonal, and interpersonal (social and public) communication and exchanges; (4) technological (blend of mobile and non-mobile devices), and (5) pedagogical (context-embedded, real-world practice, learner-centered, ubiquitous, collaborative, personalized, technology-mediated, learner-generated artifacts, and inquiry). Palalas notes that the intersection of these spaces results in a unique m-learning space: the optimal m-learning zone.

![Image of Blending Mobile Learning Spaces](developed-by-Palalas-2013-used-with-permission)

We discuss below how each mobile learning space (Palalas, 2013) corresponds to several underlying cultural spaces which had to be carefully negotiated when implementing our blended learning project.
6 Results and Discussion

We frame our project as a negotiation exercise across cultural spaces during the different phases of project planning and implementation. Figure 2 presents the cultural spaces where cultural negotiation was enacted and shows how these cultural spaces corresponded to the m-learning spaces in Figure 1. We use the metaphor of “our lens,” a multi colored eye to visualize the cultural spaces that emerged from our data analysis. These spaces intersect and interact with each other and correspond well with Palalas’ (2013) five mobile and blended learning spaces.

As can be observed in Figure 2, cultural spaces were most evident in the transactional m-learning space and we discuss this space first, followed by pedagogical, technological, physical and temporal spaces.

Transactional Space

We identified six cultural spaces that corresponded with the transactional space of mobile and blended learning: (1) identity negotiation, (2) power, status and authority, (3) communication, (4) relational, (5) resource sharing, and (6) organizational/institutional spaces. We discuss each of them in detail below.

Identity Negotiation Space

Identity negotiation spaces personify how individuals perceive themselves in relation to each other and society. From the inception of our project, identity negotiation both professional and personal between Ghanian and North American partners played a critical role in building trust. While the Ghanaian Lead and North...
American Lead met initially face-to-face at a conference when the request for the project was made, the extended negotiation of identity across team members occurred through electronic media when the project and design team met weekly to plan, develop and implement the project. Therefore, virtual identity and anonymity played a role in negotiating identity. Our electronic identity negotiation led to the development of a Memorandum of Understanding between GU and the US University, which was strengthened with the Ghanaian Lead’s visit to the US University.

However, it was not until the North American team’s visit to Ghana that we realized the depth to identity negotiation, which was not evident through electronic media. We had not been aware of the key role that tribal identity and tribal affiliation played in the lives of Ghanaian people. As with many African states, tribal identities remain entrenched in people’s consciousness, and play a role in organizations, politics, and education. In organizations, individuals tend to gravitate more towards fellow tribe members or people from their region. Those in authority view their power by surrounding themselves with classmates, relatives, tribesmen, and clansmen to ensure their power is consolidated. This dynamic came into play when the North American partners observed that the Ghanaian Lead wanted to employ people from his own tribe and had difficulty collaborating with administrators and fellow faculty at GU, which is located in a region different from his own tribe. Tribal consciousness came into play in hiring decisions as those from one’s own tribe were considered to be more supportive of one’s decisions and goals even though they might not be adequately qualified for the position. The North American team with its well prepared job descriptions to hire the most qualified project director and instructional designers for the grant funded project, had to negotiate with the Ghanaian Lead’s tribal affiliations.

**Power, Authority and Status**

Power dynamics played an underlying role in practically all our transactions with the Ghanaian partners. How power is distributed in Ghanaian society predates colonial times where the power structure in communities was determined by the amount of people or “things” a person commanded. When the Europeans arrived, those close to colonial power assumed important societal status. This carried over to modern society where people with white color jobs hold more power in society, and having any form of regular income has, in fact, prestige associated with it. Very often, a person’s status (educational or otherwise) and personal connections determine employment rather than ability or experience.

The extent to which cultures accept inequalities in power and status was defined as “power distance” by Hofstede (1980). In Hofstede’s Power Distance Index, Ghana had high power distance (80), compared to USA (40). This means social and political organizations are hierarchical in nature where members accept and expect that power is distributed unequally. Daniels and Greguras (2014), however, have pointed out that although power distance is often treated as a homogeneous national value, it varies at the individual, group, organizational and societal levels. In our transactions with the Ghanaian partners, we observed that power distance varied at each of these levels.

We observed that power distance played a role in the educational transaction, especially, the relationship between PA students and the Ghanaian Lead. Education revolves around teachers with students respecting teachers in and out of the classroom and relying on them for guidance and decision making. Students address teachers formally with acquired titles and rarely oppose their teacher’s point of view. During our needs assessment, students stated that they respected age and teachers and found it difficult to question authority. However, when the authority figure of the teacher was removed in a focus group interview with 22 PA students from different regions in Ghana, the students opened up to the North American partners about their concerns related to the project and offered to work as a team to co-design the online case studies. As practicing PAs they had a great deal of experience to offer to future PA students and, as one PA student pointed out, they had a wide range of experience to contribute into the program curriculum design: “We see 40-50 patients in an 8 hour day. We have to be prepared for anything at all times. In one day we can see a woman with pregnancy difficulties, to people with malaria.” During our needs assessment, Ghanaian students expressed that online interaction may be preferable because it could equalize status differences present in face-to-face interaction.

In hindsight, we felt that our approach of group consensus and group leadership, with all decisions being made collectively, may not have helped in the Ghanaian power-distance context. We deliberated whether nominating one key individual as an authoritarian figure, a strong leader, a key negotiator to communicate and convey our decisions and represent the North American team would have made it more of a business transaction, perhaps a more effective solution, and less of a personal, friendly, more collegial negotiation.
Many of our suggestions and recommendations, originally jointly accepted during the planning phase, were never implemented by the Ghanaian Lead, making us wonder about the winning approach for cross-cultural negotiations in the Ghanaian context.

Another factor that may have impacted our situation was that the negotiators at the North American end were predominantly female while those at the Ghanaian end were all male. We felt that gender and power dynamics played a role as the underlying masculine superiority may have impacted the value placed on advice given by the North American team.

**Communication Space**

Traditionally, Ghana is an oral culture, which relied on face-to-face communication. Thus, radio and television supported this time-honored form of oral expression. Mobile and online learning, however, shifted the conventions of interpersonal communication and reduced the power dynamics present in face-to-face and oral communication. The exchange of information between North American and Ghanaian partners occurred predominantly by means of technology. Integrating traditional modes of communication with virtual tools, such as Skype and Wiggio was often a challenge. The Ghanaian Lead felt that some of his authority was being eroded in online discussion spaces where he had no control. Therefore, instead of facilitating online discussions, he chose to answer questions individual students asked online by calling them on their mobile phones despite the many pleas by the North American team to post the answers online for the benefit of all students. In this instance, mobile technology helped to solidify the authority of the teacher, maintain the status quo, yet personalize the communication for an individual student. This example also reflects the Ghanaian Lead’s discomfort in facilitating online discussions. Therefore, the North American team took it upon themselves to facilitate discussions online often on unfamiliar topics so that the Ghanaian students felt supported in an online learning community.

Hall’s (1976) conceptualization of high context and low context communication styles, and implied indirect and direct communication, was useful for analyzing our cross-cultural interactions. While the North American partners employed direct communication and often communicated both orally and in writing, the Ghanaian partners were more indirect in their communication and mostly communicated orally. In a predominantly oral culture, meanings expressed are highly specific and local, and the North American partners lacked that local knowledge to understand communications and their connotations. While online communication tools and web conferencing proved to be very effective in planning this project, we missed out on understanding the local context by performing most of the activities remotely. While communication was challenging, non-communication was even more perplexing. We often encountered silent periods in our planning process and wondered about the meaning of this silence, which we gathered was a form of communication.

**Relational Space**

Our needs assessments with PA students and initial interactions in Ghana, highlighted the value placed on family and relationships and how communication needs to be understood within the context of these relationships. Contextual information as well as relational information were key to understanding a message and it’s meaning as is the case in cultures described as high context and high power distance. Communication in shared social and public spaces had its own conventions, such as knowing who needed to be awarded respect. We found that building meaningful relationships with those in authority in the institution must take precedence over negotiation of the project itself.

**Resource Sharing Space**

Resource sharing relates to how funds, human and technology assets are negotiated. Since ours was a grant-funded project, sharing resources within GU became a challenge. Although the grant was given to the University and the President was a signatory on the grant, the Ghanaian Lead as Principal Investigator felt that the funds were rightfully his because he made the effort to bring in the funding working with the North American partners. This led to hoarding the funds, such as not spending on the wireless plans for students that the funds were rightfully his because he made the effort to bring in the funding working with the North American partners. This led to hoarding the funds, such as not spending on the wireless plans for students that the funds were rightfully his because he made the effort to bring in the funding working with the North American partners. This led to hoarding the funds, such as not spending on the wireless plans for students that the funds were rightfully his because he made the effort to bring in the funding working with the North American partners.

The practice of the funding agency to deposit the total direct costs of the project (96%) of the entire grant in the GU account at the beginning of the project with the stipulation that grant funds must be invested in interest-bearing bank accounts with the primary objective of preservation of principal, led to many challen-
es within the GU administration, as grant funds were invested in Certificates of Deposit and not available when needed by the Ghanaian Lead. Those who held power and status controlled the resources that should have been made available to students who would have benefitted from them.

Organizational/Institutional Space

The organizational culture of GU was hierarchical and, coupled with high power distance, challenged innovation. The Ghanaian Lead as a retired physician and head of an academic department wielded substantial power and authority over those in lower status positions, considered the project as his own and excluded lower status individuals, such as his junior faculty, in the planning process. Therefore, lower status faculty who were more technology savvy were not involved in planning and executing the project; they attended the training that North American partners offered because they were required to do so, and overall lacked commitment to move the project forward. It was a similar case with the Information Technology (IT) Department, with lower ranked IT personnel, who were potential innovators, reluctant to engage in the project as they were afraid to incur the displeasure of their department Head. Daniels and Greguras (2014) have observed that new ideas and innovations, especially from lower levels of the organization, often do not get voiced or receive serious attention in high power-distance cultures because this threatens the social hierarchy of the organization.

Pedagogical Space

We identified two cultural spaces: learning and instructional spaces that corresponded with the pedagogical m-learning space. They are discussed below.

Learning Space

The needs assessment conducted with Ghanaian students who are practicing PAs provided insights on how to negotiate the design of the mobile and blended learning space to shift from a traditional hierarchical one to a more egalitarian interactive space. As one student remarked: “For a Ghanaian, learning should be one of interaction as we do not do work alone.” This student observed that Ghanaian students form study groups on their own and commented that for an online class, grouping students regionally would help so that, when experiencing bad wireless connections, they could go to each others’ villages to get support and discuss the course. This rationale for grouping is embedded in the cultural context and may have also been influenced by regional tribal affiliations. We found that women would be more reticent to participate in online discussions and therefore would need more guidance and support to feel comfortable. Students discussed the importance of conducting an orientation session to orient them to mobile and online learning, self-directed independent learning, learning how to learn skills, and training in the use of technology. In addition, students' requested avenues for visual and auditory learning preferences in course design and the incorporation of traditional culture, symbols and myths in the web interface. Clear goals and expectations and structure in the organization of the course were additional requests. Ghanaian students shared why online courses may be better. They said that those who are less fluent in English and reluctant to speak the language in face-to-face contexts are more likely to feel comfortable expressing themselves in the anonymity of the online environment where they can take time, reflect and edit. Students felt that introverts are more likely to put forward their opinions as the online environment is more welcoming and comforting.

Instructional Space

While the Ghanaian Lead had great passion and charisma for teaching PA students, he found it difficult to make the paradigm shift to online and mobile learning. It was difficult for him to grasp how technology is changing the role of the teacher from a disseminator of information to a learning facilitator. He sporadically attended the faculty development sessions we conducted but still found the entire online teaching experience daunting and did not make the effort as a SME to guide the learning design. We created and loaded the content based on documents he provided but we were never shown how the modules might connect to the clinical work students would be doing for the course. Therefore, from an instructional design perspective, we were not giving students everything they would need to succeed.

This points to the need for faculty development programs in online course design and teaching. While the North American partners provided over 300 hours of face-to-face and online training on instructional design,
mobile learning, and online teaching, the faculty and staff who should have attended the training sessions did not do so. Nevertheless, the training did make an impact on some Ghanaian faculty; several months later they e-mailed the training facilitator to ask for resources demonstrated during the training sessions.

**Technological Space**

Two cultural spaces: technology adoption space, and technology affordances and interface space corresponded with the m-learning technology space and are presented below.

**Technology Adoption Space**

This space relates to how a technology is accepted and used in a specific culture. In an oral culture, such as in Ghana, the mobile phone extends oral communication and was readily adopted. Practically all PA students had access to mobile phones and were savvy at using them. However, wireless access in remote communities was problematic and often costly for students. This had to be kept in mind when designing the online course to make it compatible with mobile devices. All PA students benefitted from the orientation provided by the Ghanaian IT experts on how to use the digital tablet to access the Moodle server in which the course resided.

Mobile service procurement became an important negotiating point between North American partners and the Ghanaian Lead. After discussion with two mobile service providers in Ghana, the North American team and the Ghanaian IT experts recommended that a Ghanaian company be hired to provide both the tablets and data plans. However, the Ghanaian Lead chose to order the tablets from the USA and found that they were not compatible with wireless services in Ghana. This meant that the tablets had to be repurchased in Ghana. In retrospect, we concluded that this negotiation process was a case of talking past each other where hidden motivation for actions was not clearly discernible.

**Affordances and Interface Space**

Mobile technology affordances can extend the notion of learning beyond traditional learning spaces, methods and materials. However, we had to negotiate the potential of mobile affordances and their juxtaposition with traditional teacher directed and controlled learning environments. It was important to embed the teacher presence—a short introductory video of the teacher and lectures via audio and text. Given the advantages to using mobile apps, we negotiated with the Ghanaian Lead to integrate apps that were relevant to the discipline and context. “Medscape” was used most often, followed by “Visual Anatomy.” In addition, we integrated Quizlet and YouTube into the course design. WhatsApp was used for learner support considering its popularity and access amongst the students.

Through trial and error, we found issues related to our interface design that had to be revised to better align with the Ghanaian cultural context. When we developed the gynecology course, for example, we had initially put a photo of an intensive care unit for babies in the U.S. in the main theme block of Moodle as seen in the screenshot in Figure 3. Our Ghanaian colleagues wanted that photo removed and replaced with a Ghanaian woman and her baby as seen in the screenshot in Figure 4.

We learned through this feedback that images and photographs must relate to the cultural context. Symbols unique to Ghana such as the Adinkra symbols from the Asante region have specific meaning and will be recognized by Ghanaian students. We had used these symbols in a pilot design to aid navigation and the design was well received.
Physical Space

Our learning design had to account for both physical space, such as clinical rotations, which are infused with specific meanings and cultural practices, and mobile and online virtual spaces. One major challenge we experienced was negotiating with the Ghanaian Lead on how to make virtual spaces come alive when he was used to teaching in physical space where he had control.

Temporal Space

One advantage of mobile and blended learning is the ability to provide for both time flexible and time bound learning events to accommodate PA student work schedules. In a culture where time is more cyclical than linear, temporal flexibility was an important feature and impacted the planning, development and implementation of the project. It was often at the 11th hour or later that content would be placed in the drop box to enable us to design the module that would open the following day. The need for prior planning in imple-
menting a distance learning solution was difficult to communicate. The concept of time is different and North American partners had to adjust to it.

7 Conclusions

This paper has demonstrated how cultural spaces influence each of the five mobile and blended learning spaces identified by Palalas (2013) and the importance of negotiating these cultural spaces when implementing mobile and blended learning solutions in emerging economies. From the onset of this project, it became apparent that the concept of national culture alone was not adequate to understand the Ghanaian context in which the project was implemented. This paper has provided a more expanded perspective employing the concept of cultural spaces to grasp the cultural negotiations that occurred.

Cross-cultural understanding is a learning journey traversing many of these cultural spaces. Our learning became both a personal and social journey through a complex set of cultural spaces that had to be negotiated continuously. Our journeys transformed each one of us and helped us to reflect on who we are and how we interact with others. This was our story and our perspective. Our own biases and frameworks have influenced our story. Other stories do exist from other perspectives.

We wanted to build a blended learning environment from the ground up so that the learning experiences and content would reflect the culture that created it. We realized that such an effort requires an enormous time commitment which the volunteer North American team found challenging. While we wanted to move toward a more negotiated culture of cooperation, nuances of unfamiliar cultures, alternative expectations, and new layers of institutional hurdles, impacted our efforts to develop the best possible learning solution.

This study has significance for future international partnerships that plan to provide education and training in emerging economies. We recommend that future international partners spend time in the field learning the hidden culture of individuals, groups, organizations, and communities that will implement the project.

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Landscape and Literacy on Aboriginal Country

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Abstract. In 2015, we embarked on a mobile learning project designed to introduce students to Aboriginal cultural sites in Melbourne. This ongoing project encourages learners to explore their surrounding ‘cultural landscape’, including the built and natural environments, art installations and popular space. Students use their mobiles to navigate to selected geocache locations (www.geocaching.com) to encourage reflection on Aboriginal place, politics, culture and heritage. Students conduct research on Indigenous issues and sites, and then develop textual descriptions of sites with accompanying digital content (videos, photographs, augmented reality, scans of old maps and other artefacts). They are provided with instructions on the assessment activity and the learning outcomes expected. In order to develop the assessment, we partnered with the Victorian Aboriginal Corporation for Languages and the Boonerwrung community as we were interested in working with the community in participatory ways. We invited community participants to provide feedback to students on the textual and digital content they produced. Some of this content was selected and used to develop a walking tour phone app of key Indigenous sites of historical significance (www.mytoursapp.com). This app will be given to Aboriginal partners, allowing them to control and manage its look and feel, and how it is used and shared. Initial findings from the project suggest that: ‘place’ is a multi-faceted concept, which mobile technologies can explore to greater effect; and app development provides an opportunity for sometimes disengaged community and student-participants to contribute to the M-Learning process and subsequent curation/caretaking. A range of issues and challenges have emerged from this project, which could help inform similar M-learning programs - our panel presentation will focus on discussing key findings, outcomes and learnings.

Keywords: phone apps, mobile learning, place literacy, intercultural literacy, digital literacy, Aboriginal Australian sites of significance

1 Introduction

This paper challenges the view that mobile phones are a source of distraction in the classroom - offering instead a perspective grounded in an alternative pedagogy of place-literacy education (see Somerville 2007; Auld et al 2012; Green 2012). Mobile learning represents a new process of teaching and learning with mobile technologies (Kukulska-Hulme 2005) and has emerged in a context where traditional assessments, such as essays, exams, and oral presentations, no longer hold the authority they had in the past (Vinu et al 2011; Huang and Yin 2012; Raybourn 2014; Falchikov 1995). Ferrell’s study (2012) shows students have become increasingly disenchanted with assessments. They expect assessments to be clearly justified, contextualised and rationalised in terms of what they have learnt and the purpose of such assessments. A survey of UK institutions revealed that students were dissatisfied not only with assessments but with the feedback they received. Both these categories ranked among students’ worst experiences studying at university (Grove 2014). The fact that 25 percent of tertiary students in UK universities were dissatisfied with the ways their studies were assessed suggests a disjunction between what is learned and how learning is evaluated.

This disjuncture highlights the need for educators to create assessments that help learners demonstrate what they have learnt, but also meet learners’ satisfaction in terms of assessment quality and content. Developing such assessments requires that educators are able to develop core competencies and integrate these with practical applications in meaningful and engaging ways (Meredith, 2016: 497; Collier 2015). Binkley et al (2014) argue that the 21st Century workplace demands news skills and competencies, including information management, media and technology skills. For students, demonstrating competencies is the means by which they orient their learning, focus their attention and organise their study-framework to “fit in” with assessments (Villa and Poblete 2011). For educators, a carefully designed assessment tool can both evaluate
and build competencies by encouraging the development of fundamental skills and training to attain successful completion of a “test” or “assignment” (Bezanilla et al 2014). Central to these approaches is the pedagogical need to move on from traditional modes of knowledge transmission (teacher-centred learning), and place the student at the heart of the learning action (Legault 2012). The need to balance the assessment practicalities with the capacity to measure higher cognitive thinking abilities is viewed as vital (Akyol and Garrison 2011).

In this paper, we propose a move away from instrumentalist approaches to using technologies for teaching purposes and examine their interactive and creative possibilities. This perspective of education is congruent with the philosophy of critical literacy (the ability to read and analyse a range of ‘texts’ e.g. media, music, art, screen, literature, places, spaces, artefacts and material culture) as an important aspect of cognitive development (Giroux 2011; Freire 1973). Learners are encouraged to develop their conceptual thinking through deep, critical, questioning and reflexive engagements with various texts in order to generate meaning from them. This builds learners’ ability to analyse content and develop a critical vocabulary around social, cultural, political, economic and historical knowledge; the hallmarks of higher order cognition. Furthermore, an emphasis is placed on the relationship between theory and practice in the learning process as a way to provide learners with insights into interpreting material contextually.

Studies have found that mobile technology plays a key role in enhancing student motivation and interest in the learning process because these devices can take students physically out of the traditional “in-class” learning context (Ruchter, Klar and Geiger 2010). Squire (2011) suggests that the participatory nature of mobile technology usage is conducive to developing important abilities, such as collaboration, interactivity and connectivity, thus helping to foster deep engagements with place through a focus on the process of learning through experience. Beyond the educational context, Jenkins (2009) notes that immersive digitally-mediated environments act as critical sites to develop “cultures of participation” necessary for democratic citizenship. Moreover, Turner’s (2015) proposal, to rethink the role of digital media in society, is pertinent to our proposal that mobile learning in education can enhance students’ conceptual skills by fostering new conceptualisations of media and their related politics. Educators and learners can tap into the affordances of mobile technology to read cultural and political environments in new, experiential and immersive ways, thus promoting important critical and conceptual literacies.

In turn, emerging research indicates the important role digital and mobile technologies has for indigenous educators and students. Rice et al (2016:13) argue that digital technology can strengthen community ties for Indigenous Australians, through encouraging a stronger sense of self-identity and linking them to others through familial and peer networks – providing an opportunity to improve educational outcomes. Johnson (2016) found that mobile/smartphones were identified as the most important technology for Indigenous adolescents in remote Western Australia – over TV, home computers, video games and the Internet. Johnson (2016:227-228) argues that M-learning is particularly compatible with Indigenous learning, as it offers a flexible and democratic style of learning, providing students more learning autonomy and control.

2 Project Background

In 2015, we set out to determine the types of learning environments, which could prove beneficial to the needs of tertiary education students. We draw on survey findings from students who are located in the discipline of media and communication, taking subjects in popular culture studies. A survey was conducted for students in a first-year undergraduate course designed to provide students conceptual and theoretical skills in the discipline. When asked what they most enjoyed about the course, positive student responses highlighted a general consensus that they were satisfied with how they were being assessed. The findings reinforced that we were partly on the right track in terms of providing feedback and clear guidelines for completing assessments.

When students were questioned about what areas of the subject required improvement, an overwhelming number commented on the nature of assessments. They felt there was an over-emphasis on developing written or presentation skills, and wanted to see other assessments introduced into their learning for their overall degree – not just the subject they were enrolled in. This reinforced the idea that we needed to place these comments in the students’ context and understand how our own teaching approach was relevant to their broader learning experience.
We developed a mobile learning strategy to address the concerns that many students had about the assessments. Moving away from traditional assessments, we could experiment with using mobile devices as assessment tools. This included designing and testing a phone app that incorporated various site-specific locations, cultural content, material culture and artefacts. The app was designed to engage students to critically examine their relationship to everyday spaces and to relate their learning to and across different spaces (e.g. indoors/outdoors, online/offline, built/natural, Indigenous/non-Indigenous, pre-colonial/colonial/post-colonial). The app also allowed us to promote the application and extension of curriculum materials into real-world learning contexts.

Perrons (2004) has argued that new approaches are required that enable critical engagements with the complicated spatial divisions within society as inequalities arise across social, spatial and gendered differences. In the same vein, Curtin (2003), in the context of television studies, suggests the demand for examining complex flows of information and social capital depend on developing alternative approaches to understanding this flow and flux. He notes:

*Political, economic, and cultural phenomena overlap, converge and collide, disrupting prior confidence in holistic approaches to culture and society. As scholars, we are challenged to make sense of this increasingly complex environment, which is now commonly characterized by transnational and transmedia alliances (Curtin 2003: 203).*

Along similar lines, Rosati (2007: 996) has argued that sociality is effectively interrogated “from their various symbolic and physical dimensions”. These viewpoints articulate a mode of approaching how conceptual thinking can be taught and learnt for experiential learning purposes. To this end, we believe the project’s focus on Indigenous cultural landscapes and its emphasis on “place” provides a way for educators to develop a critical pedagogy around literacy-focused and place-based approaches in education. Place is imbued with meaning, as well as with social, historical and cultural significance. Place offers ways to conceive of different realities, real and imaginary, visible and invisible, and thus challenge the boundaries of participants’ existing knowledge about other people and places. Place is also interwoven with the violence, resilience and hope of different social relations, and contains multiple stories of how different places have been used over time. Such ways of reading the landscape enable learners to develop their critical and visual literacy about different sites of significance. This is important because the relationship of people and societies to one another and to a range of different social encounters are complicated and change over time. Our M-Learning approach allowed us to encourage students to examine these complex connections, and question how their own politics intertwined (or not) with others. This meant that students were able to examine distinct spatial divisions in their physical environment (Perrons 2004). They were supported to explore differences across multiple sites, as well as their connection with different cultures and histories. Underpinning this pedagogical motivation was the need to inspire participants to imagine and envision a new politics of difference.

### 3 Techniques and Tools for Learning

Our project was designed to respond to student dissatisfaction with assessments, while conscious of the need to develop conceptual thinking skills through the application of M-Learning. Focusing on the experiential and interactive dimensions of learning, and a focus on learning through doing and reflection (Kolb and Kolb 2005), assessments took learners outdoors, providing opportunities to focus on different ‘cultural landscapes’ around the city. The project encouraged learners to explore their surrounding and the histories of particular locations, including the built and natural environments, art installations and popular space. Students used their mobiles to navigate to selected geocache locations (www.geocaching.com) as a way to en-

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[2] Place studies have formed an important component of environmental literacy education, which is not a new concept in education – the term dates back to the 1960s with the development of the environmental movement. The concept has gained traction in more recent years with the rapid emergence of debates around conservation and sustainability, global warming and climate change (Scholz and Binder 2011). Environmental literacy, as a concept, forms part of a long history in education focused on developing social responsibility, civic engagement and solutions for addressing climate change issues (Kudryavtsev, Stedman and Krasny 2012). Our use of the term “environmental” adopts an unconventional interpretation in that the focus is not on environmental, sustainability and conservation issues traditionally conceptualised. Rather, we broaden the term to include what we refer to as a place-based or M-learning focus, incorporating Australian Aboriginal sites of cultural significance. Such an emphasis expands the vernacular around mobile learning in ways that might be applicable to other disciplines beyond the natural sciences.
courage reflection on Aboriginal place, politics, culture and heritage. The project sought to engage cohorts of non-Indigenous students on Indigenous issues in participatory ways, often for the first time in their studies. Students were provided with opportunities in class to conduct research and collaborate on Indigenous issues and sites, and then to develop textual descriptions of sites with accompanying digital content. Students were provided with assessment instructions on what was expected of them with clear learning outcomes. Class content introduced students to ideas around popular culture – its elements, language, consumption, and relationship with specific generations, audiences and media (e.g. What is/not culture? What is/not popular? What are examples of popular culture? Who consumes this popular culture? How do these consumers differ? How do they participate or not in popular cultural practices?) In doing so, the university course was designed to place popular culture into a local context, through sites in and around CBD Melbourne. In-class lectures, tutorial sessions and weekly readings helped to provide foundations for discussing key concepts, theoretical frameworks and methodological approaches to understanding the field of popular culture. The outdoors geocaching activity was introduced as the first assessment piece to engage students further in these foundations and additionally scaffolded across two other assessments over a 12-week semester.

This initial mobile learning assessment was designed for undergraduate students with no to very little prior experience with Aboriginal culture. This meant that it was important to provide cultural awareness workshops at the beginning of the semester to support students’ cultural engagement with Indigenous content and people. We also partnered with the Victorian Aboriginal Corporation for Languages and the Boonerwrung community to develop the assessment. A key outcome was to develop a model of participatory engagement with Aboriginal communities, hence we felt it was important for the Aboriginal communities involved to provide feedback to students on the textual and digital content that students produced. Some of this content was selected and used to develop a walking tour phone app of key Indigenous sites of historical significance (www.mytoursapp.com). This app will eventually go live and be given to Aboriginal partners, allowing the Aboriginal community to control and manage its look and feel, and how it is used and shared so that other Aboriginal communities directly benefit.

We drew on a range of ‘serious game’ literature to inform our development of the assessments (Kummel et al 2016). Crocco et al (2016: 404) point out that serious gaming has been an important part of education for millennia – Plato’s Republic reflects on Socrates’ argument that ‘play’ can reveal student strengths and weaknesses, while helping to retain learning through engagement, encouraging analysis, critical thinking and ‘limberness of mind’. Educators and researchers have argued that the serious game approach to learning provides useful outcomes, so long as the game itself moves beyond simple quizzes and repetitive exercises and installs itself in roleplaying or real-world applications (Hummel et al 2016). Qian and Clark (2016: 51) argue that well-designed games promote: “meaningful learning through providing players with adaptive challenge, curiosity, self-expression, discovery, immediate feedback, clear goals, player control, immersion, collaboration, competition, variable rewards, and low-stakes failure”. The game component of our assessment meant that participants could be provided with opportunities to “treasure hunt” the different locations we provided as clues on a map, and to share via closed social media their discoveries. The assessment represented the first opportunity for participants, across their overall three-year degree (outside their internships and other industry-facing work experience), to step outside the conventional in-class context and engage with the “real world”.

Our aim in developing the subsequent assessments (3 in total in the unit) was to enable a culturally-specific and digitally-enhanced learning environment where (non-Indigenous) student cohorts were able to critically and reflectively engage with Indigenous issues. The assessments provided opportunities for students to firstly conduct research on their chosen site or issue as part of their final assessment (due last week of semester in week 12). They were asked to focus on a topic of their own interest early and identify a topic on which to present (due week 4). Topics had to centre on a physical popular site in the city, such as the Yarra River, Federation Square, the Victorian Market or Flinders Street Station. Students were then required to compare their chosen site with an Indigenous site or issue of their choice. In-class learning provided further opportunities for students to discuss their experience locating the different sites. They were introduced to various readings as part of this process to develop their conceptual skills with key concepts, such as “remediation”, “knowledge systems”, “globalisation”, “participation”, “audiences”, which were introduced through weekly reading material.
4 The New Face of Education

Our M-Learning approach is guided by the principle that places offer rich pedagogical sources through which to examine the creative potential of digital learning environments. Yet we found that the value of ‘place’, and particularly how different sites enact a place-based politics through mobile learning technologies, remains an under-theorised field. We found the following principles to be key in developing a place-based approach using mobiles and geolocation-enabled apps (geocaching, Google Maps, walking tours): Place learning promotes multi-sensorial and embodied experiences; place learning facilitates collaboration and the co-creation of content with local communities; place learning foregrounds cross-cultural engagements with complex place histories and social relations.

Previous studies on digital technology and education highlight how web-based learning can complement traditional teaching (McClelland 2001). Research has also focused on integrating technology to engage students in specific learning activities such as digital storytelling (Sadik 2008), video production (Pea 2006), and language development and reading (López 2010). Predominantly, this earlier literature centred largely on analyses of technology for skills-based learning, including the development of competencies concentrated on preparing graduates for occupational endeavours. This emphasis on strengthening ‘skills’ (e.g. adaptation, computer competence, oral communication, ability to work in teams) is unsurprising given students are under greater pressure to prepare for a competitive work environment and secure successful careers ahead (Jackson 2014; Beaven & Borghetti 2015; Olaniyan et al 2012).

We initiated this M-Learning process in a context where the challenges of preparation for work have become an important consideration for universities. Universities are now under greater pressure to link education to positive employment outcomes. Tusting and Barton (2007) have charted how the education sector has departed from its emphasis on increasing literacy levels and equitable access towards a focus on equipping students with vocational and career skills. Lesley Limage (2006), tracing the history of literacy in the West, notes how institutional endorsements around building graduate skills has become progressively more entwined with the narrative of employment, economic growth and national development (also see Furedi 2010, Yang 2008, Giroux 2012). Indeed, debates about the education system’s framing of occupational relevance and workplace preparedness are part of a wider rhetoric about economic rationalism and a new authoritarianism in the West (see Hyslop-Margison 2000).

This education context sits at the cusp of a new era of education with electronic content surpassing the use of earlier hard copy printed material as education resources. This period also marks a move from former traditional teaching methods to web-enabled and online learning and teaching practices (Warschauer 2007). Hand-held, mobile and other digital devices are expected to be necessary and indispensable tools in pedagogical strategies designed to deliver on the opportunities that the digital affords. Along with this, there has been a growing interest in online assessments, which in turn has driven momentum for high-, ubiquitous- and instant-access environments. These changes invite alternative approaches to understanding this evolving milieu of education; requiring educators to go beyond previous studies about the digital learning environment to examine its experiential, tactile, interactive, collaborative and creative possibilities.

While rapid developments in digital technologies are reshaping traditional classroom practices, educators have not always kept up with technological changes in ways that model the diverse uses of technology in the workplace (Weber et al 2015, Tyner 2014; Herrington and Kervin 2007). Studies show that while mobile technologies are pervasive in popular culture and among the new generation of digital natives now entering universities, new technological devices face opposition as pedagogical tools in education (Herrington et al 2009). Even if educators have embraced learning technologies in the classroom, they often face hurdles with the “culture” of the organisation, and a lack of infrastructure and support. Moreover, recent technologies such as smartphones, are often seen as a distraction or gimmick in traditional learning environments. Studies suggest that educators are not adequately prepared to implement digital technologies into their practices or are sometimes intimated by the students they teach who they feel know more than them about digital platforms (Stockwell 2008, Cook et al 2008, Woodcock et al 2012; Ng 2012).

Despite these challenges, we find that while the mobile learning assessment was challenging to initially set up in terms of time and practical commitments, it also has the potential to redefine and transform the learning and teaching process, and more specifically, students’ experiences with assessments (Mehdipour and Zerehkafi 2013; Cobicroft et al 2006). In adopting this stance, we follow other scholars who understand the significance of building conceptual models in education as the basis for higher order cognitive development (Har-
vey and Vásquez 2015; Garrison 2009). By departing from instrumentalist models, our approach recognises that the emerging context of pervasive and ubiquitous technologies requires a shift in conceptualising the digital landscape and its relationship to teaching and learning.

In the course of the project we found that the role of key stakeholders – in the Aboriginal community and within the University – were important in supporting the project, bringing others on board, and providing access to community and organisational resources. In turn, the limitations in project funding and time – exacerbated by the lack of ‘capability’ to design and deliver an app by the University itself – meant that alternative sources of support were utilised. Community-based apps like Geo-cache, cultural tour apps from overseas institutions like Trailblazer from MIT in the USA, and private sector tour apps like MyTours in NZ, were all investigated as possible M-learning apps for the project. Initial costings and consultation led the project to engage the services of the MyTour app – with the provider able to tailor the app to the needs of the project and the Aboriginal community.

Another significant finding that emerged from our project was the importance of developing a model of participatory engagement with Aboriginal communities, which contributed to the success of this project. The collaborative and participatory approach we adopted to working with community functioned to challenge conceptualisations about what it means to ‘share’ knowledge and content, and co-create/curate Indigenous cultural content in ways that were respectful of Indigenous aspirations and agendas. The knowledge and experience of Indigenous community elders, in particular, was key to informing the project regarding the cultural materials central to its premise. The University provided material resources, advice and guidance, and we relied on the experience of Indigenous staff members who were able to suggest culturally-appropriate ways to work with Aboriginal communities, organisations and groups.

We also discovered that “place” is a multi-faceted concept, which mobile technologies can explore to greater effect; and app development provides an opportunity for sometimes disengaged community and student-participants to become key contributors to the M-Learning process and subsequent curation/caretaking. During the project we had a number of discussions with Aboriginal community members. Some of the points raised through community discussions included:

- How to develop digital technology that is culturally-relevant, meaningful and useful for Indigenous communities.
- How this content development might be part of a sustainable framework that can be modelled across the education sector.
- How to incorporate digital innovations, such as augmented and virtual reality, to represent Indigenous culture, history and issues in visual, interactive, culturally appropriate and authentic ways.
- What this means in terms of digital visual and immersive techniques for generating knowledge and cultural content that is community owned.
- How universities can contribute to the capacity building agendas of Indigenous-led organisations and communities.

As the project progresses into an established assessment component of a tertiary-level Communications course, it is expected that these findings will serve to inform and build on future iterations of M-learning apps. Our approach serves to position students, through the M-Learning assessment model, as agents of social change in their interactions and engagements with Indigenous places and cultural content. In this way, we have illustrated how mobile and digital technologies can be harnessed to build Indigenous capacity.

5 Conclusion

This paper described an M-Learning initiative that encouraged learners to discuss their understanding of the environment with those of other learners, and contextualise their perspectives in relation to theoretical content. Engagements with place were manifested through immersions with the physical surroundings and through the overlaying of visual digital content to the real world in site-specific locations. The blending of physical and digital affordances worked to enrich the learning process, while the utility of digital interfaces converged the various elements of technology, interactivity, place and cultural material. Through this immersive experience, participants were able to develop their conceptual thinking and vocabulary by reflecting on social changes in the world and the issues influencing this change. This included issues such as globalisation,
population growth, migration and urbanisation, the consumption, re-use and disposal of resources, technology and media, and changes in the ways that the land, waters and cultural artefacts have been used and conceptualised over time.

We theorised this approach to framing the city and learners’ experience as a form of placed-based literacy education, exploring how the visual and interactive elements of culture might be creatively enhanced to deepen the learning experience and to enable participants to see their environments in new and participatory ways. We provided opportunities for participants to walk through the city, a cultural landscape we encouraged them to ‘read’ as a textual artefact using their mobile devices. As mobile learners navigated the boundaries between their online and offline geographies, we discovered they experienced a dynamic and transformative shift in their engagements with the learning content. Introducing the outdoors to this process worked to alter their environment, the atmosphere and the tone of their learning experience. The focus on the physicality of their experience, emphasised by the visual elements of culture, facilitated participants’ navigation with the cultural landscape, and the various sites of significance around which we sought to develop their critical literacy. Such a focus shifted the nature of learning from a pedagogical context, which can tend towards compliance and insularity, and opened the way for personal, playful and collaborative engagements with cultural and heritage material. This imposed a particular teaching vision that was designed to extend learning models beyond traditional, instrumentalist frameworks. It is a conceptual structure that can potentially open a variety of flexible options outside the classroom walls.

6 Acknowledgements

This research project was undertaken in partnership with the Victorian Aboriginal Corporation for Languages and the Boonerwrung community. It was supported by funding from RMIT University’s Office of the Dean Learning and Teaching under the Learning and Teaching Sustainability Fellowship and a Learning and Teaching Investment Fund.

7 References


Using Web 2.0 Tools to Support Student Writing

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Abstract. Web 2.0 technologies can support student writing by allowing teachers to use a more dialogic approach. This paper examines, using a quasi-experimental design, the extent to which the use of Web 2.0 technologies has resulted in gains in argumentation skills of Grade 11 students in Singapore and their experiences with using these technologies. At the end of a six-week intervention, the gain in argumentation skills among the experimental group students was significantly higher than that among the control group students. The qualitative analysis of interview transcripts of the students indicated that some students felt that the affordances of Web 2.0 tools helped them edit their work more easily, see different perspectives, and get better feedback while others found such tools distracting.

Keywords: web 2.0, argumentation, writing

1 Introduction

Web 2.0 technologies allow teachers and students to have an online space to communicate to each other. Students can post their ideas and their peers and teachers can comment on them and suggest other ideas. That is, Web 2.0 technologies enable teachers to adopt a different teaching and learning approach that might have an impact on student learning. With the advent of smart mobile technology, students can now access the Web 2.0 tools anytime and anywhere using their smartphones, tablets, or laptops.

It is therefore easier for teachers to engage in dialogic pedagogies that allow students to go beyond what they could have achieved on their own (Bower et al. 2010). Indeed Web 2.0 tools and mobile technology make it easier for teachers to adopt dialogic pedagogies. In dialogic pedagogies, students engage actively in discussion, support one another, and together construct meaning in a more social space. Unlike in the traditional classroom where the talk is teacher-dominated or where stronger or more talkative students dominate classroom talk, all students, including weaker and quiet students, have the opportunity to participate actively in an online space by contributing viewpoints, and by building on what other students write about and asking questions in the discussion. For example, Tan (2004) pointed out that Singapore students with lower English proficiency had the tendency to be passive in class and to lack confidence in speaking.

Kuhn and Moore (2015) proposed that in an argumentation curriculum, students should be first encouraged to address one another’s ideas before introducing new ideas as their argumentation becomes more sophisticated. Therefore, it is important for teachers to create a space for students to address one another’s ideas. An online space is suitable as it not only allows students to address one another’s ideas, but also it allows them to have more time to reflect and introduce new ideas.

In higher education settings as well as K-12 settings, the use of Web 2.0 tools to learn language has become increasingly popular. However, as Hew and Cheung (2013) pointed out, the evidence concerning the effectiveness of Web 2.0 technologies is not very strong (e.g., Pae, 2007; Wichadee, 2010; Wong & Hew, 2010) and very few studies examined the actual causal effects of Web 2.0 technologies on improvement in student language outcomes (e.g., Arslan & Shahin-Kizil, 2010; Hsu & Wang, 2011; Neumann & Hood, 2009). Even fewer studies examined the impact of using mobile devices in conjunction with Web 2.0 tools as these devices were not as readily available to students then.

To fill in this gap, this study examined whether the use of Web 2.0 technologies had an effect on the argumentation skills of students in a high school setting and their experiences with the use of Web 2.0 tools.
2 Methods

Participants

The participants were 81 eleventh graders and two teachers, Teachers A and B, in a Singapore high school. To control for teacher effect, each teacher taught one experimental class and one control class. There were altogether two experimental classes and two control classes. Only 58 out of a total of 81 experimental and control group students submitted both the pre- and post-intervention essays. Of the 58 students, 28 belonged to the experimental group students while 30 were control group students. Consent was sought from all participants. Both teachers and 12 experimental group students were interviewed at the end of the intervention.

Materials

Both the experimental and control group students were given the same reading and writing materials. The topics covered followed the school’s curriculum plan. The teachers were given the choice to use the technology that they were most comfortable with as an online teaching and learning tool. One of the two teachers, Teacher A, chose to use Schoolology, an online learning management tool which has a social media interface to allow students to collaborate with each other. This tool also allows users to create, manage and share content and resources. The other teacher, Teacher B, used Google Docs, a collaborative website that allows users to upload different kinds of documents and to comment and edit them. It also has a chat function for students who might want to use simple and synchronous communication.

The students in both experimental and control groups were taught to ask themselves the following questions while they were planning their essay writing:

(1) What is my purpose for including this argument?
(2) What are my viewpoints?
(3) How can I support my viewpoints?
(4) What evidence do I have?
(5) What are alternative viewpoints?
(6) How should I respond to them?

Schoolology

The experimental group students were taught that they could comment on the work of their classmates by using some of the following steps: clarify, value presented ideas, express concerns, and suggest improvements. They were given examples for each of the steps. Below is an excerpt of such a discussion.

<table>
<thead>
<tr>
<th>Simon</th>
<th>Was life for young people in Singapore better in the past than it is today? (Topic sentence) - Life for young people in Singapore was better in the past than it is today. (Supporting details) - There was much lesser competition in the past as compared to now. Young people had carefree lives and they could do whatever they wanted. Parents were more relaxed with their children's academic and professional achievements as the benchmark for success was much lower and people were generally less mercenary as they are today. In contrast, things are much more complicated and competitive now. Life isn’t what it used to be. Pushed by the economic success of many people, parents now have very high expectations of their children, which inevitably create lots of stress to the children in both their studies and working life. (Evaluation) - As the world is changing and technology is advancing at such a fast pace, it would be normal for the demand of humans’ ability to increase with time to improve the world, and make it a better place. As a result of this, life if getting harder and harder as time goes by, thus, life was better back in the past.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matthew</td>
<td>The idea that youth led carefree lives and could do whatever they wanted isn't exactly correct. Contrary to what you may think, not all youths of the past lived easy lives. Parents were a lot more demanding in terms of them contributing to the family with them leaving school much earlier and working so much harder. But I do agree that there are values in the past worth holding on to in today's world. However, we shouldn't look back</td>
</tr>
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and wish we lived in the past. We should instead acknowledge the past, embrace the present, and look forward to the future, however stressful life might be.

Tilly

Was life for young people in Singapore better in the past than it is today? Topic sentence - Another aspect in favour of the lives of youths today is the plethora of opportunities that come across for them in terms of education and lifestyle. Supporting details - With rapid advancements in technology that had led the world to shrinking considerably, long gone are the days of a youth in pursuit of passion and a good education bounded by geographical constraints. Industries are ever-changing and expanding, hence introducing even more job opportunities for youths today in search for a potential career. The world is an oyster for a student in search of higher education, for the array of accessible institutions all over the globe is greatly overwhelming. Evaluation - This shows that young people today definitely have a wider window to achieve their life goals as the world morphs into a single landscape of opportunity.

Figure 1. Excerpt of Online Discussion on Schoology

Google Docs
The experimental group students posted their essay outlines to share with their classmates. The teacher used the ‘See-Think-Wonder’ thinking routine, described in Ritchhart and Perkins (2008), to ask the students to plan their their essay outlines as well as critique their fellow classmates’ outlines. ‘I see’ is an objective observation of what is written followed by ‘I think’ which is a critical analysis of the statement and ‘I wonder’ which is a question that the student can pose. Below is an example of what a student wrote for this pre-writing activity.

<table>
<thead>
<tr>
<th>Essay Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was life for young people in Singapore better in the past than it is today?</td>
</tr>
</tbody>
</table>

See

| Life for young people in Singapore better in the past than it is today? |
| These topic words are important because it is specifically pinpointing the young and not the old of today, which means we have to talk about the lives of the young people from the modern society and during the olden times. |
| In Singapore need to make references and give examples of case studies only from Singapore. |
| Better in the past than today it is important because we have to explain how is it better living in the past than it is today or how is it better living in the present than it is in the past. |

Wonder

| What are the factors to prove that life for young people in Singapore is better now than in the past? Or what factors that are present to prove that life was not that bad in the past and in fact, life for young was actually better in the past than now? |
| What is the definition of today? And in the past? 21st century? etc.? |
| What about today that makes it different from the past? |
| Is there evidence or trends that support the argument made? |

Figure 2. Example of Student Work using the Thinking Routine

Procedure
Before the start of the intervention, the second author, a master teacher of English, co-constructed three e-lessions with the teachers on the topic of youth and family issues. The teachers were taught how to give online feedback to students’ comments and questions, and create prompts and questions which would lead to rich discussions. For example, the teachers were encouraged to ask open-ended and controversial questions to stimulate a rich discussion. They were also taught to create rules of online engagement for their students: (1) respect, (2) use words of encouragement, and (3) provide reasons for disagreeing diplomatically.

A pre-test essay was administered. The experimental group students then participated in both face-to-face and online discussions on Schoology or Google Docs. A post-test essay was administered to both the experi-
Data Analysis

Erduran, Simon, and Osborne’s (2004) analytical framework was used for assessing quality of argumentation, which was based on Toulmin’s (1958) Argumentation Pattern. Level 1 argumentation, the most basic level of argumentation, consists of arguments that are a simple claim versus a counter-claim or a claim versus a claim. Level 2 argumentation has arguments consisting of a claim with data, warrants, or backings but with no rebuttals. Level 3 argumentation has arguments with a series of claims or counter-claims with either data, warrants, or backings with occasional weak rebuttal. Level 4 argumentation shows arguments with a claim with a clearly identifiable rebuttal. Such an argument in this level may have several claims and counter-claims. Level 5 argumentation, the highest possible level, displays an extended argument with more than one rebuttal. All pre- and post-intervention essays were graded by the second author. Eighteen per cent of the essays written by the 58 students were graded by the two authors. The percentages of exact and adjacent agreement for the argumentation levels were found to be 62% and 38%, respectively. Thus, the percentage of exact or adjacent agreement for the argumentation levels was 100%. The change in students’ argumentation levels from pre- and post-tests on students’ argumentative essay writing were analysed using a t-test.

A content analysis was performed on the transcripts of the student interviews to examine the experiences of the students using Web 2.0 tools to learn argumentation. The frequency of codes was recorded.

3 Results

The Levene’s test of equality of variances showed that equal variances should not be assumed. As shown in Table 1, 68% of the experimental group students showed a positive change compared to 20% of the control group students. The experimental group students showed significantly higher gains in argumentation skills compared to the students in the control group, \( t = 2.4, p = 0.02 \). The gain in argumentation level among the experimental group students was 0.9 while the gain was only 0.1 for the control group students. The effect size (\( \eta^2 \)) was 0.1, which is considered quite large.

![Table 1](image)

The content analysis of the interview transcripts revealed that the students found more positive than negative aspects of learning argumentation using Web 2.0 tools. Most of the codes shown in Table 2 indicated that the affordances of Web 2.0 tools helped the students learn by allowing them to make changes easily, get feedback from their classmates, see different perspectives that they could use in their essays, and read material online easily. The students also felt that they had more time to reflect, they could discuss ideas, get more immediate feedback as well as goof peer feedback.
Table 2. Positive Aspects of Using Web 2.0 Tools for Learning Argumentation

<table>
<thead>
<tr>
<th>Code</th>
<th>Frequency</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easier or faster to edit online</td>
<td>12</td>
<td>If it's online, then it's like a google document and it is easy to make changes.</td>
</tr>
<tr>
<td>Get better feedback</td>
<td>11</td>
<td>Hmm. I think because it's very good because other classmates can see what I post quickly and they can comment straight away. It's easy for me to get the feedback...</td>
</tr>
<tr>
<td>See different perspectives</td>
<td>10</td>
<td>… you see other people's perspectives, you get a lot of points for your argumentative essays...</td>
</tr>
<tr>
<td>Develop argumentation skills</td>
<td>9</td>
<td>I guess that develops my argumentation skills because you can reply to another reply in the thread.</td>
</tr>
<tr>
<td>More convenient or accessible to read online</td>
<td>6</td>
<td>It's just that online is more accessible compared to hardcopy.</td>
</tr>
<tr>
<td>Have longer time to reflect</td>
<td>4</td>
<td>Maybe on Schoology, you, how do you say it, get to process your arguments before you type it down.</td>
</tr>
<tr>
<td>Discuss ideas</td>
<td>4</td>
<td>I found it really really useful although it is somewhat similar to the platform we currently use, AsknLearn. I think the concept is you post your ideas and it threads down. So it is quite useful for discussing ideas. So I think Schoology is a good platform for discussing ideas and stuff.</td>
</tr>
<tr>
<td>Get more immediate feedback</td>
<td>4</td>
<td>I think because it's very good because other classmates can see what I post quickly and they can comment straight away.</td>
</tr>
<tr>
<td>Get good peer feedback</td>
<td>4</td>
<td>There was this one time I wrote my paragraph and this classmate, he typed a counterargument about it and I was pretty impressed lah.</td>
</tr>
<tr>
<td>Easier to collaborate online</td>
<td>3</td>
<td>It's like very easy to collaborate with people because when you use online materials, you can like watch the video, and also there are documents there. And also we are able to do group work. It's much easier to do that than writing out on a piece of paper.</td>
</tr>
<tr>
<td>Like online feedback</td>
<td>2</td>
<td>Receiving feedback actually made my essay better. Who wouldn't want to score more for GP (General Paper)? Yah, it does help me improve on my essay. So I would like to receive feedback online.</td>
</tr>
</tbody>
</table>

The students did report some problems of using Web 2.0 technologies (see Table 3). The most frequent problem was that it was distracting to see the Web 2.0 tool because the students tended to go to other applications. Some students also found it hard to read online and preferred to have immediate clarification of teacher feedback.

Table 3. Negative Aspects of using Web 2.0 Tools for Learning Argumentation

<table>
<thead>
<tr>
<th>Code</th>
<th>Frequency</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distracting to use Web 2.0 tool</td>
<td>4</td>
<td>It's sort of, sometimes it's like quite distracting to use because let's say you open an Internet browser, when you use Schoology, you get distracted by other things like Facebook and Twitter.</td>
</tr>
<tr>
<td>Difficult to read online</td>
<td>2</td>
<td>Actually, not really because I wear glasses and it's a bit difficult for me to face the screen and read little words.</td>
</tr>
<tr>
<td>Immediate clarification of teacher feedback not possible</td>
<td>2</td>
<td>But let's say if the teacher gets your work online or even offline, but she makes the feedback through the online platform, you get more immediate feedback. But then, sometimes the feedback may not, may not get what the teacher is trying to say...</td>
</tr>
<tr>
<td>Feedback lacking on how to present arguments better</td>
<td>1</td>
<td>Like what she said, I don't get a lot of feedback on my writing style, so if I can get feedback on the way I present my argument, that might have been a bit more useful than getting different perspectives, like what I normally get.</td>
</tr>
<tr>
<td>Peers are not good at editing language</td>
<td>1</td>
<td>I think it's useful because when my teacher carries out peer editing, my friends would say that my sentence structure is not very good. And sometimes, it is very vague.</td>
</tr>
<tr>
<td>Online discussion is impersonal</td>
<td>1</td>
<td>Ah, face-to-face is like more personal. So it's like a kind of direct. But online is also ok. It's just that, ah, but face-to-face is like the most forward way of doing it. The online may be a bit impersonal.</td>
</tr>
</tbody>
</table>
4 Discussion and Conclusion

Consistent with the findings from Hew and Cheung’s (2013) review concerning the use of Web 2.0 technologies for language learning, the results of this study provide some evidence that the use of Web 2.0 tools allows teachers to use dialogic pedagogies more easily to help students learn argumentation skills. The feedback given to the students, which was made possible on the online platforms, led to an increase in the quality of argumentation in their essays. As one student put it:

For example, my GP (General Paper) teacher, she asked us to write our essay outline on Google Doc and then share with the whole class. So after I do my essay outline, I, like, look at others. So I can know which point is missing and I can learn from others. Maybe, like modify it and add into my answer. After that, normally when we write out on paper the answer, the teacher is, like, ask us to meet her and explain to us where we have gone wrong. If you use Google Doc and then the teacher can leave the comment at the side. So it is easier for me to keep in mind what she said. If it’s one-to-one consult (consultation), then whatever the teacher say, sometimes I might forget due to the heavy content. If she writes it at the side of the Google Doc, I can break it down one by one and try to arrest the problem myself. And after I do that, she can give some comments like “Good job” and stuff. Then it really encourages me to like the subject more.

Another student pointed that peer feedback was useful for developing argumentation skills:

Like sometimes when you give biased views, they will pinpoint out...Then, they will tell me, show me the other side. Like they will argue about the other side as well. Then I will get to know, like both sides. Then I can see.

One of the teachers commented that her students became more engaged in the online platform. They commented on their classmates’ arguments and provided different perspectives to the same issue.

At the beginning, they weren’t very sure...the parameters...the guidelines...so you like can imagine there needed to be certain rubrics, even how to give feedback. Then I had to post these things up and they tried, they became more structured rather than trying to be funny, doing it like Facebook style. So once it was more structured, then they were forced to respond to each other’s comments and not just to generate their own comments. It became quite good because they were more engaged and they were forced to weigh out the pros and cons of what they were talking about and to bring out other perspectives as well.

The qualitative findings suggest that to help their students develop better argumentation skills, the teachers needed to instruct students on how to give feedback with the help of rubrics and not just post their own arguments, Students needed to be shown how to respond to each other’s arguments. The teacher still remained the facilitator of student learning.

To help students improve their argumentation skills, language teachers can make use of the affordances of Web 2.0 technologies to engage in dialogic pedagogies for the teaching and learning of argumentation skills. As some of these students might not participate actively in the classroom, need more time to think through their arguments, or find it difficult to remember oral feedback, teachers might be able to address their students’ learning needs better using an online platform as it is asynchronous in nature.

5 References


Teaching Digital Citizenship in Higher Education

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Abstract. The inclusion of digital citizenship is becoming an increasingly important focus in the university agenda. Teaching digital citizenship can be seen as synonymous with making students capable and fluent users of the Internet and mobile devices in such a way as to confidently negotiate it and exploit its fullest capacities. The emergence of the concept of “digital citizenship” is associated not only with the acknowledgement of increased digitalisation of learning and teaching but also with the ethical and social impact ensuing from online engagement. Given these broad ethical and social implications, this paper proposes a framework to guide the explicit teaching of digital citizenship capabilities within tertiary education faculties as they engage with the Internet and mobile devices. This framework involves developing in teacher training students the attitudes, knowledge and academic skills to enhance current approaches to the use of digital technology.

Keywords: mobile, Internet, digital citizenship, university

The paper deals with possibilities and challenges associated with articulating digital citizenship in the university curriculum either using digital media or electronic technology. In this paper, the terms digital media or electronic technology stand for the use of mobile devices and/or the Internet. In addition, the paper proposes a new framework for implementing such endeavours through the acquisition of capabilities, a concept that involves knowledge, skills and attitudes. The paper makes use of philosophical, sociological and pedagogical arguments to support such a conceptual framework. The necessity for such a trans-disciplinary approach is based on the complexity of the constructs involved. Digital citizenship moves across a broad range of social, personal, technological and academic demands as experienced by university students and graduates before, during and after their university lives.

1 Digital Citizenship at the University Crossroad

Digital citizenship is an aspect of the evolution of modern citizenship that relies on the development of a set of competences or individual capacities, which focus on “the quality of habits, actions and consumption practices that integrate the ecology of digital content and communications” (Heick 2013) within settings through the use of the Internet and mobile devices. One would expect that the development of competencies associated with communication between citizens will take new forms in the face of technological innovation in communication and hence will have implications for teaching and learning. This section discusses both the opportunities and the challenges that the implementation of digital technology presents in a tertiary environment.

Possibilities and Challenges

As with civic, social and political citizenship, particular concepts, skills and attitudes are foundational to the notion of digital citizenship and hence to the development of digital citizens. Many programs have been designed within the school curriculum to enhance the development of the skills and attitudes requisite to digital citizenship, but much needs to be done within the tertiary environment, in terms of research that re-conceptualizes the notion of the citizen and develops practices appropriate to communication in the digital age (Couldry, Stephansen, Fotopoulou, MacDonald, Clark and Dickens 2014). For example, the shaping of the new global digital citizen demands specific training related to financial literacy and associated online competencies; awareness of the legal dimensions of the use of digital technology e.g. with respect to third party intellectual property; the ethical dimensions of online behaviours, including issues related to digital...
security and privacy; as well as the consideration of health related issues, such as bad posture, eye strain, addictions and sleep deprivation. The online reader must be trained to use and understand the syntaxes, vocabulary and semiotics of multimodal texts because most information is presented through electronic media nowadays relying on sound, animation, and icons (Bezemer and Kress 2015). The availability in easy reach of wireless and mobile technology calls for a more proactive and systematic educational action.

The way in which the competences being addressed here are contextualised in the university environment must necessarily differ from the school environment; for example, academics are alarmed by and must address students’ increasing lack of academic integrity as revealed in their assignments and research tasks (Handal, MacNish and Petocz 2013). This issue has been associated with the phenomenon of multimedia co-production, that is, the culture of sharing and repurposing that appears to be embedded in the nature and use of electronic resources (McWilliam and Dawson 2008). However, it is clear that the ethical and legal issues that arise given these practices need to be addressed so that standards of academic integrity are clarified within the tertiary context; and practices such as the formal acknowledgement of original sources in generating new knowledge in the digital environment are taken for granted. These are issues that lie at the core of the university research mission.

Questions of cybersafety, privacy, the extent of one’s digital footprint and digital reputation as well as effects on self-image and the formation of identity have been traditional issues affecting young people engaged in the digital environment whether using the Internet or mobile devices. In the past, many programs have seen school students as the appropriate target for education about healthy functioning in the online world particularly using mobile devices (Davis and James 2013). Yet, evidence shows (Suwannathachote 2012) that when this population reaches the tertiary environment, misunderstanding and malpractice are still prevalent, not only in regard to university work but also in transitioning to the professional workforce and in life in general.

The literature indicates that the patterns of Internet and mobile use among university students are complex and the range of user profiles is broad (Horrigan 2007; Adam and Smith 2008; Brandtzæg 2010; Realo, Siback and Kalmus 2011). What this variety implies is that students come to the online environment with their particular pre-conceptions or assumptions about being an Internet user. The evident diversity of use suggests the possibility of idiosyncratic conceptions or assumptions about Internet use that might sometimes misalign with the principle of academic freedom and the social and intellectual values embraced by universities. Such misalignment can reflect misunderstandings of the notion of freedom of speech, a failure to appreciate either the public nature of Internet communication and mobile telephony or the ethical imperatives that accompany such communication; as a consequence, problems such as racial vilification, sexual discrimination, abuse, harassment, bullying and trolling can occur (McCosker 2014). Current debate in the Australian media about the incitement of terrorism and racial apologetics have led many to rethink what freedom of freedom should entail at the level of Commonwealth legislation (Lee 2016).

On the other hand, as Turner and Hamilton (1994) have argued, understandings of and challenges to the concept of liberty itself have changed.

Almost all contemporary political philosophers seem at pains to point to the extensive intervention and regulation of ‘private’ life via the apparatuses of the state, and indeed the vast spread of the state agencies and apparatuses is one of the dominant characteristics of late capitalist societies (p. 140).

Similarly, Sarah Benton warned as early as in 1988 about the state tendency to regulate morality and advised that “the civil liberties we scrutinise today should not just be those of the Great Tradition of freedom of speech and movement and assembly against the state’s invasion of privacy” (1988, p. 19).

Equally significant is the issue of effective societal and democratic participation, which we might expect would help protect civil liberties. Most people would agree that the ideal of the Greek agora representing the physical place where qualified citizens debated public affairs has now become an inorganic online space where entry and exit is unrestrictedly given to all and which has no centre of power (Svensson, 2011). While eloquence and oratory were the prized attributes in the Greek agora, new competences require students to develop online information literacies either within an Internet or mobile context. Such literacies enable them to gain information about their disciplinary and broader interests but also to have a voice in conversations about issues relevant to the operation of local, regional, national and international governments.
None will doubt that the so-called digital divide between those who have access to communication technology and those who do not, creates the major obstacle to the acquisition of knowledge and to political participation for the latter group. Given that that online technology can act as an enabler of basic human rights by providing an avenue for free expression and access to information, restricted access to it is now considered a violation of an individual’s human rights (United Nations, 2011). The UN report reads:

*Given that the Internet has become an indispensable tool for realizing a range of human rights, combating inequality, and accelerating development and human progress, ensuring universal access to the Internet should be a priority for all states. Each State should thus develop a concrete and effective policy ... to make the Internet widely available, accessible and affordable to all segments of population (p. 22).*

Similarly, developments in the field of e-research calls for training in the development of the specific technical skills requisite to learning analytics, machine learning, data mining and grid computing. The capacity to understand and articulate information and to use sophisticated communication technologies within the tertiary curriculum will also require a systematic, corporate approach to pedagogy.

In summary, it is crucial for the modern university, which is rapidly moving away from the mortar-and-bricks infrastructure into the online milieu and the dynamics of mobile environments, to address many of the aforementioned issues so as to become more electronically savvy and supranationally aware.

2 Global Digital Citizenship as a New Graduate Attribute

Most university programs describe the professional profile and competencies that aspiring teachers ought to attain in terms of graduate attributes or capabilities. Among them, it is common to find reference to ethical dispositions or ideal generic values that underpin the expectation or appropriate behaviour in the school environment. For example, The University of Notre Dame (UNDA 2016) Graduate Attributes revolve around ten central values and include *ethical responsibility and commitment to active citizenship*. The former is defined as a “capacity for high ethical standards both personally and professionally, underpinned by the ability to apply ethical thinking skills to social/societal problems and challenges”. In turn, the latter is conceptualized as a “commitment to connect with and serve the community through active participation, engagement and reflection.”

Similarly, it is also common that universities across all disciplines have added the aspiration toward achievement of global citizenship to the graduate attributes that their students should attain by the end of their tertiary studies and in preparation for the workforce. Global citizenship is expressed as an ideal generic value that reflects the expectation that students will have integrated skills and attitudes in various fields and in relation to supranational contexts. With the development of information and communication technologies (ICTs) such as the Internet and mobile devices, globalisation has been closely associated with digitalisation, which has become a major disruptor of historical and geographical barriers that for centuries kept peoples estranged from one another (Simsek and Simsek 2013). This trend in human affairs creates a discourse for understanding digitalisation and citizenship as two merging constructs, which gives rise to the concept of global digital citizenship and transform traditional citizenship into a concept that blends elements of civic citizenship, technological abilities and globalisation (Amtzis 2013).

This paper claims that aspirations toward digital citizenship for our students should be built upon analyses that incorporate most of the values enshrined in dispositions to act well globally, whether that be in personal or professional life. Assisting students in developing or refining those dispositions, recognising their rights and obligations certainly presents us with challenges. In particular it calls the development of new belief systems that foster universal understanding and coexistence in a current world plagued with national, religious and racial conflicts (Kahne, Lee and Feezell 2012). Through their curricula, universities must facilitate the development of new belief systems by embedding modes of reflective practice and creating learning spaces that allow academics and students to engage with the various dimensions and implications for practice inherent within the Internet and the mobile environment.

Research in progress at The University of Notre Dame Australia attempts to identify specific digital citizenship capabilities that should be targeted by universities. Given the current trend that sees universities becoming more supranational by establishing overseas campuses, joining the massive explosion in online education by offering online courses (MOOCS) and amalgamating with other tertiary institutions to create international consortiums, it is incumbent upon tertiary leaders to ensure that new graduates are prepared to take
their place as effective digital global citizens during their student experience, in preparation for the work-force and in professional life (Ribble and Bailey 2004).

In brief, the digitalization and globalization of human affairs and the growing demands for understanding the world as one entity, constitute convincing arguments for developing and refining the concept of digital citizenship towards the supra-national sphere and paving the way for a deeper engagement with this new tertiary graduate attribute.

3 The Capability Construct and its Ethical Dimensions

Best practice requires the design of curricula based on the development of generic and specific graduate attributes or capabilities. It is our argument that deep engagement with such capabilities requires understanding the beliefs and attitudes underpinning our expectations regarding the acquisition and implementation of those capabilities. Within this paper, capabilities are defined as the set of knowledge (know-what), skills (know-how) and ethical dispositions (know-why) that are necessary to perform an academic task, in this case the task of developing capabilities requisite to the practices of good digital citizenship. Figure 1 represents graphically the association between the three elements of a capability.

![Figure 1. The Three Components of a Capability Construct.](image)

The Affective Component of Students’ Character Development

In this section beliefs, attitudes and the ethical values to which they give rise are discussed in the context of the development of online capabilities, in the light of the guidance provided by deontological, consequentialist and virtue ethical theories.

Deontological approaches to ethics help guide a decision about the rightness or wrongness of an action based on considerations of principles or rules determining what is morally required, forbidden, or permitted. Such considerations are independent of the consequences of the proposed action (Alexander, 2007), rather the deontologist asks what duties or obligations to which students must respond in the context of online activity or what rules they must follow. Thus the agent’s intention to “uphold the rules” is central to deontology. This would appear to be the dominant ethical approach to teaching digital citizenship in current educational environments, to the detriment of other approaches. The general discourse on digital citizenship has focused on a list of “dos” and “don’ts” with which students must comply while working in the online environment (Handal 2015); thus the approach to digital citizenship has been prescriptive. However, the increasing complexity of the Internet suggests the need for increasingly long lists of prohibitions and prescriptions, while the effectiveness of prescriptive approaches are called into question given that the emergence of unex-
pected ethical challenges determines that prohibitions arise after the fact. Hence, it is clear that acknowledged agreement to “accepted terms and conditions” or compliance with a code of practice in relation to online interaction cannot resolve all the ethical problems that may arise during online interactions.

More recently, the debate about digital citizenship has been broadened beyond a focus on right action and responsibility in terms of compliance with duties, responsibilities and obligations, given that such a focus is consistent with a deficit model of morality that aims to minimize misuse and filter and monitor Internet use. Nonetheless, a deontological approach is also consistent with a model that emphasizes personal judgment and discernment regarding ethical choices whereby students are encouraged to ask what they can do to use the Internet effectively and responsibly.

However, given the natural intuitive appeal of consequentialist ethical considerations, from a pedagogical view it is important to supplement deontological perspectives with consideration of consequences. Consequentialists would argue that students should attempt to predict and reflect on the potential consequences that their personal decisions in relation to online activity might have. They should consider whether the satisfaction or benefit that might accrue as a result of their prospective activity is outweighed by the dissatisfaction or damage that the activity could inflict on others, such that the activity is judged to be morally impermissible or unjustifiable.

Within the online environment, virtue ethical approaches to digital citizenship have been neglected because of the dominance of deontological approaches to ethical decision-making in this context, as noted above. They have also been neglected due to the pervasiveness of consequentialist approaches to ethical decision-making in socio-political contexts generally, and hence the gradual increase in consequential considerations in relation to Internet and mobile devices usage. As implied above, responsible and rational agents tend naturally to consider the consequences of their actions. Thus we can conclude that the factors relevant to ethical behavior include right intention, right action (which may not always be within the control of the agent), considerations of good consequences or outcomes and the cultivation of virtues that predispose agents to ethically justifiable behaviour. This implies, as it ought, that morality is a complex matter that requires the careful attention of educators.

As is well accepted in the educational literature, educational practices are not value-neutral. They are embedded with implicit or explicit commitments to beliefs and values. In fact as the Curriculum Corporation (2006) reported, state and private schools in Australia work together to clearly implement the specific values they wish to teach and promote; and the same practice is evident in tertiary institutions, where universities determine their own values though their mission statements and the articulation of the attributes they intend to inculcate in their graduates. An extensive whole body of literature highlights the influence of the constructs of beliefs and values in determining educators’ instructional behaviours (Rienties, Natasa & Lygo-Baker 2013; MacCallum and Jeffrey 2009; Kayode 2006). Given this, the teaching and learning of the competencies requisite to coherent and defensible digital citizenship requires an examination of the beliefs and values to be fostered and embedded in the curriculum, as well as those being transmitted by educators themselves, both overtly and covertly.

Thus, we conclude that treatment of the ethical dimensions of the teaching of digital citizenship has a number of aspects. It requires recognition of the forms of reasoning underlying decisions about behaviour in the online environment as well as recognition of the role of affect in the formation of beliefs and values, and consequently in associated online behaviour. This multi-theoretical approach is captured by what Sandra Lynch refers to as the achievement of a reflective equilibrium in ethical decision-making; this involves finding a balance “between our feelings, judgments and intuitions about behaviour on the one hand and the principles to which we subscribe on the other — what ever the genesis of those principles” (Lynch 2014).

The final aspect of the teaching of digital citizenship to which we draw attention is the question of how students deal with ethical conflicts that may arise for them in the online environment. We argue that students
must be given opportunities to script and rehearse ways in which they might respond to such conflicts and that the capacity to do so depends on the development of the habit of confidently and competently responding to ethical imperatives. In doing so, we are recommending a focus on the development of the virtues requisite to ethical behaviour within the online environment and on the disposition to act on those virtues, all embedded within the notion of capabilities

What is a Capability?

According to Farzam Arbab (2000):

By the term "capability" we mean developed capacity to think and to act in a well-defined sphere of activity and according to a well-defined purpose. We use the word to refer not to individual skills but rather to complex spheres of thought and action each requiring a number of related skills and abilities. Moreover, we place great importance on the notion that the gradual acquisition of a given capability, in addition to the mastering of skills, is dependent on the assimilation of relevant information, the understanding of a set of concepts, the development of certain attitudes, and advancement in a number of spiritual qualities (Arbab 2000, p. 233).

Lample (2008) explains: “Employing the concept of capabilities is not the same as the practice of setting learning objectives common to many educational programs” because “learning objectives attempt to define what can be achieved in one class session, while capabilities are developed over time, to higher and higher degrees, through the entire curriculum” (p. 172). He argues that a more flexible way of thinking about long-term outcomes of education is provided when capabilities are considered rather than just a short-term focus on what students are able to do after participating in a learning experience.

As an example on the mathematical capability of “classification”, Arbab (2000) explains how knowledge, abilities and attitudes are embedded within such mathematical capability as shown below in Table 1.

Table 1. The “Mathematical Classification Construct”

| Knowledge | At the most elementary level, say, at the beginning of secondary school, involves acquiring an understanding of the concepts of sets, of an element of a set, and of belonging to a set. It also requires an understanding of the concept that things can be divided into sets according to common properties. |
| Abilities | The ability to recognize the properties according to which the elements in question are to be classified, as well as some relevant information about those elements, is also necessary. For example, if someone is to classify objects according to size, the skill of estimating or measuring the size of the objects in question becomes essential. |
| Attitudes | As to attitudes, carefulness and appreciation for order are clearly desirable. At a more fundamental level, truthfulness is a spiritual quality that helps generate positive attitudes towards precision and care. |

Within the general curriculum capabilities could include, for instance, “to describe the world around us quantitatively”, “the capability to read at a certain level of comprehension”, “describing what we observe in the world around us in ever greater contexts”, “making organized observations of phenomena and designing experiments to test a hypothesis”. More ethically oriented capabilities would include “building environments of unity based on an appreciation of diversity” or “to manage one's affairs and responsibilities with rectitude of conduct”. Socially oriented capabilities would include “participating effectively in consultation” or “participating in collective enterprises”.

Capabilities in the Digital World

Translating the above concepts to the realm of digital citizenship we can perceive a number of generic capabilities such as

- capacities that contribute to effective societal and global participation through online media;
- capacities that contribute to the respect and protection of themselves and others in the online environment; and
• capacities that contribute to observing digital-based intellectual property rights.

Within the first group specific capabilities ("Capacities that contribute to effective societal and global participation through online media") these can tentatively be drafted as follows:

1) Participate and contribute within the world through social media
2) Use technology to collect information and express findings
3) Filter through content found online
4) Seek different perspectives on various points
5) Research a variety of texts and format
6) Attentively listen to what is being expressed
7) Collaborate and initiate discussion environments
8) Critically analyse the authenticity of what is being read
9) Confidently use all interactive equipment - computer, mobile and other types of technology
10) Create platforms to express one’s point of view
11) Connect and exchange experiences across different cultures
12) Distribute useful information
13) Collaborate and create a scheme of networks which brings together those who are most experienced with other collaborators
14) Cross check all sources

Within the second group ("Capacities that contribute to the respect and protection of themselves and others in the online environmental") the following capabilities have been identified:

1) Take a stance towards cyber bullying
2) Identify fraudulent behaviours online
3) Develop the skills to not put yourself at risk by talking to those you don’t know
4) Preserve one’s own privacy
5) Become familiar with the different privacy settings and how they can be used
6) Be active, take time to move
7) Know where to turn to when feeling uncomfortable
8) See yourself as an online citizen
9) Know your online boundaries
10) Contribute and respond in a courteous manner taking into consideration the language being used and what is being shared
11) Script and rehearse ways in which you might respond to ethical conflicts encountered

In the third group, the following capability ("Capacities that contribute to observing digital-based intellectual property rights") has been identified and others are being explored:

1) Acknowledge the author and originally sources when using them for your work.

Research in progress at the University of Notre Dame Australia is currently examining a broader range of other generic and specific digital citizenship capabilities that will be catalogued in terms of their knowledge, abilities and ethics dispositions components. For example, the digital “capability of determining of giving the author credit for the work you use” is presented under the following structure:
Table 2. Example of a Digital Capability Structure

<table>
<thead>
<tr>
<th>Components</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Creative Commons licenses, academic integrity regulations, APA style</td>
</tr>
<tr>
<td>Abilities</td>
<td>Ability to incorporate source materials in assignments through accurate use of referencing style.</td>
</tr>
<tr>
<td>Ethics dispositions</td>
<td>Truthfulness, trustworthiness, honesty (“ways of doing” activities)</td>
</tr>
</tbody>
</table>

4 Conclusions

One could argue, pondering on McLuhan’s and Fiore’s seminal claim that “the medium is the message” (1967), that to properly understand the medium of mobile devices and the Internet technology already entails understanding something of the normative content of the idea of digital citizenship. The message of the medium, in a sense, is that things can be taught and learned through practice, that students can learn to be good digital citizens by engaging in the practice of constructing themselves as digital citizens.

The paper maps the interpenetration of the ethical and the technical when academics and students carry out teaching and learning tasks in the digital world, particularly when students are provided with the skills to work with electronica media, either using mobile devices or the Internet. Digital literacy, as this paper argues, should be framed as a concept that reflects a sense of the new responsibilities and agencies that are afforded to the digital citizen. It argues, practically, that a deeper and more detailed understanding of the tools that are being created in the Web 2.0 context and the ways that they are already being put to use should be a greater focus of academics’ expertise. Understanding the possibilities for creating a non hierarchical knowledge sharing economy that the Internet and mobile devices afford and empowering students to participate in it seems to be a crucial step in creating an awareness of the rights that are available to the digital citizen and the responsibilities that go along with them.

Because of the critical nature of digital citizenship leading itself to challenge the status quo, the authors suggest that a variety of philosophical approaches be adopted in its teaching and learning. Consequentialism and virtues ethics appear to be more problem solving oriented than deontologism that seem to linearly emphasise rights and obligations.

The increasing complexity and dependence of the university curriculum on information and communication technologies such as the Internet and mobile telephony call for a systematic integration of digital citizenship into academics. Hence, the engineering of digital citizenship and of digital global citizenship into the university curriculum is articulated through the introduction of digital capabilities. In contrast with the traditional deployment of learning objectives, capabilities address specific and long-term human capacities encompassing knowledge, skills and attitudes. These were grouped into three contributing areas: (a) effective societal and global participation through online media, (b) the respect and protection of themselves and others in the online environmental, and (c) observing digital-based intellectual property rights.

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Flipped Learning Approach for a University EFL Course: Utilizing an Online Communication System

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Abstract. This paper is an in-progress report regarding the creation of an online communication system for a university English as a foreign language (EFL) flipped learning (FL) course as an aspect of curriculum reform at a Japanese university which aims to enhance students’ active participation in in-class learning tasks. The classroom is ‘flipped’ from a face-to-face format for many of the conventional lesson practices to an online communication system for both students and teachers. Course texts are studied online outside of class in collaborative learning tasks through teacher e-mentoring. In-class learning tasks engage students in various forms of discussion and presentations of the content of key aspects of the course text materials. A conceptual diagram of the transformation of a conventional in-class lesson to a FL lesson, the course design, and specifications and functions of the online communication system are described.

Keywords: flipped learning, online communication system, English as a foreign language (EFL)

1 Introduction: Flipped Learning for Foreign Language Learning

Recent studies offer encouragement that an application of the Jones Model of Learning in a flipped learning (FL) approach to language teaching should be further investigated through classroom-based action research methodology. The Jones Model of Learning can serve as a guideline for an experimental FL collaborative learning English as a foreign language (EFL) methodology if it is reasonable to assume that the learners’ creation of new knowledge about language through collaborative peer interaction leads to making connections with previous knowledge that may be beneficial because interaction with peers, ideally, can accommodate different learning styles more effectively than a ‘one-size-fits-all approach’ (Jones, 2006). Stuntz (2013) reported that students in a FL CALL EFL course needed instruction and practice in the use of communication and study media such as Gmail and Google Docs to complete outside-of-class assignments. Improvements in these skills allowed for effective use of class time to discuss outside-of-class learning tasks with both their peers and the instructor. The collaboration resulted in higher quality task performance. A Learning Management System platform can help students in the outside-of-class online collaborative activities (Sung, 2015). Student satisfaction can enhance motivation when FL course learning tasks products are shared with the class and members of a broader community via YouTube® (Leis, Cooke, & Tohei, 2015). Interactive communication with an international community can be achieved by engaging EFL students in FL video conferences with students in other countries (Kuhn & Hoffstaedter, 2015). Access to authentic language-use opportunities of this nature in FL courses may decrease in-class performance anxiety among students (Egbert, Herman, & Chang, 2014).

There are encouraging reports of efforts by educators to constructively apply the on-going developments in ICT to create effective combinations of what can be done best outside of class with what can be done best in class time. The potential of FL rests on the assumption that EFL students will use the learning materials before class, so that classroom time can be devoted to interaction between students, and with their teacher, that will support the outside-of-class study through mutual problem-solving tasks and analytical examinations of learning materials. Thus, sustaining student engagement in outside-of-class learning tasks in EFL courses is crucial.
2 Transformation of a Conventional In-class Lesson to Flipped Learning

A conventional EFL in-class methodology typically consists of three phases: input, intake, and output activities. Students are exposed to comprehensive input of an English text so that they may have an opportunity to learn about a language feature that is new to them. If they understand the new feature of the language and it becomes part of their language knowledge, intake has occurred (Ishikawa, Kondo, & Smith, 2010). After engaging in learning tasks which are intended to allow intake to occur, students conduct output activities to practice using the new language feature. At the end of the class time, the teacher usually assigns homework as an individual outside-of-class learning task to reinforce the in-class learning. The grading of the homework assignment by the teacher confirms whether the intended teaching aims have been achieved.

In FL, as the input component, students work together outside of class on learning tasks in an interactive online environment, in collaboration with each other and their teacher. The teacher supports students’ learning by sending the students timely needs-based messages by means of a message board. Kim (2008) summarized the benefits of using technology in an e-mentoring message capacity: 1) the specific and changing needs of learners can be considered; 2) interpersonal connectivity is facilitated; 3) interpersonal skills are built; 4) the development of cognitive strategies, reflection and planning is encouraged; 5) interest is raised and participation is improved; and 6) anxiety decreases. These benefits would help sustain students’ engagement in online learning outside of class. Table 1 shows examples of the messages by the teacher.

<table>
<thead>
<tr>
<th>Message type</th>
<th>Time when the message is sent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advice</td>
<td>When the students find problems related to the outside-of-class activities</td>
</tr>
<tr>
<td>Encouragement</td>
<td>Every day until the students start collaborative learning After the initiation of collaboration—before and after weekends</td>
</tr>
</tbody>
</table>

Table 1. Examples of the Messages by the Teacher

In class, after the students reflect on their outside-of-class activities, they collaborate in small groups on intake and output learning tasks which the teacher facilitates within the collaborative learning environment. Before the end of the class time, the students reflect on what they did in class. Figure 1, below, shows a conceptual diagram of the transformation of a conventional in-class lesson to an FL lesson.
3 The EFL Flipped Learning Course Design

The FL course consists of two-session units, one session per week. The following outline shows the flow of the learning tasks in the two sessions of one unit:

Session 1
In-class learning tasks: 1) Students reflect on what they have done in the outside-of-class learning tasks. 2) The teacher provides the students with an achievement test, such as a reading comprehension test, to make sure that the students have understood the text. 3) The students collaborate in small groups on writing a summary of the text and preparing an oral presentation of the summary for the in-class session. 4) The teacher provides the students with information and suggestions for the next outside-of-class learning tasks. The teacher also gives the students information about useful websites for further research assignments. 5) Students reflect on the in-class learning tasks.

Session 2
Outside-of-class learning tasks: 1) Students in small groups collaborate on the research questions assigned by the teacher. They prepare a group slideshow on the online communication system for a presentation of their research findings in class. 2) The teacher sends needs-based messages via the message board during the collaboration process.

In-class learning tasks: 1) Students reflect on what they did in the outside-of-class learning tasks. 2) The students in their groups use the slideshow to present their research findings. They hold discussions about the presentations. 3) The teacher supports the students by giving them comments and advice. 4) Students reflect on the in-class activities.

4 The Online Communication System

“Through the Internet, technology can support the conversational process by connecting learners to other learners, whether they are in the same classroom, different cities, or around the world. Therefore, ubiquitous computing technology can be seen as an on-demand learning partner and provide when-needed assistance in the sharing of learners’ cognitive responsibilities” (Peng, Su, Chou, & Tsai, 2009, p. 179). Here Peng, Su, Chou, & Tsai (2009) describe how the connectivity and accessibility to learning resources and other learners via the Internet on a mobile device with ubiquitous technology can turn learning into something that is carried on to outside of the realm of the classroom and can form part of a FL environment.

Research by Kwon & Lee (2010) has shown how mobile learning can be learner centered, with learners enabled to regulate their own learning within their daily lives, and have more context-based knowledge acquisition through learning in real-life situations. Mobile learning can be used effectively to connect traditional learning materials to the outside world, increasing relevance and value to the learner.

Derakhshan & Khodabakhshzadeh (2011) described the utilization of mobile learning within the different stages of learning. While the novelty factor carries the risk of losing the interest and thus motivation of learners over time, the dynamic visual and auditory ability can attract and engage, particularly those who do not work well within more traditional learning environments. Assessing and understanding materials can be easier when there are less time and access limits, which means the learner can increase the amount of time spent working with and using learning materials outside of class, and with the constant improvement and refinement of technology, assessment functions are becoming more widespread on mobile devices, allowing learners to assess themselves and be assessed with less time and space restrictions.

The nature of mobile learning means that it has become easier for learners to interact with materials from outside the classroom that are utilized within the face-to-face time in lessons, while also being able to take lesson materials out and about with them. The advanced features of a majority of the mobile devices bring a rich array of sources to the learner’s attention increasing interest and amount of interaction with learning materials. In addition to being able to access the Internet, there are other information collecting features on the majority of mobile devices such as digital cameras, digital voice recorders, and mini-camcorders. The user can then use the Internet or mail function to share this information on websites, utilizing the benefits and
connectivity of Web 2.0 for the purpose of sharing and acquiring knowledge (Motallebzadeh & Ganjali, 2011).

Mobile devices make access to learning materials, the Internet and other resources easier, wherever and whenever they feel motivated to study. Learners are often attracted by the convenience of mobile learning, finding it simple to fit learning in with their needs and daily routines, rather than learning interrupting it. The use of SMS or other mail functions to deliver content to the user in manageable amounts in spaced intervals is an example of this. Content-based push delivery systems can prompt the learner and act as a kind of ‘stimulus’ for learning within their regular routine, and not just consider learning as done exclusively in a classroom or other formal learning environment (Meurant, 2010, 2011; Wang & Shen, 2012).

**Specifications of the Online Communication System**

The online communication system is being developed as an application for smartphones. As is shown in the software block diagram in Figure 2, the system provides a learning environment on the smartphones of students and the teacher. All the functions are delivered by the server through the Internet. Various data such as the list of the students and teachers, text and comprehension questions of the subject and students’ performance data will be stored MySQL.

![Software Block Diagram](image)

**Functions of the Online Communication System**

In order to use the system, both the students and the instructor need their own accounts. List of the students and instructors will be registered on the system. Instructor use the administration functions to divides students into small groups and assign subjects to them in advance of each session. Students study texts of the subject in collaborative learning tasks through teacher e-mentoring on a message board within the group. The teacher gives comprehension questions about the texts to the students. Files and materials are able to be attached to messages which are posted on the message board. Figure 3, below, shows a diagram of function components in the system.
When logging into the system after enrolling in a course, as is shown in Figure 4, the indicated course subjects assigned will be displayed as a list. Affiliated group members are shown as a connected icon for each subject. Students study with the affiliated group members. If a subject is selected, the subject’s texts are shown on the screen as is shown in Figure 5.

Figure 4. The Screenshot of the Subject List

Figure 5 is a screenshot of a text of the subject. When a word or phrase is selected, a message board is shown.
As is shown in Figure 6, messages are posted to the group members about opinions on the topic, and a summary about the texts is composed with the support of instructor e-mentoring. Files and photos can be attached to the messages. Comprehension questions about the texts can also be given to the students. A time period to answer the questions can be set.

5 Further Directions

Research will be conducted to discover how often, and how, students use the online communication system. In addition, research is also being planned to quantitatively measure whether the EFL FL approach will result in an improvement in active student participation in both in-class and outside-of-class activities. An improvement in active participation levels may lead to better academic performance.
Acknowledgements

This study is supported by the Cooperative Research Project Initiative of Kyoto University of Foreign Studies, Japan. The data presented, the statements made, and the views expressed are solely the responsibility of the authors.

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A Mobile Learning Framework for Developing Educational Games and Its Pilot Study for Secondary Mathematics Education

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Abstract. This study aims to explore a mobile learning framework using games and its impact on the learning. The framework has been used to produce a simple education mobile game for secondary mathematics education in the UK, which has been piloted in a classroom. The early findings indicate that the mobile educational game structured through the proposed framework approach can be successful in increasing motivation and engagement in the student and elicit a greater understanding of the mathematical concept.

Keywords: educational gam, loops, skill chains, stages of learning, scaffolding, variable reward ratio

1 Introduction

There is a need to develop a framework to guide mobile learning practitioners to design educational mobile games that is engaging and has real impact on learning. This study aims to build a mobile game learning framework based on the existing many game design techniques and pedagogical theory. The game will focus on Mathematics Education at General Certificate of Secondary Education (GCSE) level specifically for the learning objectives of coordinates and translations.

2 Background

Loops is commonly regarded as an iterating mechanism that delivers assessment and describe the process of understanding when encountering a game. When first approaching a game the brain creates a mental model of what is expected. The player then performs an action within the game; the rules of the game dictate whether that action is valid or not. The game then provides feedback (either positive or negative) to the player that allows the player to update their mental model of what the game is about. The feedback is what guides the player towards the right decisions to progress through the game (Cook 2013). Arcs deliver intense evocative stimuli through a broken loop where the action ends with an emotionally stimulating feedback hit to the player. They can commonly be used in games involving a story through cut scenes breaking up the gameplay into chapters (Cook 2013). Skill chains are hierarchal structures of loops. When someone is playing a game they will learn new skills as they progress through the game. To learn a skill, the user will go through several iterations of a loop to understand what the skill is and what it can be used for (Cook, 2013). To motivate users to continue progressing a blend of fixed ratio and variable ratio reinforcement should be applied. A Fixed ratio schedule of reinforcement rewards the player after a known number of actions and provides the player with the milestone for the player to achieve. A Variable ratio schedule of reinforcement rewards the player after an unknown or approximate number of actions. This provides a steady flow of engagement as the player does not know the required number of actions to gain the reward (Linehan et al, 2011). A positive level curve should allow the player to feel like they are progressing and gaining experience quickly within the opening stages of the game. This engages the player and captivates them into playing the game for a longer time. If after the first 15 minutes the player has not felt like they have progressed in the game they may not feel, motivated enough to play on further. (Long, 2013).

Scaffolding is a progressive teaching strategy whereby the difficulty or complexity of a lesson or assignment increases incrementally in order to build a strong understanding of the subject and create more independence in the learning process. The idea of a spiral curriculum builds on this by ensuring some of the pre-
viously taught knowledge is revisited in order to build a strong understanding of the entire concept (Wood et al, 1976). Skill chaining in game design borrows from the scaffolding concept by incrementally building on the player’s skill set and revisiting older skills to ensure the game is enjoyable for the player. Kinesthetic learners have a preference for learning through touching, moving and interacting with objects. The interactivity involved in the activity allows the learner to explore the concept and can enable discovery learning (Curry, 1990). There is a lack of evidence to support the claim that people have a particular learning style and simply learn best from one category (Coffield et al, 2004) However evidence does support the theory that mixed modality teaching (teaching inclusive of visual, auditory and kinesthetic learning styles) improves performance amongst students (Kolb 1984) (Manolis et al, 2012).

Learning takes place in stages (Holmes, 2014). These stages of learning outline the cognitive process of flow that takes place as followed:

**Acquisition Phase:**
1. Encountering the Knowledge skill or Concept
2. Relating to (challenging) pre-existing knowledge skills or concepts
3. Assimilation
4. Understanding

**Practising Phase:**
5. Encoding
6. Consolidation
7. Automation
8. Recall
9. Application
10. Transfer

The subject learners learn about must first be encountered in some way, then it must be related to something you already know about. Then the knowledge must be assimilated and an understanding of the concept must take place. The knowledge is then encoded into memory and the information is consolidated. A process of automation should take place if relevant to be able to store it in long-term memory so that it can be recalled. The learnt knowledge should then be able to be applied in the real world (or applied through a test) and finally if each stage has been fully completed it will enable the transfer or explanation of the concept (Holmes, 2014).

### 3 The Learning Framework Using Games

As shown in Figure 1, a learning framework using games has been proposed. The key areas of the Framework are to create an educational game that leads to better engagement and higher motivation in learning are to:

- Scaffold the learning objectives into levels then designing loops to enable the understanding and practise of the concept.
- Think about how the skills or elements of the level accommodate the acquisition and practicing phases of the stages of learning.
- Structure the reinforcement of behaviour of certain skills over a variable ratio reward system.
- Design the progression of the game over a positive level curve.

To create a successful educational game, the learning objectives must first be identified. There should be a clear understanding of what details of the curriculum should be covered. The learning objectives should then be broken down into an educational skill chain or scaffolding diagram of what the learner should already know in order to understand the knowledge and concepts of the chosen learning objectives.
Loops should then be designed to practise the necessary skills that are required. Consideration of the platform the game will be played on should be taken into account when designing loops. In the case of this project the platform will be a mobile tablet. The interface in this case allows for tapping, dragging and multi-touch controls. The loops designed should ensure that an understanding of the learning objective is taking place. The acquiring phase from the stages of learning should be taken into account. As the loop will be repeated many times, the practising phase of the stages of learning should also be taking place. Therefore, both acquisition phase and practicing phase in the stages of learning will take place within the loop that is designed.

The loops designed should then be structured into game levels by the skills or knowledge required to meet the desired learning objectives. It is possible to include more skills within a game level but it is far simpler to design one level for one skill.

The game level should use a variable reward ratio system for the scoring of correct questions. This will ensure the motivation and engagement of the player throughout the level. Currency within the game (points, stars, gold) should be gained at the end of the level, the amount of which should be dependent on how well the player did. This will reinforce the idea that the player is progressing towards something in the game.

In a larger game the levels should be structured into chapters or subject areas. Chapters allow for the learning objectives of a subject area of the curriculum to be concisely defined. Chapters also allow for a game arc to take place by having a harder, more difficult level (or levels) at the end of the chapter. This level (or levels) can contain pieces of each of the covered learning objectives ensuring that the player has learnt all of the content within the subject area. A larger reward of currency can be offered to the player upon completing the level and reinforcement over a fixed ratio system can take place, as the player will be expecting a larger reward for completing a more challenging level. This level will be about practice of the learnt skills so
will focus on stages of learning 7-9. Through a fixed ratio reward schedule over more difficult end-of-
chapter levels the player will feel they are progressing positively in the game.

Each stage or element of this framework will be considered during the implementation of the game. Throughout the design stage the relevant parts of the framework will be taken into account whilst thinking about how each loop and level will be constructed.

4 Design and Development

Designing a game around a spiral curriculum teaching approach would be the easiest method to employ, because games themselves present a similar incremental approach to the difficulty in the patterns and challenges for the player. Players also need core skills to navigate up a skill chain to more complex patterns. A spiral curriculum will begin with a concept and then revisit it at intervals increasing the sophistication each time, building on the learner’s knowledge each time. Games use a similar strategy to keep the player interested by increasing the difficulty of the challenges through the introduction of new or more challenging loops. For the purposes of this research, arcs will not be used due to the time constraints in the development stage of this game. A positive level curve is implemented through the gentle incremental loops on the hierarchy of the skill chain.

To aid in the design decisions for the game, several questions from past maths GSCE papers were taken and deconstructed into elements that could be interacted with. Through the touch screen interface of a tablet the potential possibilities were drawn out. Various Maths GCSE revision books (Wood et al, 2000) and the popular revision website GCSE bitesize (http://www.bbc.co.uk/education/subjects/z6pfb9q) were used to help in the understanding of the subject area and also aided in the design of the challenges within the game.

After some deliberation on what subject areas to cover, negative numbers, coordinates and translations were settled upon. These were chosen because it was believed that the difficulty of the topic would get progressively harder and each stage requires that the previous level of knowledge is acquired. Negative numbers are required in coordinates and in translations and knowledge of coordinates should be acquired before attempting translations. These topics also allowed for interactivity using a touch screen interface: the negative numbers can be moved into the correct order; lines can be moved along a grid and can display the updated coordinates in real time. As well as moving a shape along a grid, the vectors from where the shape started could also be updated in real time. Interacting with the material in this though a kinesthetic leaning style should elicit a greater understanding of the concept.

The score for a correct answer is determined by how long the player takes to answer the question. There are three tiers of time in seconds that affect the score. In each tier a random number is selected between two given values. The score values and the time are dependent on the level being played, due to the difference in difficulty in each level. This uncertainty within the reward system should help to hold the player’s engagement in the game as the reward system is based on a Variable Ratio Schedule of Reinforcement. It should also provide the player with an enigma in the patterns presented to them. The only fixed ratio reward shall simply be to finish the game by completing all four levels. As discussed earlier due to the time constraints, producing multiple arcs is not feasible for this project.

5 A Pilot Study in GCSE Classroom

Pilot Study Setup

Twelve students were used as subjects to test the game. The students were first given a set of coordinates questions and a set of translation questions to answer before they played the game to judge their current level of ability.
As shown in figure 2, the first level of the game involves dragging the numbers into the correct order. The second level is based on finding positive coordinate values. The third level features a grid that includes negative coordinates on both axes. The fourth level changes the dynamics of the gameplay slightly and gives the player the challenge of trying to discover the pattern of how translations work by interacting with a shape on the grid. Finally, the result screen appears after each game is finished. It displays the total score that was achieved in the game and the number of stars achieved for the level. Stars are the primary currency for the internal economy of the game. They are used to unlock levels. The total score is used as more of a specific measure of how well the player did in a level.

After they had played the game another set of coordinates questions and another set of translation questions were then given to them to assess if the game had any improvement on their understanding. A questionnaire was also used to collect their opinions on the game.

Results

As shown in Figure 3, out of twelve students in the pilot study, in the first three coordinate’s questions eleven out of twelve students got the first question correct, nine out of twelve students got the second question correct and ten out of twelve students got the third question correct. In comparison 100% of students got the second set of coordinates questions correct after playing the game. For the first set of Translation questions, six out of twelve students got the first question right and five out of twelve students got the second
question right. However, on the second set of translation questions, eleven students got the first question correct and nine students got the second question correct after playing the game.

Figure 3. Questions

6 Discussion

Based on the testing results it is clear that there was a positive impact on the students understanding of coordinates and translations. The improvements shown on the exam-paper questions answered after playing the game demonstrate that that some of the students who face similar questions in their GCSE Maths paper have a higher chance of getting these questions correct.

Allowing the students to interact with the material rather than having to try and figure the problem out visually creates a greater understanding of the concept.

This paper also provides more proof based on the testing results that an educational computer game can contribute to helping the student to learn.

Maths is a particularly difficult subject especially for students’ in the lower sets (students of lower ability in English schools). Increasing engagement and motivation in Maths is essential helping them understand the underlying concepts and knowledge that is required to succeed in their exams. This has an impact on their future career path but Mathematical skills are also very useful in many aspects of life after school.

Future work will involve further development of the proposed Gamification framework. It can be used to develop educational games for many other areas of the curriculum, not just in Maths but in other subjects too, and at difficult qualification level as well. It will be interesting to investigate how the framework may need to be adjusted to better serve different qualification level and subject.

7 References


Designing an Engaging Healthcare Simulation Game

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Abstract. We present an on-going design-based research project to develop a healthcare simulation game that is more engaging and game-like and to develop pedagogical practices. Data will be collected through three case studies, using mixed methods. From our results we expect to have a more user friendly and engaging simulation program for learning critical communication within the social and healthcare fields and to have empirically tested pedagogical practices that help to create meaningful learning opportunities with the simulation game.

Keywords: healthcare simulation games, design-based research method, in-service education

1 Introduction

This study presents an on-going design-based research project (Barab and Squire 2004; Wang and Hannafin 2005) to design and develop TETRAsim simulation software to be more engaging and game-like. In particular, we explore how to create an effective computer-based simulation game for learning critical communication in the field of healthcare (see also Poikela, Ruokamo and Teräs 2015). TETRAsim simulation software is a computer-based simulation program that is used for independent or team-based training on the official terrestrial trunked radio (TETRA) phones. TETRA phones are currently used by several Finnish authorities (e.g. police, armed forces, border guards, healthcare services) and operate through a special digital network called VIRVE, which has been built specifically for use by the authorities. Benefits of these devices and networks include the continued use of the VIRVE networks and TETRA phones when the normal GSM network fails, especially during crises. Similar networks exist in other countries, for example, RAKEL in Sweden, The Airwave Network in Britain and ASTRID in Belgium.

Computer-based simulation games (also referred to as gaming simulations, serious games or educational games [e.g. Tobias and Fletcher, 2012]) promote learning by simplifying complex systems and making difficult concepts accessible and understandable. They also help learners in receiving a holistic understanding of a domain or system (Kriz 2003; Rieber, Tzeng and Tribble 2004). According to Kriz (2003), computer-based simulation games help to mimic processes, networks and structures, with their main goal being to simulate decision-making processes and their consequences. Other benefits include the safety of learning environments, the possibility of repeated practice, enhanced knowledge retention, the application of procedural skills in real practice and improved psychomotor, decision-making and problem-solving skills (Chodos et al. 2010; Garris, Ahlers and Driskell 2002; Kapralos, Johnston, Finney and Dubrowski 2011; Knight et al. 2010; Lewis, Davies, Jenkins and Tait 2005; Tashiro 2009; Torrente et al. 2014; Woodward, Carnine and Gersten 1988). According to Kapralos et al. (2011), computer-based simulation games reduce the need for resources, such as time and infrastructure. Most importantly, they afford teachers and students an engaging and safe learning environment, thus making learning more motivating than in traditional lecture-based instruction (Annetta 2008; Begg 2008; Bellotti, Berta and De Gloria 2010; Garris et al. 2002; Huunonen 2015). Some researchers make a distinction between simulations and games; the main features of simulations are that they represent the real world, whereas games do not intend to mimic the real world, rather they form their own world with their own rules (Garris et al. 2002).

These game-like simulations, however, are usually designed with little understanding of human cognition and learning (Rieber et al. 2004; Tashiro 2009). For this reason, Tashiro (2009, p 3) proposed a number of questions that educational games should address: 1) How do instructional materials enhance the predisposition to learn? 2) How do the materials provide multiple paths for learning? 3) How does an instructional package help students overcome the limitations of prior knowledge? 4) When and how do the educational materials provide practice and feedback? 5) Can the instructional materials help students develop the ability to transfer the knowledge acquired by extending the knowledge and skills beyond the contexts in which they
were gained? 6) How will the instructional package incorporate the role of social context? 7) How and why will the instructional materials address cultural norms and student beliefs?” These questions are also congruent with the concept of meaningful learning, which was originally invented by Ausubel (1968). Later the many authors have developed the concept further in various contexts. For example, Jonassen (1995) have proposed seven distinct, but overlapping characteristics of meaningful learning, namely active, constructive, collaborative, intentional, conversational, contextualized and reflective. According to Jonassen (1995) learning in schools and universities should emphasise these characteristics. Bellotti et al. (2011) also note that educational games should be grounded in a proper educational foundation, but it is not yet clear how to turn simulation games into effective learning (e.g. Annetta 2008; Garris et al. 2002). In this study we will try to enhance participants’ meaningful learning experience by designing the actual game, but also designing the simulation training that it would enhance their meaningful learning.

With this background, we set the following research questions for this study: 1) What are the features of effective and meaningful healthcare simulation games? 2) How can such features enhance the meaningful learning experience? The rest of this paper consists of the introduction of the research design, expected research results and a brief summary.

2 Research Design

We follow the principles of the design-based research approach (Barab and Squire 2004; Wang and Hannafin 2005) and answer the research question through three case studies (see Table 1). In addition, the project follows the principles of agile game development in which each development cycle builds on the previous ones and changes are considered even in the late phase of game development (Agile Alliance 2015). This means that between the case studies there might be changes to the game design as well as how the simulation trainings are conducted.

<table>
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The case studies aim to test and train official communications in different contexts and conditions. In all cases, participants will first use a web-based version of TETRAsim to individually train on how to use and operate through a TETRA phone. The online TETRAsim will be accessed through tablet computers. Following the individual training period, a face-to-face training session will be organized that follows the pedagogical model designed for simulation-based training in healthcare (Dieckmann 2009; Keskitalo 2015). Applying Keskitalo’s (2015) pedagogical model, the participants will first have the online individual training with
TETRAsim, where the purpose is to learn the basics of the phone and how to operate with that. Thereafter, participants will have the actual simulation training. Simulation training starts with introduction, which include also the small discussion about the important concepts concerning the content of the training. After the introduction, participants familiarize themselves with the environment in order to succeed in the actual scenario. Scenario includes the actual training of critical communication with the TETRA phone followed by debriefing. During the debriefing participants review their own learning and set the new learning objectives. During each case study, various kinds of qualitative data will be collected and analysed, following the principles set for design-based research (Barab and Squire 2004; Wang and Hannafin 2005). The case study’s participants will be Finnish authorities from social and healthcare fields as well as from the fire department. We expect to have approximately 10 participants in each case.

3 Expected Research Results

During the research project, both the TETRAsim simulation program and the pedagogy will be developed further. The main expected outcome is a more user friendly and engaging simulation program for learning critical communication within the social and healthcare fields. In addition, the study will yield the design principles that help to design simulation games. The development of the pedagogical practices is also intertwined within the research project. The aim is to develop such practices that promote meaningful learning opportunities within simulation games (Poikela in progress) as well as full-scale simulation environments (Keskitalo 2015).

4 Conclusion

This article presents an on-going design-based research project to develop the technologies and pedagogical practices employed by authorities in Finland. The overall aim of the research project is to develop simulation-based education, critical communication, services and technologies of social and healthcare in order to enhance the safety of patients, customers and workers. As the research proceeds, the project will yield results that are widely applicable nationally as well as internationally.

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A Mobile Reader for Language Learners

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Abstract. This paper describes a new approach to mobile language learning: a mobile reader that aids learners in extending the breadth of their existing vocabulary knowledge. The FLAX Reader supports L2 (second language) learners in English by building a personalized learner model of receptive vocabulary acquisition. It provides dictionary lookup for words that they struggle with, tracks a learner’s reading speed, and models their vocabulary acquisition, generating appropriate exercises to aid in a learner’s personal language growth.

Keywords: Mobile language learning, implicit language learning, vocabulary acquisition, learner modelling

1 Introduction

There are thousands of language learning applications on the mobile market, as well as thousands of web-based language learning systems that can be used on mobile devices. These applications focus on explicit learning through intensive reading, which has been successful in initially learning a second language but may have less importance when extending a learner’s vocabulary to a more advanced level.

The FLAX Reader supports L2 (second language) learners in English that are interested in extending the breadth of their vocabulary. Where majority of mobile language learning applications focus on introducing a new language, the FLAX Reader focuses on building existing language knowledge. The Reader takes advantage of implicit, incidental learning, exposing the learner to articles of various length, and building a learner model of receptive vocabulary acquisition that is unique to each language learner. The Reader allows learners to extend their vocabulary without the use of intensive reading or explicit learning goals.

2 Literature Review

“Implicit learning” is the process of acquiring knowledge without conscious intention. Sternberg (1999) describes implicit learning as “the process whereby knowledge is acquired largely independently of awareness of both the process and the products of acquisition”. In contrast, “explicit learning” is the process of acquiring knowledge with conscious intent. Explicit learning includes structure: clear outlines, learning goals, and unambiguous explanations. The FLAX Reader takes advantage of implicit learning, providing L2 learners with reading material and dictionary lookup, extending their vocabulary knowledge without conscious intention.

“Intensive reading” focuses on small sections of difficult text, addressing the language itself rather than the text, and is the reading technique that is used primarily in second language learning, particularly when an L2 learner is first starting out. In contrast, Nation (2001) advocates “extensive reading”, where 95%-98% of words are familiar, leading towards extensive reading being used to increase reading fluency and to build language knowledge, rather than for introducing a new language. The FLAX Reader uses extensive reading to build L2 learners’ vocabulary knowledge.

“Learner modelling” refers to the generation of a learner model, where the model is created based on the interactions between the L2 learner and the language learning system (Walmsley, 2015). iCALL (Intelligent Computer Aided Language Learning) uses learner modelling to adapt in order to suit the users learning experience. Researchers have investigated using iCALL in language learning and tutoring systems; for grammatical practice and error detection (Amaral and Meurers, 2011; Heift, 2001, 2012). Unfortunately, prior research into learner modelling of extensive reader systems is rather limited. The FLAX Reader uses learner model-
ling to model an L2 learner's receptive vocabulary acquisition. The model changes based on assumptions that a learner does or does not know a word (i.e. does or does not click on a word).

3 Existing Applications

There are a large number of language learning applications available in the mobile market but they all tend to focus on intensive reading and explicit language learning. Mobile applications that use extensive reading (i.e. E-Readers) may provide dictionary look-up, but they do not include further language learning features, such as learner modelling for personalized vocabulary growth.

4 The FLAX Reader

The FLAX (Flexible language acquisition) Reader is a mobile-based reader that tracks a learner's reading speed and builds a model of receptive vocabulary acquisition. It was developed as a tool to aid in language learning, and generates exercises based on areas of the English language where the learner has been shown to struggle. The primary contributions of this work are:

1. Providing reading material, using extensive reading to extend the breadth of an L2 learner’s vocabulary.
2. Providing dictionary look-up, allowing a learner to extend the breadth of their vocabulary each time they encounter a word that they are unfamiliar with.
3. Modelling vocabulary acquisition, building a personalized learner model, including the degree of the learner’s confidence in the meaning of each word.
4. Tracking a learner’s reading speed, using the lowest WPM to generate language learning exercises.

The FLAX Reader retrieves a collection of articles from the existing FLAX server for learners to use as extensive reading material. Twenty articles are currently retrieved from the FLAX server, however the Reader has been implemented in a way that allows it to be extended to include any reading material found on the server, from beginner, intermediate, and advanced reading levels.

By interacting with an external dictionary application, the FLAX Reader helps with receptive vocabulary acquisition, providing the learner with dictionary look-up. This allows a learner to extend the breadth of their vocabulary each time they encounter a word that they are unfamiliar with. The dictionary application that the Reader interacts with is Livio English Dictionary. The definitions are based on Wiktionary and are all built into the Livio application so network connectivity is not required.

Learner modelling allows the FLAX Reader to build a personalized vocabulary model for each learner. The learner model holds a list of entries which represent each word that the L2 learner has encountered in the articles to date. Each entry in the learner model is made up of a key-value pair, where the key is the base word and the value is the degree of confidence with which the learner knows that word. We cannot assume, simply from clicking a word, that the user is entirely unfamiliar with its meaning. Giving each word a degree of confidence, allows us to account for accidental clicking and individual response styles. The degree of confidence is a value between 0 and 1 which represents the probability that the L2 learner is familiar with a word, with 0 having 0% probability that the learner is familiar with the word, and 1 having 100% probability that the learner is familiar with the word. When an L2 learner reads an article, every word that they do or do not click contributes to the learner model, with the degree of confidence increasing or decreasing relatively. As a learner reads each article, the learner model develops and grows to include every word that they have encountered, with words that they struggle with percolating up to the top of the list, where their degree of confidence is lower than words that the learner is comfortable with. These low confidence words can be used to generate language learning exercises, reinforcing the relevant vocabulary.

The FLAX Reader tracks a learner’s reading speed in order to generate language learning exercises that suit their reading ability. The time taken to read a page is used to generate WPM (words per minute), where the WPM are considered valid if and only if they fall into a given threshold. Any outliers are excluded, assuming the learner either skimmed the article too quickly to have genuinely read it, or was distracted and left the article open too long. This data is used to generate personalized language learning exercises that are tailored to each individual learner’s abilities. The Reader keeps track of the page in each article that had the
lowest WPM, assuming the page with the lowest WPM is a page that the learner struggled with. The Reader can then generate an exercise to reinforce the vocabulary that was seen on that page.

Language learning activities are a way to further cement the process of learning a second language. The FLAX Reader utilizes three existing FLAX mobile-based language learning applications: Hangman, Split Sentences and Scrambled Paragraphs. As an example of one of the three activities, Hangman is a language learning activity that helps L2 learners with receptive vocabulary acquisition. Each exercise has one hidden word represented by a row of dashes. The learner has to guess this hidden word by guessing the individual letters. The FLAX Reader uses the learner model to choose the words in the current article that have the lowest degree of confidence (i.e. the words that the learner is least familiar with) in order to generate exercises for the Hangman application.

5 Usability Study

A usability study was conducted on the FLAX Reader to evaluate the applications functionality and ease of use. The study was in the form of an interview, where each participant was asked to complete four tasks (saving an article, deleting an article, reading an article, and playing a language learning activity), and was interviewed at the completion of each task. Participants were asked a total of 24 interview questions: 3 relating to saving an article; 3 relating to deleting an article; 9 relating to reading an article; 4 relating to playing a language learning activity; and 5 that related to the usability of the FLAX Reader in general. The aim of the usability study was to determine whether the design and functionality decisions that had been made were supported, and to outline any additional issues that may not have been previously identified.

The usability study showed three main areas that stood out as problematic: the process of saving or deleting an article; the position and emphasis of the play button; and the article content itself. UI changes have been made to the application since the completing of this study in order to correct these issues. Overall, the final results of the study were positive, with the majority (80%) of participants saying that they would use the FLAX reader to aid in their language learning. 50% of participants thought the ability to provide dictionary look-up was one of the main positive features and 30% of participants thought interacting with language learning applications was one of the main positive features.

6 Conclusion

The FLAX Reader is a mobile-based extensive reading application that helps with language learning. It uses learner modelling to build a personalized model of receptive vocabulary acquisition, generating language exercises to aid in learning English as a second language.

The development of software is never finished. There is always more that can be done: further research, additional features, the refinement of current features. The FLAX Reader has simply scraped the surface of mobile based, implicit language learning, using learner modelling to create a basic model for vocabulary acquisition. The progress made in this project raises the possibility of monitoring the acquisition of vocabulary at an even more fine-grained level of detail; a precise, timed, history of encounters with every individual word.

7 References

Mobile Learning as a Tool for Indigenous Language Revitalization and Sustainability in Canada: Who Will the Pipe Holders Be?

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Abstract. The FRAME analysis in this paper represents a preliminary exploration how mobile learning can complement the Certificate of Indigenous Languages program at the University of Saskatchewan in Western Canada. Through the analysis, the authors extract salient cultural, pedagogical, environmental, and technological characteristics that should be considered in the development of mobile learning tools for Cree language teachers. It is hoped that this paper will stimulate a dialogue amongst designers and Indigenous groups regarding language sustainability through mobile learning.

Keywords: Cree, Indigenous languages, mobile learning, FRAME model

1 Introduction

In this paper, we view sustainability as the management of knowledge and resources so as to preserve natural and cultural ecosystems thereby ensuring quality of life for future generations. In the case of the Cree and other Indigenous groups in Canada, linguistic revitalization is a key to cultural sustainability. Before embarking upon development of mobile language tools for specific Indigenous communities, it is important to consider how to design such tools in ways that are respectful of the people’s needs, worldviews, protocols, and physical environments.

Much of the mobile technology available has been developed primarily from Western, European scientific traditions. Such traditions can privilege knowledge derived from reason and individualism over knowledge derived from tradition and community (Pegrum 2014). Furthermore, technology can allow people to reconfigure their relationships to each other and the world. Reconfigurations of relationships can both empower and endanger cultural practices. Deer and Hakansson (2005) note: “Indigenous Peoples have their own concepts of knowledge, information and communication and have developed their own forms of information communication” (p. 237). Such knowledge should be integral to the development of mobile learning applications.

In 2015, the Certificate in Indigenous Languages (CIL), at the University of Saskatchewan was introduced in support of Cree-language revitalization and sustainability. In this paper, we use the FRAME model (Koole 2009) as a needs analysis tool to explore how mobile tools can be designed to complement the program.

2 Frame Analysis

The Framework for the Rational Analysis of Mobile Learning (FRAME) Model is depicted as a Venn diagram comprising three intersecting circles representing social, device, and learner aspects (Figure 1). Although the FRAME model was originally designed within a social constructivist perspective, we hope that it can also complement the Indigenous ways of thinking. Kovach (2009) suggests that “even with their inherent bias, Western research frameworks can be adapted as structural forms that are helpful to the Indigenous researcher for allowing the entrance of visual, symbolic, and metaphorical representations of a research design that mitigates the linearity of words alone” (p. 41).
Figure 1. The FRAME Model

The CIL Context

The CIL program focuses on Cree, a polysynthetic language that belongs to the larger Algonquian language family. In Saskatchewan, there are 3 dialects of Cree spoken: the Plains, Woodlands, and Swampy (Figure 2). The Government of Saskatchewan (2012) reports that there are 24,045 people who speak Cree as a mother tongue, but only 13,130 indicate using Cree as the main language at home. Statistics indicate a drop of 2,110 Cree speakers from 2006-2011 (ibid.). At the same time, it is projected that by 2026, 36% of the Saskatchewan population aged 15 to 29 will be Indigenous (Townsend and Wernick 2008). Socially and economically, it is important to ensure that these young people have educational opportunities. To avoid cognitively imperialistic education, Indigenous knowledges and languages need to be incorporated into school curricula (Battiste, 2013).

Figure 2. A Map of the Cree Language in Canada
The CIL comprises ten courses targeting speaking, writing, and second language teaching methodologies. Learners develop their Indigenous voices in the classroom, out on the land, and in ceremony in both urban and reserve locations. The students practice the methodologies with their own students. To accommodate working teachers travelling from distant communities, the classes are taught on weekends and during summer vacation.

Social Aspect

The social rules, ceremonies, worldview, and protocols are integral for sustaining cultural and linguistic practices. A Cree Elder once related his concern regarding the ceremonies. He was worried about who the pipe holders were going to be. He asked about who would lead the feasts, round dances, and ghost dances where the ancestors are fed and cared for. The worldview of the Cree requires understanding the interconnectedness of everything: the Earth, the sun, the four-legged creatures, and the flyers are family. They are addressed as grandfathers and grandmothers. The people also have relationships with deities such as rocks and the wind. If the language were lost, the ancestors and spirits would possibly misunderstand the prayers, which would negatively affect the connection to the ancestors. The roles, significance, and protocols related to certain materials and practices such as tobacco and gifting must be respected and preserved.

A large amount of cultural information is specific to families, leaders of ceremonial lodges, and particularly Elders. The Elders, the knowledge holders, are aging and have limited funding. Young people must often travel in order to learn the traditions from them. Reciprocity, respect, and a spirit of appreciation are a part of knowledge sharing. It takes a lifetime to develop relationships and acquire the epistemological competence necessary to become trusted and to be seen as a rightful knowledge holder.

Learner Aspect

The first cohort in the CIL have a breadth of goals, fluency, and learning preferences, but all share the desire to regain their cultural and linguistic identity. The majority of the seventeen Students are teachers. They range in age from 20 to 65. Some of the teachers are employed on-reserves in northwestern Saskatchewan; others work at an urban, bilingual school. Two participants are university students. There are also some non-Cree teachers enrolled. Those with adequate fluency can visit Elders and can verify the nuances of the knowledge shared in class. Few are literate in either Standard Roman Orthography or Cree syllabics.

Device Aspect

There is very little published information on the communications infrastructure and device ownership for Indigenous communities in Northern Canada. But, personal observation suggests that smartphones, iPads, and other tablets are diffusing into these communities throughout the province. Approximately half of the Indigenous people in Canada live in rural and remote communities (Indigenous and Northern Affairs Canada, 2010) in which there is little or no reliable mobile or Internet connectivity (Canadian Radio-television and Telecommunications Commission, 2014). To exacerbate access, the OECD reports that connectivity fees in Canada are amongst the most expensive in the world (OECD 2013).

Interaction Learning Intersection

Formal and informal practices strongly affect how knowledge is passed along to others. Cree is a living language that is traditionally situated in relationships with family, community, and the environment. In addition to conjugations and grammar, Cree must be heard, used, and usable. Songs and prayers are significant for giving thanks and healing. Similar to any language-learning environment, community sharing, relationship development, and reciprocity requires a sense of safety and approval.

In the CIL, a variety of pedagogical methods have been working well: songs, total physical response (TPR), the picture-word-inductive-model (PWIM), and writing in Cree syllabics. The less fluent students pick up the writing systems quickly. As a result, the first language speakers depend on the second language speakers in terms of writing, and the second language speakers depend on the first language speakers for translations and transcribing. In-class discussions occur in Cree, English and in Cree-English (mixture).
Social Technology Intersection

This intersection asks designers to consider collaboration and networking amongst people and technology. While the Cree are generally willing to adopt and adapt technologies to fit their needs, community members may need to request permission from Elders to implement technology and/or transmit cultural knowledge. There are still Elders, for example, who do not want to be recorded with audio or video technology. In cases such as sharing on YouTube and/or Facebook, an Elder’s committee normally outlines processes for recording, storage, representation, and distribution of cultural information such as spiritual, medicinal, and ceremonial knowledge.

New technologies bring new concerns. The idea of ownership and copyright is a new topic for the Cree people. This can be a problem when working with developers and vendors who might take “ownership” over content. Commercially produced software can also lead learners to inadvertently share personal information on servers located in distant lands. And, finally participation in social media may result in loss of ownership of personal data, depending on the terms and conditions of the respective site. These issues strongly suggest the need for careful control over ICT development so as to ensure that the transmission and use of cultural knowledge is done in a “good way”—that is, respectfully and appropriately (Kovach, 2009, p. 35).

Device Usability Intersection

Device-usability characteristics include portability, quick access to information, usability, learnability, and aesthetics. In current practice, it is increasingly common for the people to record, edit, and share videos of Elders interviews, powwows, round dances, and other cultural practices. The Cree Dictionary app is an example of highly used tool for just-in-time information. Fluent speakers text in Cree; less fluent speakers will sometimes text a few words in Cree. Even fewer are able to text using Cree syllabics. Ease-of-use and learnability is significant for Elders learning how to connect to the Internet. Finally, portability remains of great importance as community members who move away from home for extended periods of time still desire access to linguistic and cultural information. Out-of-date phones with limited memory and functionality as well as the lack of connectivity impacting the ability to update apps and transfer information hamper use of mobile technologies by members of Northern communities.

3 Conclusions: Mobile Learning Needs

We believe that mobile learning can provide enhanced access to cultural resources and community dispersed across vast territories and throughout a learner’s lifetime. We invite discussion on how mobile learning tools can be designed to

- incorporate traditional ways of learning such as prayer, songs, kinship and spiritual views (LS).
- reflect key cultural pillars such as relationship/trust, respect, reciprocity, and responsibility (S).
- facilitate ongoing interaction amongst learners, Elders, family, and community members (LS).
- facilitate switching or translating between dialects of a language (DS).
- incorporate unique, non-standard fonts cost-effectively (DL).
- incorporate non-Western language methodologies (LS).
- maintain Indigenous ownership of traditional knowledge (DLS).
- ensure high quality interaction in areas of low/intermittent bandwidth (DL).

Language is intrinsically connected to the sustainability of cultural practices, worldview, and identities. The development and shaping of mobile tools in ways that reflect Indigenous epistemologies and cultural backgrounds can help the new generation of pipe-holders sustain their language, culture, and communities.

4 References


Mobile Learning in Practical-based Subjects: 
A Developing Country Perspective

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Abstract. A plethora of stumbling blocks impede on students’ ability to successfully complete practical-based subjects off campus, especially in developing countries. Since the preponderance of students is from previously disadvantaged communities, they are reliant on campus computers, whose access is not always probable due to location, time, and distance restraints. As a result, students are not given the liberty to elect when, where, and how they learn, which in turn adversely influences student performance. This research investigates the utilization of mobile technologies to facilitate practical-based subjects, affording students the opportunity to learn without the necessity of a computer, anywhere and at any time. In order to ascertain the effectiveness and usefulness of mobile learning, and address the benefits and barriers experienced during the m-learning process, an action research study was conducted to investigate whether m-learning can bridge existing learning gaps in practical-based subjects in Higher Education institutions of developing countries. Key findings indicate that m-learning can broaden educational opportunities for disadvantaged and marginalized students, assist in bridging existing learning gaps in practical-based subjects, and most importantly increase throughput and success rates.

Keywords: mobile learning, mobile technology, mobile device, developing country

1 Introduction

The use of mobile technologies is gradually drawing a great deal of attention across every sector of education in both developed and developing countries. The benefit of such mobile technologies lies in that they are not location-specific and are increasingly viewed as an affordable means to bridge the ‘digital divide’ (Brown 2005). Mobile learning (m-learning) is defined by Crompton (2013) as “learning across multiple contexts, through social and content interactions, using personal electronic devices”. In spite of the increasing popularity of m-learning, existing literature provides little evidence of how mobile technologies can effectively be utilized for practical-based subjects (subjects that necessitate the use of a computer preloaded with the required software), especially in developing countries.

Numerous obstacles impede on students’ ability to successfully complete practical-based subjects off campus, particularly in developing countries. This phenomenon is mainly attributed to four key encumbrances, namely the inadequate accessibility of computers; the lack of software to complete and submit assignments off campus, and to practice subject-related skills; limited Internet access and bandwidth; as well as the prohibitive cost of mobile technology to students. As the majority of these students are from previously disadvantaged communities and can merely not meet the expense of computers, relatively costly commercial software, and exorbitant Internet connectivity fees, they are reliant on campus computers, whose access is not always possible due to location, time, and distance limitations. Consequently, student performance over the past few years indicates a disconcerting downward trend year on year. Stemming from the aforementioned, it is evident that current learning tools in practical-based subjects do not comply with the demands (providing access to the required subject-related software and learning material while on the move from any location at any time) faced by Higher Education (HE) institutions in developing countries. It is therefore imperative to determine whether m-learning can bridge existing learning gaps in practical-based subjects in HE institutions of developing countries. The aim of this study is thus to utilize mobile technologies in order to extend ways in which students could be supported in practical-based subjects, and as a result, increase throughput and success rates.
2 M-learning: A Developing Country Perspective

All humans have the right to access learning materials and information to improve their quality of life regardless of their culture, status, and where they live. Technology is inclined to reinforce existing social and cultural iniquities. It is essential to understand and pro-actively seek ways to address such challenges (Adam, Butcher, Tusubira and Sibthorpe 2011). Even though m-learning is moving from small-scale pilot studies to institution-wide implementation worldwide, it characteristically does not reflect the present situation in developing countries. The majority of research studies focus on the conceptions of m-learning based on the culture and affordances of developed countries. From a developing country perspective, m-learning, through the use of mobile technologies, could potentially empower students by allowing them to practice subject-related skills, learn while ‘on the move’, and access learning materials and information from anywhere and at any time they wish. In addition, mobile technologies could also assist ‘just-in-time’ learning by enabling students to make use of unforeseen free time, in view of the fact that students invariably have their mobile devices with them. Not only can m-learning research within a practical-based subject place HE institutions in developing countries at the forefront of pedagogical practice, but it can most importantly address student requirements for mobility, flexibility and ubiquity. The developing country dispensation is however subject to caveats such as, low level of technology penetration (Botha and Ford 2008), poor infrastructure, lack of reliable and affordable Internet access, narrow bandwidth, lack of reliable Wi-Fi connectivity on campus and limited Wi-Fi availability off campus, logistics and deployment challenges, cultural, economic and social issues (Adam et al. 2011), financial resources and academic preparedness, as well as robbery/crime (Le Roux 2015). In quintessence, it is evident that despite the growing demand of mobile technology in the developing world, the potential to address educational challenges through mobile technology is restricted by the level of technology adoption and resource constraints in the HE environment of developing countries. Notwithstanding these constraints, the ubiquity of mobile technology advocates that it could be meaningfully applied in an educational environment of developing countries in order to provide equal access to remote resources while ‘on the move’, and potential collaboration with educators and peers outside the boundaries of the classroom, and hence broaden educational opportunities for disadvantaged and marginalized students (Mafunya n.d).

3 Research Design, Methodology and Methods

This research study fell within the positivistic research paradigm, was empirical in nature and took on the form of action research (plan, act, observe, reflect) to glean data pertaining to the effectiveness and usefulness of m-learning in facilitating practical-based teaching and learning. True to the characteristics of action research, this research study moved through two cycles over a period of two consecutive years (one cycle during the second semester of each year). Data were obtained from two distinct groups consisting of undergraduate first-year students (Cycle 1, n = 33; Cycle 2, n = 48) enrolled in the Financial Information Systems (FIS) course at the Cape Peninsula University of Technology (CPUT), Cape Town, South Africa. These two groups (m-learning group 1 and m-learning group 2) where exposed to m-learning and their performance where compared to that of four distinct groups over a four-year period. The latter groups were not exposed to any form of m-learning and will hereafter be referred to as the pre-m-learning groups (Figure 1). In quintessence, primary quantitative data were obtained by means of a combination of quantitative (questionnaires, formative and summative assessments, as well as academic student research journals) and qualitative (observation, focus groups, academic student research journals, as well as synchronous and asynchronous communication) techniques for analysis and interpretation.

Application of the Action Research Model for this Research Study

Action Research Cycle 1

The first cycle (Cycle 1, n = 33) was viewed as exploratory in nature in which the data gathered influenced the approach for the second cycle (Cycle 2). Table 1 depicts the comparative design (two m-learning groups vs. four pre-m-learning groups) used in this research study for both formative and summative assessments. Non-shaded assessments indicate that students were not exposed to any form of m-learning prior to the assessment(s), whereas shaded assessments indicate that students were exposed to m-learning preceding the assessment(s). Both the pre-m-learning and m-learning groups were accessed by means of two summative
assessments (T1 and T2), and formative assessments consisting of practical assignments (A1 and A2) and class tests (CT1 and CT2).

One month after classes commenced during Cycle 1, each student within the first m-learning group was issued with a high-end Android tablet containing the required software that enabled them to complete and submit practical assignments and interact with educators and peers in a revolutionary way outside the boundaries of the classroom – something that was previously not possible. It is however important to note that these devices were only provided to students after the first formative (T1) and summative assessments (CT1 and A1) for exclusive use at the institution during Cycle 1. These students were thus only partially exposed to m-learning (on campus access only and for a shorter duration than the Cycle 2 m-learning group) during the course of their studies. Furthermore, these students were assessed by means of similar/comparable formative and summative assessments when compared to the four distinct pre-m-learning groups. After being exposed to m-learning over a six month period, students were assessed by means of a second summative assessment (T2), and various formative assessments consisting of practical assignments (A2) and class tests (CT2). The preliminary plan was to supply students with mobile devices for use both on and off campus for the duration of the subject (a semester), however technical support issues, an increased risk in mobile device loss/theft, and device breakage, made this an impracticable option during the execution of Cycle 1. Formal reflections by the educator were kept by means of an academic research journal, focusing on the entire m-learning experience from an educator and student perspective. It was clear that the technology did not work seamlessly, but despite this barrier student enthusiasm and participation were remarkable. In addition, student observations served as a reflective mechanism to identify the benefits and barriers of m-learning, to evaluate the implications of m-learning in a practical-based subject, as well as to serve as a record for future use. Reflections maintained for the duration of Cycle 1 (a semester) by the educator met the expected outcome and revealed that the teaching and learning experienced of students were enhanced, which in turn resulted in improved student performance.

**Action Research Cycle 2 (Year 6)**

After reflection (Cycle 1), the learning design was improved upon when, in contrast with Cycle 1, a new intake of students were at the outset exposed to m-learning during Cycle 2 (n=46) the following year. These students were also supplied with tablets and were, unlike their Cycle 1 counterparts, allowed to utilize mobile devices off campus, hence allowing students a true m-learning experience. In addition, students in Cycle 2 were also exposed to Mobile Instant Messaging (MIM) discussions via WhatsApp by utilizing their own smartphones to send questions on subject-related assignments/tasks or concerns to the educator. This support service enabled students to complete their work by adding further perspectives to their applications gained through the interaction with the MIM group members and input from the educator. Not only did this initiative assist students in their learning process, but it also provided an attractive and effective learning tool that can enrich the learning environment and experience of students.

| Table 1. Comparative Design for Formative and Summative Assessment for the Pre-M-learning Groups (Year 1 to Year 4) and the M-learning Groups (Year 5 to Year 6) |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Summative Assessment | Formative Assessment | | | | |
| Test 1 (T1) | Test 2 (T2) | Class Test 1 (CT1) | Class Test 2 (CT2) | Practical Assignment 1 (A1) | Practical Assignment 2 (A2) |
| Pre-M-learning Groups | | | | | |
| M-learning Group 1 (Cycle 1 – on campus only) | | | | | |
| M-learning Group 2 (Cycle 2 – on and off campus) | | | | | |
Figure 1 provides a summary of student demographics, as well as the average formative and summative assessment marks of the different pre-m-learning and m-learning groups (Year 1 to Year 6) gathered during the longitudinal action research study. Similar to Table 1, non-shaded assessments indicate no exposure to m-learning prior to an assessment(s), whereas shaded assessments indicate exposure to some form of m-learning prior to the assessment(s). Assessment results will be elaborated upon in more detail in Paragraph 4.

![Figure 1: Student Demographics and Average Formative and Summative Assessment Marks for Distinct Groups Over Six Years (Year 1 to 4: Pre-M-learning Groups vs. Year 5 (Cycle 1) to 6 (Cycle 2): M-learning Groups)](image)

4 Results and Discussion

Formative and Summative Assessment

The formative and summative assessment marks of undergraduate first-year students enrolled for the FIS course at the CPUT, consistently decreased over a period of four years prior to the m-learning intervention (Cycle 1 and Cycle 2). Formative assessments (class tests and practical assignments) were used to evaluate student knowledge on the prescribed source on a continuous basis throughout the semester. Summative assessments (formal tests) were used to test students’ theoretical and practical knowledge on all the learning units covered.

Both formative class test marks (Table 2 and Figure 2) and formative assignment marks (Table 3 and Figure 3) reflect a statistically significant decrease (class tests: 21.7%, assignments: 30.0%) prior to m-learning (Year 1 to 4). Conversely, these marks reflect a statistically significant increase from prior to m-learning (Year 4) to Cycle 1 (Year 5) (class tests: 20.3%, assignments: 27.6%), and from Cycle 1 (Year 5) to Cycle 2 (Year 6) (class tests: 15.6%, assignments: 37.8%) when m-learning was introduced to the two groups. A zero mark reflects that a student did not write any formative class tests or did not submit any practical assignments.
Table 2. Difference in Means Matrix for Average of Formative Class Test Marks (M-learning Groups)

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>66.4 – 62.1 = 4.3</td>
<td>66.4 – 56.7 = 9.7</td>
<td>66.4 – 44.7 = 21.7*</td>
<td>66.4 – 65.0 = 1.4</td>
<td>66.4 – 60.3 = 6.1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>62.1 – 56.7 = 5.4</td>
<td>62.1 – 44.7 = 17.4*</td>
<td>62.1 – 65.0 = -2.9</td>
<td>62.1 – 60.3 = 1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>56.7 – 44.7 = 12.0*</td>
<td>56.7 – 65.0 = -8.3</td>
<td>56.7 – 60.3 = -3.5*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>44.7 – 65.0 = -20.3*</td>
<td>44.7 – 60.3 = -15.6*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>65.0 – 60.3 = 4.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(“Statistically significant at level 0.05”)

Figure 2. Decrease (Pre-M-learning) and Increase (After M-learning) of Formative Class Test Marks

Table 3. Difference in Means Matrix for Average of Formative Practical Assignment Marks (M-Learning Groups)

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>77.4 – 73.9 = 3.5</td>
<td>77.4 – 67.5 = 9.8</td>
<td>77.4 – 47.4 = 30.0*</td>
<td>77.4 – 75.0 = 2.4</td>
<td>77.4 – 85.2 = -7.8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>73.9 – 67.5 = 6.4</td>
<td>73.9 – 47.4 = 26.5*</td>
<td>73.9 – 75.0 = -1.1</td>
<td>73.9 – 85.2 = -11.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>67.5 – 47.4 = 20.1*</td>
<td>67.5 – 75.0 = -7.5</td>
<td>67.5 – 85.2 = -17.7*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>47.4 – 75.0 = -27.6*</td>
<td>47.4 – 85.2 = -37.8*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>75.0 – 85.2 = -10.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(“Statistically significant at level 0.05”)
Figure 3. Decrease (Pre-M-learning) and Increase (After M-learning) of Formative Practical Assignment Marks

Table 4 and Figure 4 overleaf, reflect a statistically significant decrease in the summative assessment marks prior to m-learning (Year 1 to Year 4) (26.6%), and a statistically significant increase from prior to m-learning (Year 4) to Cycle 1 (Year 5) (19.5% increase), and from prior to m-learning (Year 4) to Cycle 2 (Year 6) (24.5%) after students were exposed to m-learning.

Table 4. Difference in Means Matrix for the Summative Assessment Marks (M-Learning Groups)

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72.6</td>
<td>69.7 = 2.9</td>
<td>72.6 – 61.6 = 11.0*</td>
<td>72.6 – 65.5 = 7.1</td>
<td>72.6 – 70.5 = 2.1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>69.7</td>
<td>61.6 = 8.1</td>
<td>69.7 – 65.5 = 4.2</td>
<td>69.7 – 70.5 = -0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>61.6</td>
<td>46.0 = 15.6*</td>
<td>61.6 – 65.5 = -3.9</td>
<td>61.6 – 70.5 = -8.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>46.0</td>
<td>65.5 = -19.5*</td>
<td>46.0 – 70.5 = -24.5*</td>
<td>65.5 – 70.5 = -5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(* Statistically significant at level 0.05)
During Cycle 1 (Year 5), as explained in Paragraph 3, students were not exposed to any form of m-learning prior to the second summative assessment (T2), as well as some of the formative assignments (A2) and class tests (CT2). A paired t-test was performed to compare the first (T1) and second summative assessments (T2) marks for the m-learning students (Year 5) to determine whether there was a significant difference between the summative assessment marks prior to (T1) and after the m-learning intervention (T2). The t-test results reflect $t(33) = 1.9223$ and $p = 0.0635$, thus indicating that there is no statistically significant difference (gain) in the post-m-learning test marks (T2).

On the other hand, there was a statistically significant gain in both the formative practical assignment marks (Figure 5) ($t(33) = 6.2945$ and $p$-value < 0.0001) and the class test marks (Figure 6) ($t(33) = 8.9429$ and $p$-value < 0.0001) post m-learning implementation in Cycle 1 (Year 5) when students were allowed to use the tablets on campus.
Figure 6. **Average of Class Test Marks (Pre-M-learning vs. After M-learning) Over a Six-Month Period in Cycle 1 (Year 5)**

Similar to the results obtained in Year 5 (Cycle 1 - on campus m-learning only), a significant difference in formative assessment marks (practical assignments and class tests) were found when comparing the Year 5 and Year 6 (Cycle 2 - on and off campus m-learning) groups. In both cases the Year 6 group scored statistically significant better than the Year 5 group. Since no significant difference was found between the summative assessment marks of the two m-learning groups, an analysis of variance was performed to determine whether there are differences between the years (Year 1 to 4 vs. Year 5 to 6) concerning the formative and summative assessment marks. From the results depicted in Table 5, it is evident that there is a difference between the means of the assessment marks for the different years, however the ANOVA does not indicate between which years these differences lie.

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF</th>
<th>ANOVA SS</th>
<th>Mean Square</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Test 1 (T1) summative mark</td>
<td>5</td>
<td>15315.9311</td>
<td>3063.1862</td>
<td>9.11</td>
<td>&lt;0.0001***</td>
</tr>
<tr>
<td>2. Test 2 (T2) summative mark</td>
<td>5</td>
<td>23764.1294</td>
<td>4752.8259</td>
<td>13.05</td>
<td>&lt;0.0001***</td>
</tr>
<tr>
<td>3. Average of practical assignment mark before m-learning</td>
<td>5</td>
<td>41856.6204</td>
<td>8371.3241</td>
<td>12.58</td>
<td>&lt;0.0001***</td>
</tr>
<tr>
<td>4. Average of practical assignment mark after m-learning</td>
<td>5</td>
<td>40268.4554</td>
<td>8053.6911</td>
<td>12.67</td>
<td>&lt;0.0001***</td>
</tr>
<tr>
<td>5. Average of class test mark before m-learning</td>
<td>5</td>
<td>13505.8456</td>
<td>2701.1691</td>
<td>7.49</td>
<td>&lt;0.0001***</td>
</tr>
<tr>
<td>6. Average of class test mark after m-learning</td>
<td>5</td>
<td>14793.5679</td>
<td>2958.7136</td>
<td>8.09</td>
<td>&lt;0.0001***</td>
</tr>
</tbody>
</table>

(*** Statistically significant at level 0.001)

With respect to Year 5 when m-learning was introduced, there is clear evidence that the marks improved after the m-learning experience. More specific, there was an increase in especially formative assessment marks for both Year 5 and Year 6 after m-learning implementation. Stemming from the aforementioned results, it is evident that m-learning had a positive impact on student throughput and success rates. It is however important to note that since this study was an exploratory research, it did not control for other variables that may influence student performance.
Questionnaires

Students from Cycles 1 and 2 were asked to complete pre-questionnaires (that address their current use and perception of mobile technology before being exposed to m-learning), as well as post-questionnaires (that address the usability, use and impact of mobile technology, as well as the experience and attitude of students toward the utilisation of mobile technology) to assess the effectiveness and usefulness of m-learning after being exposed to mobile technology. Findings highlight that the majority of students would like to be able to use mobile technology outside the boundaries of the classroom as a tool to help them with work since nearly 75 percent found it difficult to access university computer laboratories outside class times, and none of them have access to the required software off campus. The findings furthermore, in no particular order, reveal that the use of mobile devices are perceived to: 1) be useful for teaching and learning purposes; 2) have mobility and 3) have social interaction value; 4) have an enjoyment factor; 5) be easy to use; 6) improve student attitudes; 7) have certain access barriers; and 8) the behavioural intention to use mobile devices is perceived to be positive. Most of the students use mobile devices on a daily basis for at least 30 minutes at a time for mainly formal subject-related activities, and indicated that it should be mandatory for students to utilise mobile technology, especially within practical-based subjects. Students find it acceptable to learn practical subjects with mobile device access only and felt more enthusiastic about the use of mobile devices after being exposed to m-learning.

Focus Groups

Focus groups took place during Cycle 2 only, after all the questionnaires have been conducted and were based upon the further exploration of issues that had emerged from questionnaire data. It focused on students’ experience with mobile technologies and how they use and interact with these technologies. Student responses were collected for qualitative analysis similar to research conducted by Boone (1995), i.e. for "Comments", "What did you like?", "What did you dislike?", etc.

Consolidated research findings extrapolated from the data analysis reflect that only 44.95 percent of the Year 5 (Cycle 1) and Year 6 (Cycle 2) m-learning groups own a computer/laptop computer, of which furthermore only 26.0 percent of the Year 6 m-learning group have access to the Internet off-campus. This implies that these students cannot view and download any online course-related material or assignments, nor electronically submit any assignments when they are not on campus. In addition, and more importantly, none (0%) of the Year 5 students, and only 45.7 percent of the Year 6 students had off campus access to the required subject-related software that allows them to practice practical subject skills, as well as complete and submit their assignments. It is however of importance to note that this tremendous hike (due to two students who distributed illegal software copies amongst students within the class) had no significant impact on this research study during the Year 5 to Year 6 research period. Students as a result were therefore dependent on campus computer laboratories whose access is not always practical due to time, distance and location constraints. This fact had a significant impact on especially the practical assignment marks of students.

Most of the focus groups (89%) found it extremely easy and expedient to use mobile technology in a practical-based subject. In contrast with the continuous inaccessibility of overpopulated computer laboratories, groups highlighted the usefulness of mobile devices that could be used anywhere on campus to complete subject-related work. Most of the students used mobile devices on a daily basis or at least a few days a week for more than 30 minutes at a time. Students primarily made use of mobile devices for formal subject-related activities (assignments etc.). Moreover, 63 percent of students expressed that it is acceptable to exclusively use mobile technology in practical-based subjects, primarily as a result of practical computer classes always being occupied during the day and the evening when part-time classes are offered, thus not providing them with adequate time to complete subject-related work. Groups viewed mobile technology as an educational investment and indicated that they would buy a mobile device if it could aid them in their studies, or if it would be a subject requirement. Students found it acceptable to learn with mobile device access only, and would prefer to use a mobile device during tests to assist them with practical work. Regrettably, it is a harsh reality that theft and robbery in most developing countries are severe problems, especially for mobile devices that are carried on a person. Because of the danger of using these mobile devices in public spaces, and even to transport them due to risk of theft/robbery (if its presence is noticed), most students did not utilise mobile technology while commuting. On the contrary, some students, however by far the minority, indicated that they have use mobile technology while travelling (train, bus/university bus, taxi), but that it was dependent on the location, time of the day, and the travelling time.
Observation

Observation of students was conducted by the educator during Cycles 1 and 2 to gather information on student attitudes and how they use and interact with mobile technology. Video material and photos were included as observation examples in order to provide an accurate description of events, as well as to assist in the triangulation of data. Students have shown a substantial amount of enthusiasm when mobile devices were handed out for the first time, and during the course of their studies. Unlike studies that have fell victim to the 'novelty effect' (Kneebone and Brenton 2005), also referred to as the 'generally positive effect', that results from the enthusiasm for using a new device or tool in learning, no attrition was experienced, as students have never appeared to be bored or frustrated (despite several limitations or barriers) when the novelty of using these devices started wearing off over a period of six months. To these students the benefits and use of mobile technology to assist them in practical subjects were clearly outweighing the limitations they faced. Furthermore, students became effective quickly in executing subject-related assignments/tasks, were found to be less bored in class and became more active and engaged during the learning process. Despite the fact that engagement does not necessarily translate in learning more, this research study proves that student marks (especially formative assessment marks) improved dramatically since the implementation of m-learning. Mobile devices are mainly used to accomplish subject-related tasks such as going online (74.7%), completing and submitting assignments (67.1%), accessing institutional web pages (64.6%), accessing social networking sites to communicate with peers (59.5%), viewing and downloading course material and assignments (59.5%), as well as taking notes in class (53.2%). This is mainly attributed to the structure of classes, which are based around students utilising mobile devices to aid their classroom-based teaching and learning practices in formal educational settings. It is of interest to note that despite the smaller screen size and on-screen input of tablets and smartphones (when compared to computers), 35% of the students unexpectedly opted to make use of mobile devices even if they had access to a personal computer in a practical class. Unexpectedly, some students have even gone so far to have never used a computer again since they received the mobile devices. Mobile devices are also used for other teaching and learning purposes such as taking photos (instead of taking notes) of work covered on the whiteboard, recording lectures, downloading and listening to podcasts and vodcasts, assessing library services and communicating with the educator.

Students in general assisted each other when struggling with subject-related aspects, and indicated that they predominantly do not use their mobile devices to communicate with peers and educators outside the classroom (i.e. MIM, e-mail), but rather prefer face-to-face discussions on subject-related issues. Regardless of the vast possibilities that mobile devices bring to an educational environment, it comes as no surprise that some students still prefer to use conventional mechanisms (i.e. desktop computers, class hand-outs/subject material, paper-based notes) to accomplish their learning activities in formal learning settings. On the contrary, it is also true that some students prefer to use mobile technology to do subject-related work as opposed to using computers and taking notes, which proved to be mostly the case in this research study.

Synchronous and Asynchronous Communication

During reflection in Cycle 1, it was decided to introduce synchronous and asynchronous communication during Cycle 2 to further enhance the learning experience of students. The communication entailed records of comments and thoughts generated by learners by means of MIM (WhatsApp) and e-mail. WhatsApp, a synchronous communication tool where text messages can be sent and delivered instantaneously between users, provided learners the opportunity to interact and collaborate with their peers regarding subject-related issues, and to access professional educator support 7 days a week/24 hours a day (24/7) in an affordable manner. Students were initially excited and keen about the idea of using MIM, however it was found that only a few (30.4%) made use of this unique opportunity. Students used this service mainly to: 1) Ask subject content-related questions before formative and summative tests; 2) ask for assistance with assignments/tasks; 3) be assisted with subject administrative queries; and 4) resolve technical difficulties experienced with mobile devices. MIM were received and answered any time during the day and night, with the earliest being at 05:59 am and the latest at 00:59 am. From an educator perspective, MIM proved to be quite a challenge to use when answering student queries, since it is a relatively time-consuming process to answer queries using the different input mechanisms of a smartphone.
Academic Student Journals

Academic student journals were kept by students during Cycle 2 to reflect on their m-learning experience, activities and thoughts during mobile technology utilisation. Student journals addressed issues relating to the when, where, for how long, for which event/activity, and by whom the mobile technology was used. In addition, it also provided students with the opportunity to comment on any high or low aspects experienced during mobile technology utilisation. Journal entries were reviewed and assisted in identifying common trends in mobile technology utilisation amongst students, isolating areas where problems regularly occur, and identifying where more work needed to be done or where real strengths have been developed and some obstacles have been overcome. During reflection in the second cycle, the aforementioned assisted the educator in identifying the typical potential usage patterns for m-learning learners, and in setting new goals for future research projects and developments. Most students used mobile technology in the mornings and the afternoons for 10 minutes to an hour per session for formal subject-related activities.

Benefits and Barriers Identified with Regard to M-learning in a Practical-based Subject

Since the introduction of m-learning in a practical-based subject, all students, for the first time, could do subject-related work anywhere, and at any time without the necessity of a computer or being on campus. In addition, student marks improved statistically significant after the implementation of m-learning. Students had 24/7 access to learning material and their educator – something that was not previously possible. From a classroom perspective, students have rarely subverted formal education by engaging in activities that are not related to the lecture. This proves that mobile devices can effectively be used to facilitate learning in formal and informal educational settings, without necessarily distracting the teaching and learning process.

Students expressed and were confronted by several barriers that kept them from enjoying a true m-learning experience. During Cycle 1, students were only allowed to utilise mobile devices exclusively on campus. Several Wi-Fi related issues were also experienced, which included extremely weak or no Wi-Fi signals on campus and at university residences. These issues had a severe and critical impact on students’ ability to access the Internet, and most importantly subject-related work via mobile devices. A major concern throughout the duration of the m-learning initiative was the constant anticipation for lost or stolen devices. This was the main and exclusive reason for not allowing students to use mobile devices off campus during Cycle 1. This proved to be successful as all the students returned their devices in working order. On the other hand, during Cycle 2, where the m-learning group was allowed to utilize mobile devices off campus, four devices were either lost, stolen or never returned. Furthermore, students could not directly print any subject-related material from their devices, as there were no Wi-Fi enabled printers available on campus. Students were therefore once again forced to use the old fashioned method of connecting the mobile device with an Internet-enabled computer (via cables) in order to print – clearly defeating the objective of providing students with a true m-learning experience.

5 Conclusion

This research study is concerned with exploring whether m-learning can serve as a learning tool to bridge existing learning gaps to facilitate practical-based subjects in developing countries. This research sought to identify by means of a mixed-method approach, the effectiveness and usefulness of m-learning, as well as the benefit and barriers related to m-learning in a practical-based subject. Providing students with access to remote resources while on the move, has increased their capability to physically shift/transfer their own learning environment as they move, thus enabling them the opportunity of taking the learning experience outside the boundaries of the classroom and institution.

Key findings indicate that mobile devices can be utilised as an acceptable additional technology in practical-based subjects, and that it can assist in bridging existing learning gaps by extending the availability of educators outside the boundaries of the classroom, addressing student requirements for mobility, flexibility and ubiquity, increase student enthusiasm and motivation to work and learn, and improve student throughput and success rates. However, despite the vast number of advantages that mobile technology brings to practical-based teaching and learning, it is important to recognise that mobile devices still cannot entirely replace traditional methods of instruction and assessment, and thus should be combined with face-to-face education in developing countries. Conversely, it is important to ensure that mobile technology is used in a pragmatic way by focusing on the advantages of mobile devices, rather than to endeavour and replicate the functionali-
ty of a computer, allowing traditional instruction and the utilisation of mobile technology to complement each other. The research results of this study contribute to the knowledge base of m-learning in practical-based subjects, especially in a developing country. The author of this paper suggests that further research is conducted on providing a better understanding as to how m-learning in practical-based subjects, work in great detail. By doing so, HE institutions and educators, among others, may glean more insight into how m-learning can be effectively implemented to provide sustainable, affordable and reliable teaching and learning to the academic environment.

6 References


Learning beyond Classroom Walls: A Case Study on Engaging Learners with Mobile Devices in Dance and Drama

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Abstract. The prevalence of technology use in both primary, secondary and tertiary education is evident across many disciplines. Big Data, MOOC (Massive Open Online Course), learning management systems (LMS), e-Learning and mobile-learning are buzz words in educational settings and they are the focus of conferences and frequently mentioned at department meetings. However, for the vast majority of Dance and Drama educators whose primary teaching method relies on lecture and demonstration, technology integration seems to be not as relevant. It is indisputable that the value of lectures and demonstration in dancing and acting by experts is important. Nonetheless, solely relying on these teaching models may produce limited learning outcomes and even disengagement, especially for General Education (GE) students, who come with various backgrounds, fields, learning styles, and capabilities. This ethnographic research surveys over 145 students in Dance and Drama GE classes at a comprehensive Asian university. It explores recent studies on technology integration in Dance and Drama education and it also looks at the effectiveness of using technology, especially mobile devices and the role they play in teaching and learning. Findings show that despite initial difficulties, both students and instructors benefit from technology integration. Concerns, challenges, problem-solving strategies, and outcomes in integrating technology in teaching and learning are also discussed.

Key words: Dance and Drama, mobile devices, learning engagement

1 Background

Dance and Drama are traditionally taught with top-down models and student learning is more or less limited to within the classroom or studio. This model is widely applied in performing arts institutions, e.g., performing arts academies and theater schools. In comprehensive universities where Dance and Drama are offered as General Education (GE) or under Elective Course (EC) category, traditional models are neither effective nor appealing because (a) students come with various level of backgrounds, (b) top-down or sage-on-the-stage model may produce limited learning outcomes and even disengagement (Adler, 2016), and (c) it may further alienate students from the subject area (Holdt, 2013).

Though computer technology has been used in education for almost fifty years (Bakir 2016), the number of teachers and students using technology in classrooms has increased dramatically in recent years (Purcell et al. 2013). Nonetheless, when it comes to the use of technology in performing arts programs (Dance and Drama), it has rarely been systematically studied, documented, and reported. Some researchers claim that Dance is one of the last subjects to embrace technology applications (Calvert et al. 2005). The impression of an educator modeling in a dance/drama class appears to be irreplaceable. However, the advancement of technology has taken significant leaps in the past decade. Devices used for e-learning have moved from desktop computers, to laptop computers, to tablets, to today’s smartphones, which are ubiquitous among university students. For better teaching outcomes and learning engagement, technology integration provides a strengthened approach for teaching Dance and Drama (Doughty et al. 2008; Anderson & Dunn, 2016).

Young people today are familiar with mobile devices and many of them rely heavily on smartphones to communicate, complete assignments, watch podcasts, pay bills, and more. This is hardly a surprise as Roschelle and Pea (2002) predicted more than a decade ago that “handheld computers will become an increasingly compelling choice of technology for K-12 classrooms because they will enable a transition from occasional, supplemental use to frequent, integral use” (p. 2). Campbell (2006) stated, “young people tend to have very positive perceptions of mobile phones and regard the technology as an important tool for social
connection‖ (p. 290). The prevalent use of smartphones creates both opportunities and challenges for educators and students. Kuznekoff and Titsworth (2013) found that students who were not using cell phones during lecture time achieved better grades and learning outcomes than those actively using mobile devices in class. It is an uphill battle for any educator to compete with mobile devices, with which learners could “text, play games, check Facebook, tweet, or engage in other activities available to them in a rapidly evolving digital terrain” (p. 233). However, these “distractive” devices can be harnessed to facilitate student engagement and learning both within and beyond the classroom walls.

Sööt and Viskus (2014) wrote “the availability of dance through classroom media can improve the teaching of dance as well as bring excitement to the classroom to a younger generation hooked on technology” (p. 296). Similar statements are echoed among Drama educators in reference to technology, mainly the use of iPad in drama teaching as an effective tool in building student-centered learning as well as for collaboration and innovation among staff (Geer et al. 2016). Dance in the media could serve dance education by acting as a conduit or connection between the known (popular culture) and the unknown (dance as art) (Benson, 2016). Yet, researchers pointed out that “technologies have not been incorporated in the classroom [Dance and Drama studio] everyday learning practice, although contemporary technological media are substantially advanced and innovative” (Dania et al. 2011, 3359). Five years has passed since that study and with the fast advancement of technology, much has changed in education. This paper looks at the effectiveness of using technology, especially how mobile devices work and the role they play in teaching and learning Dance and Drama. It also shares challenges, problem-solving strategies, student sample works, and insights from educators as well as students.

2 Methodology

This ethnographic research included classroom observations, surveys, semi-structured interviews on focus groups and student artifacts. It looked at three General Education classes (one Dance and two Drama) classes (total of 145 students) over the course of one semester (January to early May) in a comprehensive university in Southern China. Anecdotal notes were taken by the researcher and a video documentary was completed by a research assistant.

The purpose of the study was announced at the beginning of the semester in each class. The researcher stressed that participation was entirely voluntary and anonymous. Students were informed that whoever chose to not participate in this study would not be penalized and that his/her mark would not be affected. All 145 students agreed to participate and they completed an online survey (Qualtrics) at the end of the course in late April. Among all students, ten participants were randomly selected (through a lottery system) to form a focus group for a semi-structured interview. Classroom observations were conducted throughout the semester. Anecdotal notes, photos, and short videos were taken for documentation and data analysis. Observations included looking at how students responded to in-class lectures, presentations, group discussions, peer-evaluation, and collaborative activities. Student artifacts including written assignments and short-films are also discussed in this study.

3 Outcomes

The survey showed that the majority of students taking Dance and Drama classes were females (102 females and 43 males). Students were from a variety of disciplines and interests: Faculty of Business Administration (48%) Faculty of Social Sciences (19%) and Faculty of Education (17%) amongst other faculties. English was the teaching language but there were three languages being spoken among students, English, Mandarin, and Cantonese. Approximately 130 students (90%) indicated that they had no previous dance/drama training background. It also revealed that students owned multiple mobile devices and they were familiar with the latest technology trends. These findings were in accord with previous studies (Roschelle & Pea 2002; Campbell, 2006). The percentage of mobile device ownership at the university where this study took place is extremely high. According to a recent survey of more than one thousand university students on this campus, over seventy-five per cent had 2.8 mobile devices each (Benson, 2015). That translated to an average of two to four mobile devices per student on campus. This survey found a matching result to Benson’s statistic (see Figure 1 below).
When students were asked what was the most memorable thing after completing this course, they rated group work with others (39%) as No. 1, followed by dance and drama activities (39%), then the visual material used by students and professor (13%). Technology integration and lecture were among the least memorable items (3%). However, it did not mean that students did not value technology in learning. In a separate question, the researcher asked “How important is the use of technology, particularly mobile devices in your learning?” More than half of the participants (94 students or 65%) considered technology important to very important (see figure 2 below).

Although mobile device ownership was high, it does not mean that they were meaningfully used. Many dance and drama students expressed that they did not like how technology was used in teaching and learning in this university and beyond (other institutions as some students were transfer or exchange students). Their responses echoed Dania’s claim that technology use in classrooms has lagged behind the advancement of technology (Dania et al. 2011, 3359). Of 145 students, 95 or 66% rated Power Point Files (PPT) as the least liked yet commonly used by professors in all classes. “It’s so boring and I cannot follow the PPT because fonts are so small and it gets wordy,” one student commented in the interview. The survey acknowledged the fact that increasing numbers of professors used online tools in teaching, including surveys (24%) and quizzes (4%). Still, seven students (5%) indicated that a few professors never used any form of technology in teach-
ing. “I felt like walking into an isolated world where he [professor] reads/talks about his subject while the majority of students are on something else. I usually have my dinner and chat with my friends online to kill time during the lecture,” that student said.

Towards the end of the course and in four weeks period, all dance and drama students were required to complete a short-film project in which they had to work in groups (5 to 8) to design, write script, act (drama)/move (dance), polish, record, edit, and upload the final video to YouTube. Students claimed that they completed the majority parts of the project by mobile devices. Students used Google Doc for project design and script co-writing; WeChat (Skype alternative) for viewing and discussing work-in-progress; various mobile apps to record and edit final videos before unloading to YouTube. Students spent numerous hours, in addition to lectures and in-class activities on this culminating task. The course director, on the other hand, utilized various technological means (Moodle, iClass, Zoom, office Mix, etc.) in his meddler-in-the-middle approach (Mcwilliam, 2008), and flipped classroom (Anderson et al. 2001; Tucker 2012) model. It’s worth noting that many activities during the last month of the course were involved with technology, mainly mobile devices such as smartphones and tablets. Students formed project groups and they communicated via social media sites (QQ, Facebook, WeChat). During this period, one class occurred in “virtual reality” form, in which the lecturer stayed in the classroom alone viewing students who worked at different locations on and off campus. The lecturer provided feedback in front of the computer screen via Zoom, a video and audio program supported bilateral communication. On the other end, students in groups presented their progress report through Zoom on mobile devices. Traditional in-class lectures still existed but the main content was delivered prior to the class time via Office Mix, a multimedia platform that consists of short lectures, videos, reading materials, quizzes. All these files were then compressed and adjusted for small screen – mobile device viewing. During the lecture time, discussions, sharing, debates, and Q & A sessions took center stage rather than a solo preacher. Then the lecturer was able to focus on weak students/groups, raised deeper and more challenging questions on advanced students, and visited worksites at various locations to monitor students’ working process in person.

This mobile technology infused approach made positive impacts on the students, especially those with little or no dance background in dance and drama. It matched Doughty and Anderson’s claim that the use of technology enriched Dance and Drama education (Doughty et al. 2008 and Anderson & Dunn, 2016). One student stated, “I wasn’t sure about taking the course [dance] at the beginning. I would have dropped the course if it were a skill-based course.” “The tech stuff made this course quite engaging and fun. I have learned so much more than just acting,” another student added. However, this study also found many challenges that students encountered in adapting to technology friendly classrooms.

The survey revealed that students considered how to use technology and make it work in learning the most challenging task, a finding shared by researchers many years ago (Calvert et al. 2005). It was different in this case as students actually learned from each other on “How to issues” instead of waiting for the lecturer to guide. For instance, on their short-film project, students divided responsibilities in terms of expertise and interests and each was responsible for a specific task. They were able to maintain their focus and they were aware of each other’s progress because the whole project was interdependent. One first year business student stated “my friend showed me how to use Google Doc. to co-author script and that’s quite interesting. We worked together on the same document from different places simultaneously.” Such student centered approach nurtured collaboration (Geer et al. 2016) and engagement (Sööt & Viskus 2014).

Still, challenges persisted. One student commented, “I don’t know how to use editing program and it’s much harder than I expected.” Few students suggested in the interview that a session or even an instruction lecture on how to use mobile device to shoot, edit, and finalize film would be ideal. Another challenge was time management. The survey showed that more than 60 per cent of students spent between 5 to 20 hours to finish their final film, which was between three to nine minutes in length. Another 35 per cent of students used more than 20 hours to complete the work. Many students expressed that “there were too much to do in too little time.” An interview with focus group members discovered that many of them would like the final project to be released earlier or at least be announced and clearly explained at the beginning of the term. “I did not know it’d take so much of my time,” one student said.

Facing various challenges, students’ approval rate of using technology in Dance and Drama classes was surprisingly high. They seemed to agree on the fact that integration technology in Dance and Drama classes was beneficial. When asked, how much technology should be used in future Dance/Drama classes, 91 students (64%) chose the same amount of technology; 21 students (15%) suggested the technology integration
be expanded; 22 students (15%) wanted the integration to be simplified and only nine students (6%) wanted the technology component to be eliminated.

4 Conclusion

This study suggests that the use of technology in Dance and Drama GE classes can positively impact teaching and learning. The use of mobile devices helps students and educator research, communicate, reflect, and create effectively and efficiently. However, challenges on how to use mobile devices to enhance learning and time management remained. Perhaps that pre-lecture should include an introduction to basic functions of mobile devices. Alternatively, learning groups could be set up to facilitate their exchanging ideas and ways of manipulating mobile devices. Educators in other subject areas may apply similar pedagogical approach (pre-lecture on Mix, Zoom, Google Doc, etc.) to make teaching and learning a great memorable experience. The limitation of the study on gender and duration actually points to the potential areas of research in this emerging field. Yet, there are promising signs that mobile devices will lead to a pedagogical shift supporting enhanced teaching and learning in nearly all subjects, locations, participants.

5 References


Abstract. This paper investigates the efficacy of gamifying educational resources to increase student engagement, with a view to improve the learning outcomes, as seen through the lens of three teaching academic. Firstly, this paper will briefly discuss some industry concerns about the benefits that gamification has in educational settings, followed by the solutions that the Media Design and Development team at the University of Southern Queensland (USQ) offer for developing mobile friendly resources. Lastly, three case studies of gamification will be reviewed with reference to a series of semi-structured interviews involving the lecturers who drove the development of these gamified resources. Although further detailed feedback is required from students, the conclusion will be proffered that, from the teacher’s perspective, gamification improves the likelihood of success by enhancing student interest and engagement, which intrinsically improves outcomes.

Keywords: multimedia, gamification, mobile delivery, user interface, user experience, mobile first, interactive, digital, engagement, understanding, cognition.

1 Introduction

Gamification, “the process of adding games or game-like elements to something (as a task) so as to encourage participation” (Merriam-Webster 2015) is an ever growing field of development utilised in an increasing variety of applications, particularly in educational settings (Losup & Epema, 2014)). This paper will demonstrate, through the lens of three academics (content experts), how the development of resources, have been underpinned by a methodology for using gamification to motivate and engage students with a view to improving knowledge retention (de Santana. et.el. 2016, p.915).

2 Gamification in Learning

Taito’s Space Invaders introduced the world to digital gamification, and although the term ‘gamification’ wasn’t officially defined until 2002 (Marczewski, 2013), the concept has continued to increase in popularity. Although promising when used with an appropriate level of scaffolding, Marquis (2012) raises a number of concerns when placing too much reliance on this method in education. Issues such as a lack of knowledge about technological integration and working with resources that may not have appropriate content for the curriculum all need careful consideration. Clarke & Feldon (2014) also state that “multimedia courses may be more attractive to students and so they tend to choose them when offered options [yet]…student interest does not result in more learning” (p.154). This inherently implies that multimedia used in courses i.e. including gamified resources, is worse in terms of education than courses without multimedia.

While these are valid counterpoints, experience has shown some interesting practical trends when developing gamified resources to augment key concepts within courses.

Gamified resources can allow greater access to knowledge in various formats to accommodate different learning styles (Grünewald, Meinel, Totschnig, & Willems, 2013). They can be more attractive to students and that attraction should be harnessed to encourage user engagement. Or, as one lecturer at our university put it, “Traditional methods such as pad and paper, lists etc. haven’t tended to engage the students to the level they’re engaged now. Students seem to be more interested, they’re finding it more relevant to them and…unless it’s relevant to them – they’re not going to engage.” (USQ, 2016a)
The three case studies featured in this article are all self-paced learning activities developed by the Media Services team at the University of Southern Queensland (USQ). They were all designed to augment the main content being addressed within a course. In other words they are smaller contextualised activities, designed not to overwhelm or detract students from the core information, but clearly focus on specific learning outcomes within a course. As highlighted by one content expert, together “we can make what can be seen as quite dry content at times, more interesting.” (USQ, 2016a). This paper will briefly describe the resources that were developed, the rationale behind why gamification was pursued and any outcomes that have been recorded to date.

In these cases, technological integration concerns include designing and programming for the technology readily available to students, as well as considering whether students have limitations to online access. Knowing how to work with mobile-first responsive design is integral, as is knowing where to host the resources and implementing database creation. As one lecturer stated, “It’s very easy to make practical sessions boring” (USQ, 2016c). So while using the skills of in-house experts to gamify their content, lecturers can concentrate on developing sound pedagogical foundations upon which to base their games which are more often than not, used to enhance traditionally static concepts.

Case Study 1: Employability Memory Game

![Employability Memory Game Desktop and Mobile User Interface](image)

Figure 1. Employability Memory Game Desktop and Mobile User Interface

The employability memory game is similar in nature to the traditional memory game, the user must match up the pairs using the content on the cards. They are encouraged by a time counter to complete the activity quickly and challenge themselves to beat their record. As described by the content expert, this interactive game replaces printed cards designed to provide low socio-economic students and early school leavers with a “literacy of career to better prepare them for interview situations to promote their skills in an appropriate language” (USQ, 2016c). The game is designed to be platform neutral to make it easier to access from any device; an important consideration when designing for a low socio-economic cohort (McKenzie, et.al., 2014).

Rationale

The original paper-based game was a well-used resource with the major shortcoming of portability. This limited use outdoors and while travelling, meant that the information wasn’t disseminated terribly effectively. Now digitally gamified, this resource allows for far greater portability and dissemination throughout
schools, to parents, and universities. This resource was designed with simplicity in mind, to appeal to the target demographic. By designing the card-pairs to be matched by their content, students are encouraged to engage with the content more effectively.

**Outcomes**  
The content expert reports that the target demographics for this resource have responded extremely well with students liking it as well as educators with some schools integrating the resource into their year 10 set plans. Parents are also finding it very useful in increasing their knowledge and understanding of how to talk to their children about careers (USQ, 2016c).

**Case Study 2 UV&U**

![Figure 2. UV&U Desktop and Mobile User Interface](image)

Originally designed by the content experts specifically to engage primary school-aged students, the UV&U game (Figure 2) is also beneficial to a far wider age bracket. It is designed to encourage self-paced learning about the effects UV radiation has on the body. The user is instructed to create an avatar from an extensive range of interchangeable options. These are not restricted to representing the user’s own attributes in order to encourage a deeper understanding of the effects of UV radiation on a broad spectrum of people.

**Rationale**

This approach encourages engagement beyond what would traditionally have been a text-based or auditory resource. Historically television, newspaper and radio advertising is how the populace has been informed of the UV index. These delivery methods lack the more detailed and customized information such as why different people are affected differently. Multimedia is the missing link to get the idea across in a different, very powerful medium. Especially for young people, this [gamification] is worth trying. (USQ, 2016b) By encouraging personalized engagement with this gamified resource, students are able to increase their knowledge about how UV radiation affects them and those around them.

**Outcomes**

One of the content experts describes, the students as being better engaged with the content through this alternative mechanism as they increasingly feel more and more comfortable using multimedia to learn “I think it can help to break down those barriers in the beginning…if you’re getting an alternative offering to understand something, it might be that one thing that helps get them past that confusing little step that they don’t understand.” (USQ, 2016b)
Case Study 3: Endocrinology Game

Designed for university students studying the endocrine system in a biomedical science course. This resource (Figure 4) uses a scoring system to motivate students to actively engage with the resource. By naming the 52 parts of the skin model and their 52 locations correctly, students earn points that are displayed on a leaderboard if they are within the top fifty of participants. Feedback is instantaneous and progress is saved for each student for portability and ease of access for learning at any time. In developing this tool the content expert believed that they were helping their students to engage at a deeper level, as “it’s very easy to give the students a diagram…and say “label this”. So they take a textbook or some sort of resource and just copy it out. And that means that they haven’t understood, they’re just doing the exercise without engaging with it.” (USQ, 2016c).

Figure 3. Endocrinology Game Desktop and Mobile User Interface

Rationale

Increasing student engagement is the biggest reason why gamification was pursued for this resource, or as the content expert said, “if it’s fun, the students will engage with it” (USQ, 2016c). As mentioned above, complex concepts can benefit greatly from being gamified. It allows more active engagement and the ability to segment information - “students learn more deeply when an information-rich multimedia lesson is presented in learner-paced segments rather than as a continuous unit” (Mayer, 2014, p. 326-328). Tests conducted over several years by various teams have proven that this principle consistently yields improved performance compared to non-segmented group trials (Mayer, 2014). Based on a physical model of the skin, this
resource offers students a more portable and engaging activity than a paper-based version. It is also “gamifying quite a complex structure…hopefully to encourage students to use it and to remember some of the more intricate aspects of the skin.” (USQ, 2016c)

**Outcomes**

Further monitoring of student use will continue for this newly released activity, however, initial tracking data reveals an impressive cohort of students who are achieving high scores within the game. Scores are gained through correct answers being selected: 20 points for a correct answer on the first attempt, 10 points for a second attempt and 0 points for a third - which then reveals the answer to the student. A total score of 2080 is achievable if all answers are completed correctly on the first attempt for 20 points each. At the time of writing, the top 20 scores were all over 200 points with the highest score at 680. A mean score of 360 for the top 20 scores indicates that students are completing at least ¼ of the entire activity before ceasing use. The higher the score is, means that more correct answers were achieved and more time was spent engaging with the activity.

3 Discussion

Stemming from the interviews (linked in the Reference section) conducted with USQ lecturers in relation to the gamified resources they helped develop, it can be seen that there is a strong perception of ‘improvement’ in regards to extended support provided by these resources. It is noted by the content experts that Student engagement had increased, due to the transformation of the traditional text-based resources to a more portable and customizable environment. The most accurate representation of success lies with the students’ continued engagement with the resources. While encouraging feedback and analytics have been received for each case study continued monitoring will occur over subsequent semesters to measure their success, the finding of which will be published with the video interviews. It is also anticipated that the content experts themselves will seek extended student feedback in relation to these resources. However, the purpose of this paper was to see the efficacy of gamification through the eyes of the content experts.

4 Conclusion

Gamification is not always viewed in a positive light, and sometimes integrates poorly and without defined benefits (Crane, 2011). However, gamification in an educational setting offers plentiful benefits – mainly in increasing student engagement which is of paramount importance to lecturers. The three case studies used in this paper were created to aid with engagement and cognition, “you would want to use every opportunity to engage with your learners.... Everyone learns in a slightly different way, so being able to broach things in a slightly different way can help people get past those barriers that reading or listening doesn’t help. ‘Doing’…sometimes helps.” (USQ, 2016b). While Marquis (2012) raised some valid points, when properly addressed, these concerns need not affect educational gamification in a negative way, they can instead be used to bolster the foundations for making successful games that encourage learning.

5 References


A Theory-ology of Mobile Learning: Operationalizing Learning Theories with Mobile Activities

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Abstract. Theory is often neglected when planning and analysing mobile learning projects, beyond perhaps a brief but unexamined list of learning theories in the introductions to articles. Theory is, however, important since it underpins the expectations of meaningful learning outcomes that any given mobile learning activity should have. Attention has been paid in the past to theoretical frameworks that might usefully be applied to mobile learning. Underpinning these frameworks are a specific set of learning theories, but such is the variety of mobile learning that no single theory, or set of theories, should be assumed to be fully embodied in any single activity. The aim of this paper is to identify, from the literature, the key underpinning theories of mobile learning, then to examine how these might be called into play in varying combinations, depending on the nature and intent of specific types of mobile learning. The identification of these theories is grounded in their links to mobile affordances. An approach to analysis is suggested that could prove a useful tool in designing and evaluating mobile learning activities with due consideration of their embodied learning theories. This approach is briefly explained through two contrasting examples.

Keywords: mobile learning, learning theory, affordance, framework

1 Introduction: Theories of Learning

A learning theory can be described as a conceptual framework used to understand and frame how information is absorbed, processed, and retained during learning (Luis & D'Cunha, 2014). Considering how theory underpins learning activities is important to ensure appropriate pedagogical practice. This is especially important when adopting emerging technologies, such as mobile technology, to ensure that the learning, not the tool, is the driver of the activity. Since mobile learning is relatively new, there has been considerable debate about whether it is significantly different from current learning to warrant its own unique theory, or whether it is simply underpinned by a range of existing theories. Harasim (2012) notes the historical context of 20th century learning theories and questions whether new contexts and technologies require new learning theories. However, she also notes the intrinsic link between theory and teaching practice even if this is implicit, thus theory, old or new, is what we operationalise in our pedagogy. The assertion of this article is that consciously mapping appropriate learning theories to a given activity can help educators to understand and apply appropriate mobile learning and teaching practices.

Learning theory addresses a range of factors, including, from a behavioral perspective; how such changes become relatively permanent, whether the change is immediate, or potential, what role experience plays and what aspects of reinforcement are present (Olsen and Hergenhahn, 2013). There are many learning theories, most of which have been developed over the last century or so. There are also many categorizations that may be applied to these theories, but we might make a distinction between those that look at intrinsic factors, such as the cognitive processing that goes on inside the brain, and those that look at extrinsic factors, such as context, social interaction and (increasingly digital) learning tools. Some theories are grounded in experimental methods, such as classical and instrumental conditioning, while others are less rigorously validated and open to more interpretation (e.g. connectivism.) Some of these fields are so broad as to require considerable explanation in each case to define which specific approach is being taken (e.g. constructivism).

Early learning theories tended to focus on aspects of behavioural conditioning, such as Pavlov’s classical conditioning, where stimulus leads to response, and Skinner’s instrumental conditioning, where behaviour leads to reinforcement (Olsen and Hergenhahn, 2013). Whilst such approaches might seem somewhat mech-
anistic, the concepts of rapid feedback embodied within them are important concepts in helping learners to work at their own pace. The idea of reinforcement having a benign, positive impact was underlined by Thorndike, who emphasised positive reinforcement over negative punishment (Olsen and Hergenhahn, 2013.)

Not all of the early learning theorists were experimental behaviorists. Dewey (1933) stressed the value of outdoor education and hands-on, experiential learning, while Vygotsky (1978) emphasized the social role of learning, with the help of ‘more knowledgeable others’ (which might these days include digital sources) in the Zone of Proximal Development. Other theorists also looked at the learner’s environment, for example Piaget (1955), who believed that educational environments should provide the opportunity for discovery learning. More recently, Brown, Collins and Duguid (1989) asserted that learning is embedded in the activity, context and culture in which it is learned. The importance of learning with others is central to the Community of Practice (Wenger, 2000) which similarly emphasizes context and culture but also regards the authentic domain of the learning community as important. These aspects are to some extent brought together in distributed cognition, where situations, tools and communities distribute knowledge (Hutchins, 1995).

While most learning theories are grounded in 20th century thinking, in the 21st century we have seen the rise of new theories such as constructivism (Siemens, 2004), which has been proposed as ‘a learning theory for the digital age.’ The concept of constructivism is based on the idea that internet technologies have created new opportunities for people to learn and share information across networks. As one example of this, Siemens has engaged with the MOOC movement (McAuley, Stewart, Siemens & Cormier, 2010).

While all of the theories above apply to learning in general, in this article we ask in what ways they apply to mobile learning. Further, we consider whether there are any theories that have particular applicability to understanding how mobile learning works in practice. In the following sections we begin to explore these questions.

**Frameworks and Theories of Mobile Learning**

In addressing whether we need a new theory of learning for the mobile age, Sharples, Taylor and Vavoula (2010, p4) identified five clear criteria that should underpin mobile learning theory and differentiate it from other existing learning theories:

- is it significantly different from current theories of classroom, workplace or lifelong learning?
- does it account for the mobility of learners?
- does it cover both formal and informal learning?
- does it theorise learning as a constructive and social process?
- does it analyse learning as a personal and situated activity mediated by technology?

This is a broad set of criteria and it is a matter of debate to what extent they have been met by the proposals of researchers, though some theoretical frameworks specific to mobile learning have been outlined. These have included Sharples, Taylor and Vavoula’s (2006) framework for analysing mobile learning, Laurillard’s (2007, 2013) Conversational Model, Koole’s (2009) Framework for the Rational Analysis of Mobile Education (FRAME) and Kearney, Schuck, Burden and Aubusson’s (2012) mobile pedagogical framework. However, these frameworks are not learning theories per se. Rather, they are ways to evaluate and frame mobile learning activities within the ubiquitous landscape of mobile learning.

Underpinning all of these frameworks are a range of pre-existing learning theories. This multiplicity of underlying theory is highlighted by Laurillard (2009), who identifies the learning process as having elements of ‘instructionism’ (i.e. behaviourism), constructionism, social constructivism and collaborative learning (or ‘social constructionism’). However, the focus and context of a learning activity will lead to different levels of each element as each one is appropriately applied. It can thus be questioned if one theory or framework can truly capture the dynamic and varied nature of mobile learning. Mobile technologies lend themselves to certain activities, and they might be only one element of a larger learning experience; mobile activities are often integrated as part of blended learning contexts, including face to face classroom interactions. Therefore, it is important to clearly understand the learning activity and the proposed outcomes. Herrington and Herrington (2007) highlight that guidelines for learning with mobile technologies should be theory-informed. Clearly understanding what learning theories underpin a learning activity will help inform and ensure effective pedagogy.
Theory-ology and Affordances

One reason that a plethora of theories have been applied to mobile learning may be that mobile learning activities themselves vary considerably. In the same sense that a methodology is a collection of interacting methods, there may be a theory-ology of theories that interact in mobile learning. Which of these apply most directly to mobile learning may, perhaps, be analysed through the lens of affordances. Gibson (as cited in Bruce, Green & Georgeson, 2003) developed the theory of affordances, which says that the affordances of the environment are potential actions and interactions that the environment offers. Parsons, Thomas and Wishart (2016) identified six specific affordances from the mobile learning literature. Table 1 outlines these identified affordances and matches these to the learning theories most commonly associated with mobile learning. As indicated, there are a number of learning theories that are especially underpinned or enhanced by related affordances. We have used this link between theory and affordance to focus down from the very large number of available learning theories to a small subset that we believe provides the core theory-ology of mobile learning. These learning theories have been placed in approximate chronological order of their emergence. In Table 1 we have attempted to define the essence of these learning theories, though it is acknowledged that these summaries are, of necessity, simplifications. We use this subset of theories, comprising behaviorism, constructivism, experiential learning, situated cognition, community of practice and connectivism, in the remainder of this article. It should be noted that the examples of mobile activities are intended to be indicative rather than comprehensive, and linked with those theories that they most closely operationalise, though they may also be applied to others.

2 Mapping Learning Theories to Mobile Activities

When designing a mobile learning activity, it is important to understand how learning theory underpins the learning design. An appropriate and considered pedagogical approach will help ensure that learning is the primary and main concern and that the technology is not used for technology's sake. Multiple learning approaches may be adopted within one extended activity, so it is important to conceptually frame the learning within the targeted learning outcomes that one would expect from operationalising one or more learning theories.

The following discussion focusses on the six theories from Table 1; behaviorism, constructivism, experiential learning, situated cognition, communities of practice and connectivism. As a way of gaining deeper insights into how these theories have been applied in mobile learning, we evaluate to what extent different mobile learning experiences have exercised these theories in their designs by applying a rubric. This rubric was underpinned by the criteria identified in the Appendix. These criteria were identified from the literature as principles which frame learning design within the six chosen learning theories. For example, this scale was used to evaluate behaviourism:

1: The mobile activity does not use stimulus and response, involves no measurable outcomes, sequenced materials, feedback or reinforcement.

5: The mobile activity is wholly designed around stimulus and response, measurable outcomes, sequenced materials, feedback and reinforcement.

These results were collated into radar charts for a number of different examples. We found this exercise to be a very useful way of identifying which types of mobile learning activity operationalised which group of learning theories. To illustrate this process, we have included two contrasting examples in the following sections; the well-known Ambient Wood project (Rogers et al, 2002) and the mobile language app Busuu (www.busuu.com). These examples highlight two very different mobile learning activities, and we examine how learning theories have been incorporated (whether explicitly or implicitly) into each of these activities. It should be noted that this analysis was undertaken by the authors using subjective assessment of each example against our rubric-style criteria and was thus performed through an interpretive lens rather than with empirical measures. In the following discussion, the criteria referred to are taken from Table 2 in the Appendix.
Table 1. Learning theories and the mobile learning affordances which they underpin (adapted from Parsons, Thomas & Wishart, 2016).

<table>
<thead>
<tr>
<th>Learning Theories</th>
<th>Examples of Mobile Activities (examples)</th>
<th>Mobile Affordances</th>
<th>Context of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviourism</td>
<td>“The ideal of behaviorism is to eliminate coercion: to apply controls by changing the environment in such a way as to reinforce the kind of behavior that benefits everyone.” (Skinner, cited in Sobel, 1990)</td>
<td>Portability, Immediacy</td>
<td>To receive and give immediate feedback within and outside the classroom</td>
</tr>
<tr>
<td></td>
<td>Quizzes, in class polling, discussion and question and answers. Skills-based learning (e.g. languages).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constructivism</td>
<td>“The principle goal of education... should be creating men and women who are creative, inventive, and discoverers, who can be critical and verify, and not accept, everything they are offered.” (Piaget, 1988, Unpublished Paper)</td>
<td>Portability</td>
<td>Working with physical or conceptual materials to construct new artefacts and knowledge</td>
</tr>
<tr>
<td></td>
<td>Taking Photos, Recording Videos, Notes &amp; Sound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiential learning</td>
<td>“The process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience” (Kolb, 1984, p. 41)</td>
<td>Evidence gathering</td>
<td>To gather, manage or store information and display understanding To visualise and present digital content</td>
</tr>
<tr>
<td></td>
<td>Using experimental tools e.g. mobile device sensors, GPS QR codes, augmented reality, virtual reality</td>
<td>Contextual, active learning, Portability, Communication</td>
<td></td>
</tr>
<tr>
<td>Situated cognition</td>
<td>“The activity in which knowledge is developed and deployed, it is now argued, is not separable from or ancillary to learning and cognition... Rather, it is an integral part of what is learned. Situations might be said to co-produce knowledge through activity.” (Brown, et. al, 1989, p.32 )</td>
<td>Portability</td>
<td>For movement during learning activities. To support learning outside the classroom For active learning interacting with a context.</td>
</tr>
<tr>
<td></td>
<td>Using tools to explore environments e.g. Augmented Reality, audio tours</td>
<td>Contextual, active learning, Outdoor environment, Location awareness, Communication</td>
<td></td>
</tr>
<tr>
<td>Communities of Practice</td>
<td>“A community of practice can be viewed as a social learning system... In a sense it is the simplest social unit that has the characteristics of a social learning system.” (Wenger, 2000, p. 1)</td>
<td>Communication</td>
<td>For communication and/or collaboration To support learning outside the classroom</td>
</tr>
<tr>
<td></td>
<td>Coordinating distributed messaging Social media</td>
<td>Immediacy</td>
<td></td>
</tr>
<tr>
<td>Connectivism</td>
<td>“Learning... can reside outside of ourselves... is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing.” (Siemens, 2004, para 21)</td>
<td>Interaction with the interface Communication</td>
<td>To explore knowledge through networked interaction with machines and other people</td>
</tr>
<tr>
<td></td>
<td>Sharing and communicating dynamic knowledge creation with others and networked sources of dynamic data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example 1: Augmenting the Real World with Mobile Technology in Ambient Wood

The Ambient Wood Project was an innovative educational project involving primary school children using mobile technology to augment and explore a physical woodland environment (Dix, Finlay, Abowd and Beale, 2003). Underpinning this project was a rich set of located technologies which supported collaborative construction of knowledge (constructivist criteria 3). Mobile devices, radio frequency (RF) identification tags, movement sensors and multi-modal displays were used to trigger and present the ‘added’ digital infor-
mation (Rogers, et. al., 2002). The mobile devices were used to look up more information about these points of interest, as well as to take environmental readings like temperature and humidity, reflecting a typically constructivist mobile learning activity (Anand, Herrington and Agostinho, 2008). The students were engaged in active learning and had control of their mobile devices (constructivism criteria 1 and 4). However, we might regard the activities as being too directed by the embedded tools to fully engage with constructivist learning.

The project centered around pairs of children equipped with a number of devices exploring and reflecting upon a physical environment that had been prepared with a WiFi network and RF location beacons. This exploratory investigation allowed the children to build complex understandings of the rich ecological environment and lifecycles including the fragility of these habitats. The project was underpinned by experiential learning principles where the children were transforming their experience into knowledge (experiential criteria 1, 2). The children were allowed to explore and discover aspects about plants and animals living in the various habitats in the wood. The field trip was used to encourage learners to discover, hypothesize and experiment with biological processes taking place within a physical environment (Rogers, et. al., 2002) (experiential learning criteria 4 and 5).

The learning was based on exploring a physical environment, proving the authentic context and activities typical of situated cognition (criteria 1). The project enabled learners to integrate their understanding and knowledge through a dialectic process of reflecting and acting (Situated cognition criteria 1 and 4; experiential learning criteria 3), and to do so in a playful way (Rogers, et. al., 2002). The students interacting with the environment and with others through shared activities and language (situated cognition criteria 2 and 3).

Social interaction and communities of practice were encouraged to a degree. Walkie Talkies were used by the children to communicate with a remote facilitator, they were used to answer questions posed by the remote facilitator (criteria 2 and 4). Additional information could also be received by the students via the mobile devices (Randell Phelps and Rogers, 2003). They shared a domain and learned within it, but this community was short lived, confined to the scope of the activity. The connectivism component was limited by the range of networked resources and tools that were available at the time of the project, which predated the publication of connectivist theory. Nevertheless, the technologically-supported environment that supported dialogue and collaboration supported some connectivist features (criteria 2). No significant behaviorist components were identified in the learning process.

Based on this analysis it is evident that the project was underpinned, to different degrees, by five of the six learning theories focused on within this article; namely connectivism, experiential learning, constructivism, communities of practice and situated cognition, with a core focus on situated, experiential learning (Figure 1).

![Figure 1. Analysis of learning theory in the Ambient Wood project](image)

**Example 2: Mobile Language Learning Apps within a Personal Learning Environment**

Mobile Assisted Language Learning (MALL) is a popular topic for mobile learning applications and has been the subject of extensive research (Viberg and Grönlund, 2013). Reasons for the popularity of MALL
include personal mobility, personalised learning, social contact and collaboration (Kukulska-Hulme and Shield, 2008). Thus any exemplar chosen to explore MALL in practice should not only provide individual language experiences but support learning with others. With this in mind we have chosen the Busuu app as one example of many, because it combines both the conventional drill and practice of a multitude of language learning apps with a connectivist approach to social media and personal learning networks (Brick, 2011). Busuu is a mobile and web self-paced language learning application. The platform allows learners to practise their skills directly with other native speakers in a world-wide community of users. The application embeds interactive multimedia content with a social networking environment (Busuu, 2006). Ketyi (2013) notes that Busuu has an active and supportive community of learning, and its social networking features scored highly in a study by Liu et al (2013), while Gaved et al (2013) emphasised the impact of its feedback and progress indicators.

As with most language learning applications, Busuu is heavily underpinned by behaviourist learning principles, with the core aspect of the app focusing on drill and practice of the repetitive language activities (Storz, Maillet, Brienne, Chotel and Dang, 2012). Learners are scaffolded within their learning, where a course is broken down into learning units (behaviourism criteria 1 & 3). The learning units enable learners to practice and reinforce their learning, underpinned by the formation of habits mainly through imitation and repetition (Mitchell et al, 2013) (behaviourism criteria 4).

Badges are used to reinforce behaviour, show achievement (e.g. completing a learning unit or finishing a course) and encourage interaction in the community (e.g. correcting posts) (Álvarez Valencia, 2014). The use of the reward system is an example of continuous reinforcement and therefore further emphasises the behaviorist approach to learning (behaviourism criteria 2 & 5).

In addition to reinforcing and encouraging positive behaviour, badges are used to encourage collaboration and interaction between users. Some of these collaborative activities include written exercises, audio recording, and chat. These collaborative and cooperative learning are an important driving factor for encouraging and facilitating constructivist learning (criteria 3). Also underpinning the constructivist paradigm is that learning is self-paced and learners can attempt the activities at their own pace (criteria 4).

The badges also reinforce gameplay (Álvarez Valencia, 2014). The game play extends the behaviourist approach to include also elements of constructivism. Users are able to compare and rank themselves based on the number of Busuu-berries (the reward system used in Busuu) they have and with those of their friends. Learners are also able to challenge other users to complete learning units to obtain more berries. The gamification approach adopted in the application helps to “builds goal-orientation, collaboration, and competition into otherwise boring or hard activities” (Reinhardt, 2013 p 13). This approach helps make the learning more active and supports the transformation of the learning into a meaningful process (constructivism criteria 1).

Another factor within the application is its strong domain-based learning community which is an important component of communities of practice (Wenger, 2000). Users are encouraged to engage with other learners, for example by peer-reviewing others’ audio-recordings of dialogues (communities of practice criteria 1 & 2). The audio recording facility allows learners to participate in a dialogue with others and more advanced learners are encouraged to support new learners (communities of practice criteria 3 and 4) so learners are encouraged to be both teacher and student. The social network allows people to correct other users’ written work, making each user an expert in their own language (Garcia, 2013).

The use of social networks to connect with friends and others is an important focus of the app. Users sign up, send friendship invitations, and create groups to exchange text corrections, translations or simply to exchange some thoughts, as well practice with native speakers of a specific language (Garcia, 2013). This interaction enables and supports meaningful dialogue and collaboration, a significant component of connectivist learning theory (connectivism criteria 2). The application provides the ability for users to network with other learners to discuss and share learning (Orsini-Jones Brick and Pibworth, 2014). The features of the system enable a dynamic, technology-based knowledge community and learning network wherein students critically evaluate and synthesise concepts, opinions and perspectives (connectivism riteria 5).

Our analysis suggests that the application mainly leverages the principles of four learning theories; behaviourism, constructivism, connectivism and communities of practice, but is most strongly behaviorist and connectivist (Figure 2).
3 Conclusion

Careful and thoughtful application of theory within a learning activity helps to ensure that appropriate pedagogy is adopted. Within mobile learning there has been considerable debate as to whether a specific learning theory is needed to capture the unique character and affordances of mobile learning, part of a broader debate about whether 21st century tools and contexts demand new learning theories to understand their characteristics and potentials. However, with our current understanding, it may be considered that applying range of existing theories, a ‘theory-ology’ of mobile learning, may be usefully applicable to the design of mobile learning activities. This study identified six major learning theories as being particularly relevant to mobile learning, and used them to examine two different learning contexts. These contrasting examples were chosen to highlight the wide variations in how mobile learning is applied, and also to suggest the potential change in the way that theory may be operationalised as technology develops. Our contemporary mobile app, for example, is much more capable of supporting connectivist learning than the woodland experience of a previous technology generation. Although we have so far only used this approach to analyze previous work, we believe that it could provide a useful tool to design learning activities, as well as assist in evaluation of their effectiveness, by framing their design and evaluation within a structure of interacting learning theories.

The acknowledgement that mobile learning draws on a mixed and rich range of learning theories recognises that mobile learning experiences can be extremely diverse. Mobile learning can, therefore, be a theoretically rich way of teaching and learning when the various affordances of the technology are taken into account. These affordances can help us to leverage the unique properties of mobile learning.

In this article we have emphasised the role of mixed-theory in understanding the pedagogical value of different mobile learning affordances and activities. In addition, we have explored how different learning theories can play more or less pivotal roles depending on the features of a particular learning activity. However, our intention is not only to look backward at previous mobile learning examples but to suggest that similar analyses might usefully be applied to the design of future mobile learning tools and activities. It may be that new learning theories will emerge that will provide new understandings of how we learn in an always connected mobile world of ubiquitous devices. In the meantime, existing learning theories still have much to offer.

4 References


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## 5 Appendix

### Table 2. Learning Theories Adopted in the Study and the Criteria Each Case Study was Measured against

<table>
<thead>
<tr>
<th>Learning Theory</th>
<th>Learning Design Implications (as identified in the literature based on each learning theory)</th>
</tr>
</thead>
</table>
| **Behaviourism**| 1. An emphasis on producing observable and measurable outcomes in students  
2. Learner tested to determine whether or not they have achieved the learning outcome  
3. Learning materials must be sequenced appropriately to promote learning  
4. Learners must be provided with feedback so that they can monitor how they are doing and take corrective action if required  
5. Use of reinforcement to impact performance [tangible rewards, informative feedback] (Ertmer & Newby, 2013; Ally, 2004) |
| **Connectivism**| 1. A stimulating and motivating learning activity that asks of and allows for learners to create artefacts in personal networks linked to other social networks  
2. A technologically-supported environment that supports meaningful dialogue and collaboration  
3. Learners use diverse information sources offline and online, formal and informal  
4. Leveraging skills that are transferable across media, platforms and tools to expand students’ learning networks  
5. Developing a dynamic, technology-based knowledge community and learning network wherein students critically evaluate and synthesise concepts, opinions and perspectives (Armatas, Spratt, & Vincent, 2013; Kizito, 2016) |
| **Experiential learning**| 1. Experience as foundation for learning  
2. Learning as the transformation of experience into knowledge, skill, attitudes, values emotions  
3. Reflection as a means of transforming experience  
4. Learning through a cycle of concrete experience, reflective observation, abstract conceptualization, active experimentation,  
5. Knowledge is created through the transformation of experience (Weller, 2006) |
| **Situated cognition**| 1. Provide authentic context and activities that reflect the way the knowledge will be used in real-life  
2. Provide access to expert performances and the modelling of processes  
3. Support collaborative construction of knowledge  
4. Provide coaching and scaffolding at critical times  
5. Promote reflection to enable abstractions to be formed (Herrington & Oliver, 1995) |
| **Communities of Practice**| 1. ‘Practice’ as the unifying feature of the community  
2. Relationships that are grounded in information exchange and knowledge creation  
3. Membership ranging from novices to old timers  
4. Shared learning, which may also occur effectively at the boundaries/peripheries of the community  
5. Learning can be, and often is, an incidental outcome that accompanies these social processes (Lai, Pratt, Anderson & Stigter, 2006) |
| **Constructivism**| 1. Learning should be an active and meaningful process  
2. Learners should construct their own knowledge rather than accepting that given by the instructor  
3. Collaborative and cooperative learning should be encouraged to facilitate constructivist learning  
4. Learners should be given control of the learning process and time and opportunity to reflect  
5. Learning should be interactive to promote higher-level learning and social presence, and to help develop personal meaning (Ally, 2004) |
Responsive Web Design: Experience at the National Distance University of Costa Rica

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Abstract. More than half of the student population of the National Distance University of Costa Rica (UNED) live on the periphery and have difficult accessing conventional learning resources. Because of this, in 2010, the university changed its production focus to multimedia materials based on the use of Responsive Design. This allows students who do not live in the city but have a high ownership of mobile devices to access academic content, giving them the opportunity to continue their studies without problems. This paper describes the process of implementing a range of multimedia responsive materials, such as multimedia books, virtual labs, content modules and learning objects. It details lessons learnt and provides recommendations to others pursuing this path.

Keywords: Responsive Design, distance learning, multimedia learning materials, Latin America

1 Introduction

The National Distance University of Costa Rica, or Universidad Estatal a Distancia (UNED), opened on March 3rd, 1977, based on the standards of the National Distance University of Spain and the Open University of Great Britain: “it is created as a higher educational institution specialized in teaching through social communication media” (Congress of the Costa Rican Republic, 1977). Since the very first moment its main goal was the production of didactic materials. These materials have allowed it not only to operate effectively in its specific field of expertise (distance education) but also to adapt to technological trends and to the demands of new generations of students over the years.

At the end of the 1970s UNED started to use mainly written materials such as letters and brochures in its teaching practice, which were sent by mail to the few students who dared to enroll in this particular brand of new educational system, the first of its kind to be offered in Costa Rica. Next, when the massive production of materials started, new media appeared, like the radio and the telephone: new options were created such as radio programs, over-the-phone tutoring, and audiovisual products such as cassette tapes. In 2000 the usage of digital resources just started to gain popularity, so an implementation of virtual aids was included and the Multimedia Electronic Production Program (PEM) was created with the objective of leading this new production line. Initially, digital materials that were developed in the PEM had their origin in books: in other words, the complementary materials were produced to support the content of printed material. For example, compact disks were produced with HTML and Flash components. Gradually materials evolved with the emergence of new devices, beginning with the CD ROM, DVD, then using portable storage devices such as USB flash drives, and then the Smartphone. Because of changes in the world context it is inconceivable that all activities should be delivered in the same way and in one place: technology has broken the old paradigms and allows people the chance to have access to information in a ubiquitous way. For this reason UNED is producing didactic materials that can be used on a number of devices and accessed no matter where people are, as long as there is a web connection available.

Since 2010, there has been a series of research studies undertaken at UNED in order to find out what kind of technology students have. The results have indicated that over 90% of them have access to mobile devices. Based on these results, a change in the production of multimedia materials has been taking place since 2012. With the invention and widespread use of the smartphone, production at UNED focuses on mobile learning and involves delivering the content by media such as enriched multimedia books, modules content, learning objects and virtual labs. A major aspect of the development of these new media is the deployment of Responsive Design: in other words, the materials are produced so that they adapt to different technological
devices and screen sizes, whether they be desktop computers, laptops, tablets or smartphones. Right now UNED has a student population of over 30,000, with more than half of them living on the periphery. This is why it is difficult for them to have access to conventional materials, but they can access materials on the internet. It is important to emphasize that more than 80% of Costa Rica’s territory is connected to the internet. For all of the above reasons we expect that the usage of adaptable materials to different devices will allow, for those students who live away from the city, access to academic content so they can have the opportunity to continue their studies without any problem.

This paper describes the work that UNED has done to deliver learning to students via whatever device they choose and the use of Responsive Design to enable this. We provide some examples of learning units that have been developed and give several recommendations.

2 Responsive Design

Responsive Web Design (RWD) is a technique of design and development of both web sites and web applications that allows pages to fit the size, resolution and screen orientation of the user’s device to facilitate navigation and exploration of the different sections of content (Castillo, 2013). This term was first used in 2011 by Ethan Marcotte, in an article published on the web site “A list apart”. Commonly, this term has been associated with flexible design, but this is a mistranslation of “responsive” (EstudioDispersium, 2011). Responsive Design has become a necessary strategy to service the accelerated invention of internet-enabled devices such as laptops, smartphones, tablets, game consoles, digital TV, among others.

With Responsive Design there are a number of advantages. For UNED costs are saved because it is unnecessary to create and update the navigation features and configuration of multiple websites with the same content to be accessed from different devices. This facilitates the update of information, because it is not necessary to publish different versions. For students it promotes greater comfort in navigation, for example, allowing the reading of texts without using the zoom, and thus allows greater and more direct visual impact of the content since students are not distracted by difficulties of navigation.

Apart from the attention that must be paid by developers to the configuration characteristics, the size of the screen and the different modes of user interaction, e.g., via mouse, touch screen display or voice recognition, one disadvantage is that sometimes the contents do not adapt well, as Jakob Nielsen (2011) showed in several studies on the subject of access to content from mobile devices:

“... We do not consume information in the same way on a desktop computer as on a mobile device. Navigation from a computer is more immersive and promotes exploration, whereas when we connect from a mobile we usually seek a specific figure. The browsing experience is more important on a computer, and the speed and ease of use is critical on a mobile phone.”

UNED has had to take this into account when developing multimedia materials for mobile learning.

The adaptation of content to different devices is achieved by flexible structures (in which the content area is calculated proportionately to 90% of the width of the screen, irrespective of the actual resolution) and fluid images that are added through programming options such as Media Queries (Labrada and Salgado, 2013) and CSS (Cascading Style Sheet). HTML5 (Hyper Text Markup Language, version 5) is a programming language that allows working with proportional sizes. That is, the information is variable, resizes and moves to automatically adapt according to the demands of the screen resolution of the device.

The use of typography has improved substantially, with various “web fonts” available from servers in the cloud, such as Google or Adobe, which means that it is not necessary for these to be installed on the device. While students are connected to the network, the fonts are displayed. Again, typography responds to fluid design (flexible structures or columns), with relative measures of typography adapting to the resolutions of the various devices.

Only with regard to images (photographs, graphics, 3D objects, videos, etc.) did the PEM team find it necessary to generate at least three packages of inputs, based on the three resolutions of the most common devices owned by the students. This avoids excessive data processing, which prevents the bandwidth being saturated.
3 Production and Realization

When planning the design of a digital resource, the different needs of the user should be considered, particularly whether they will access the content from a variety of devices like a smartphone, tablet or a desktop. Examples of questions that need to be asked during the production process include:

- Are the users interested in checking the same information from different devices?
- Is it correct to make changes only in the content design?
- Do the users invest the same amount of time browsing through web content from their mobile device as from their desktop computer?

Having resolved these questions multimedia production begins to produce a supplementary learning resource that strengthens and extends either a book’s content or a teaching unit. Its aim is to facilitate student understanding of content.

All of the multimedia production is developed under Responsive Design to be accessible not only from mobile devices but also from computers, both desktops and laptops. Responsive Design provides flexibility in the production process: production depends on the creativity and initiative of the academic producer who takes the decisions and leads the interdisciplinary team in charge of the development. All products are produced under the Mobile First approach, because if you can correctly view content from a mobile device, it can be displayed correctly in any other medium. To achieve this, some considerations must be contemplated during the production process:

- Analyze the content and information to identify those graphical elements that are essential for understanding.
- Ensure the quality of all resources and graphics used, and consider copyright.
- Use illustrations to facilitate the understanding of concepts and content. For example, the use of a pedagogical metaphor, distinctive design which graphically supports the curricular content of each product.
- Apply the institutional processes for the hiring of content specialists.

At present, there is not a clear policy on the publication of resources in virtual stores for student access, as copyright enforced by the stores does not permit the use of content freely. This is why production has focused on the development of web apps which can be accessed from UNED’s repository through an internet connection. This publication strategy has certain advantages:

- The memory of the user’s device is not used up because the access is made through a direct connection to the UNED’s servers, where the product is hosted.
- It facilitates the upgrade of the resource when necessary, since there is no need to publish different versions of the same content.
- There is therefore a low investment cost in maintenance since there is only one version.

4 Examples of Multimedia Distance Learning Materials Produced using Responsive Design

Currently, there are many responsive multimedia materials available. Here we give several examples to illustrate the range of materials, the application of Responsive Design, and some of the issues that have been considered in production.

Aquatic Birds of Costa Rica (Aves acuáticas de Costa Rica)

This resource has as its learning objectives the identification and acquisition of knowledge regarding different species of waterfowl in Costa Rica. The material enables the user to access basic content; scientific illustrations for each species, with their physical characteristics; exercises in identification; a map showing
the location of each species; a diagram of the general anatomy of each bird; a glossary; and downloadable PDF files (Villarreal, 2013).

Figure 1 shows the home page of the app for viewing on a desktop.

![Home Page, Aquatic Birds of Costa Rica](image)

As can be seen in Figure 2, so that users can access the information from their mobile devices, an adaptation of the content was performed and some options (the top menu of the window, for example) were omitted. However, this does not put at a disadvantage the user wishing to view the basic information required.

![Identification Page, Aquatic Birds of Costa Rica](image)

Because of a lack of clear policies regarding the copyright of content, this app was removed from the Android Store, where it was originally made available, and published in the repository of materials on the University website. The app must therefore be accessed through a network connection.

Mountaineering and Orientation Techniques in the Field (Montañismo y técnicas de orientación en el campo)

This digital resource was produced with the interdisciplinary contribution of different programs, namely Management of Natural Resources, the Department of Geographic Information Systems and the School of Science. It comprises five modules: Land Navigation; Knots and Cords; Climbing and Abseiling; Camping; and Search and Rescue (Álvarez, 2016). It seeks to establish a closer proximity between the outdoors and those who enjoy hiking, mountain climbing or simple contact with nature.

The production of this digital material was made in several stages. The first version was made modularly in PDF format. This version is public on Moodle, which is the learning management system administered for
the Online Learning Program. The second version has less content to allow adaptation of the material using Responsive Design and to be viewable on students’ smartphones, a more appropriate platform if they are learning in the field. It also has several interactive features that allow students to undertake exercises and includes a series of demonstration videos which serve as a guide for the preparation of knots, the main weakness of students (Figure 3).

![Figure 3](image_url)

**Figure 3.** Knots and Cords Page that Includes Videos and Illustrations (Mountaineering and Orientation Techniques in the Field)

**Numeric Methods for Teaching (Métodos numéricos para la enseñanza)**

It is noteworthy that the School of Science has developed several Responsive Design products, such as Euclidian Geometry, Development of a Maths Class through Problem Solving, and Trends in Mathematics Education in the 1960s and ‘70s. These materials are used in various courses in the School. One example of a resource is Numeric Methods for Teaching (Sequeira and Rojas, 2011).

This material offers tutorials examples of problem solving and exercises on topics related to error theory, approximation methods for solutions of nonlinear equations, polynomial approximation of functions, and values of shunt and integration approaches using various techniques and methods. It supports the book with the same name, used for the Numerical Methods for Teaching Mathematics Program. The digital material was made in response to the need expressed by students to obtain concrete examples of the application of curricular content (Figure 4). So varied multimedia content was developed showing how to use maths in everyday life and videos where teachers show possible solutions to problems. The contents displayed on each of
the devices is always the same, regardless of the screen where the student views the material. This ensures access of information to students.

Figure 4. Introduction, Numeric Methods for Teaching

Tell Me, I want to Hear (Contame, que te quiero escuchar)

The learning objective of this course material is for students to undertake a language assessment of children four to six years old to establish any speech difficulties. It is composed of the following modules: Basic sign language; Teaching strategies to administer the assessment; Recommendations for sampling; Analysis of the data obtained in the activity; and a Bibliography (Salas, 2016). It forms part of the Early Childhood Education Program of the Department of Language Stimulation, School of Education. Because the students had problems applying theory to practice, it was decided to show them how to perform this language evaluation activity. So videos exemplifying recommended strategies are included, and even downloadable materials that can be used in the activity, such as finger puppets, masks for role playing, extracts of children’s stories, etc. (Figure 4).

Figure 5. Two Tablet Pages showing Procedures (Procedimientos) and a Downloadable Cat’s Mask for Role Play (Tell Me, I want to Hear)
Ethnocultural Tourist Route: The War of ’48 (Ruta Turística Etnocultural: Guerra del 48)

This app allows a historical and cultural tour of some of the key communities in the War of 1948, by which a democratic process was established in the country and the Costa Rican Army was abolished. This is the first app that has been produced at UNED which not only displays relevant course content but also uses several features of the devices, such as providing geospatial location using GPS (Figure 5). The material is currently being developed, with expected testing in the third quarter of this year with students of the Department of Tourism, Social Sciences and Humanities School. It includes four possible paths to relevant historical sites, showing the relationship of these sites to the rural tourist (Quirós, n.d.). It aims, too, to support the development of small entrepreneurialisms in these places.

Figure 6. Page for Route 1 Showing Integration of Information with Maps (Ethnocultural Tourist Route: The War of ’48)

5 Conclusions and Recommendations

UNED has embarked on an ambitious program to deliver multimedia learning resources to its distance education students, wherever their location and whatever digital device they choose to use. For this, we have to investigate continually the use of the materials already made in order to obtain feedback from the students and to improve the production process of materials currently underway. It is also necessary to change institutional policies concerning the process of producing and publishing materials with the objective of adapting these to formats more widely used today, such as web apps.
Below are several recommendations from lessons learned during the didactic materials production process at UNED in Costa Rica:

1. A real institutional commitment is required in terms of adopting a policy to conduct ongoing evaluation of the quality and usage of the materials, and their impact on students’ learning.

2. Using Responsive Design only one application needs to be created, allowing students to have access to all of the content published by the university, organized in an institutional repository.

3. It is considered necessary for apps to be developed in the administrative and management area, so that students can have easy access to institutional services.

4. Authorship and related rights are inalienable, so at the institutional level is not always possible to make content freely available. Because of this it is necessary to address the issue from a clearly defined institutional policy.

5. In UNED, Responsive Design has become a necessary strategy to balance the accelerated inventing of new digital devices.

6 References


Analysing Student-Generated Digital Explanations

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Abstract. In this paper, we describe our developing analytic approaches for understanding meaning making as learners create digital explanations of science concepts. We use qualitative methods and analytic tools based in social semiotics. Through register analysis using the conceptual tools of field, tenor and mode, we consider the design choices made by pharmacology students who generated a digital explanation of a drug pathway or therapeutic approach as a presentation task in the subject. Through our lens in multimodal learning, we examine the digital explanations and interpret how topic knowledge is represented (field); how the designer attends to the audience (tenor); and the semiotic choices made (mode). Learning may be seen as a process of expanding one’s registerial repertoire, hence register shift is deeply implicated in learners’ development of content knowledge. In this study, we are investigating how learners come to deeper understandings of content through working with multiple modes. We can also examine overall modal coherence as indicative of learner awareness of important communications concepts. These sorts of texts are becoming more common and thus implications for mobile learning include a deeper understanding of how contemporary digital technologies can drive meaningful learning activity.

Keywords: student-generated digital media, tertiary science learning, explanations, analysis

1 Introduction

There has been a significant shift in recent years in how learners interact with media. The shift, according to Jenkins (2006), has been from ‘passive media spectatorship’ to ‘a participatory culture’ (p 6) because nearly everyone has access to digital technology that enables them to create digital content and upload it to public websites or share it on private networks. Jenkins argues that this participatory culture includes new forms of communicating and interacting with knowledge and this happens in different ways when compared to traditional print media sources. Clear examples can be found in journals like Nature and Science where a range of digital modes supplement the traditional text forms and provide additional content embedded in articles or as additional files, such as animations, web links, audio segments or virtual reality. These forms and modes can be used in creating digital explanations as assessment tasks in science subjects, which positions learners as both consumers and producers of content. In tertiary science learning contexts, this has interesting implications for engaging students and developing their content knowledge and communications skills.

Engaging the next generation of scientists and science teachers in digital decision-making and composition is essential to improving their learning through digital technologies. Some university teachers have begun to use innovative strategies that integrate digital technologies as recommended in the Australian Tertiary Learning and Teaching Academic Standards (ALTC 2011), National Professional Standards for Teachers (AITSL 2013) and the 2014 Horizon Report (Johnson et al 2014). Through such strategies as having students develop their own digital media representations of science utilising visual, textual and verbal modes, our research interest is in characterizing the meaning made as students create these often interesting and engaging digital media products. Our earlier work demonstrated that preservice K-6 teachers develop content understandings by creating a digital explanation to explain a science concept to children (Hoban, Loughran and Nielsen 2011; Hoban and Nielsen 2013; Nielsen and Hoban 2015). With the ubiquity of digital technologies, other university science students now make a range of digital media to explain science in both disciplinary science and science teacher education (e.g. podcasts, videos, digital stories, musical explanations, blends) and while we know that creating digital explanations supports science learning, the creation may differ across science discipline subjects. The field needs more sophisticated analytic approaches to meaningfully consider both what is represented in the digital explanation and how the construction process is implicated in
meaning making for the creator. Further, because learners’ engagement with the content is multimodal and the digital media products are also multimodal, analysis strategies that elaborate the intersemiotic relations among and between these multiple modes provide a window into meaning making by the creator. Thus, the current paper develops our analytic approach to examining student-generated digital media that provides depth to our examination of meaning making. We ask the research question: How can we describe student meaning making when they construct digital explanations?

2 Theoretical Perspectives

Earlier work with Slowmation (a simple form of stop-motion animation, see Hoban 2007, 2009) showed that learners make meaning as they construct a sequence of representations including research notes, storyboard, models and still images that are used to generate a final multimodal representation that is a narrated slow-motion animation (Hoban and Nielsen 2010, 2011). Hoban and Nielsen theorized that the preservice teachers who created slowmations developed content understanding because they engaged with content in multiple ways across multiple modes. In other words, their learning about the science was multimodal even as the digital product displayed multiple modes or media forms. However, in the earlier work with slowmation as a digital explanation, the ability to assess what the preservice teachers learned was limited by both the research methodology to capture the construction process and the means available to assess content knowledge before and after constructing the digital explanation. Literature in multimodalities (Jewitt 2014; Kress 2010) allows us to consider how the combination of different modes in a digital explanation supports meaning making by the creator. The so-called ‘self-explanation effect’ (Chi et al 1994) may also help us understand learning because the process of generating an explanation helps the learner to consider aspects of the concept and how these aspects meaningfully relate to one another (Lombrozzo 2012). Hoogereide et al (2016) demonstrated that students’ learning activity is more effortful when they study with the intention to teach the concept to others (vs. studying to take a test). It remains challenging to determine what students learn through generating a digital explanation. Thus, in the current study we build on a conceptual framework based in social semiotics to analyse a range of digital explanations made by tertiary science learners as tasks in their science subjects.

Social Semiotics

In learning science content knowledge, tertiary students must gain familiarity with a range of representational forms (Nielsen and Hoban 2015; Tytler et al 2013). Students are thus both consumers of multiple forms of representations in their learning and producers of different representational forms when they display information, for example, in lab reports or written assignments. As a result, they need to learn to translate information between different modes of representation. This ability to translate between different representational forms is also key to effectively communicating science knowledge, as stated in the Tertiary Learning Standards (AITSL 2013). When students construct a sequence of representations, as in a slowmation, they make a ‘cumulative semiotic progression’ (Hoban and Nielsen 2013) where learning cumulates across the representations. The notion of a cumulative semiotic progression is closely related to two important concepts in multimodal learning: translating between modes requires a ‘register shift’ (Macken-Horakik et al 2006) and combining modes to achieve ‘modal coherence’ (Jewitt 2014). Register shifts when a learner interprets written text to image to final narrated animation, and since each mode entails a different kind of logic, each mode used in the representational sequence illustrates the ways in which the learner has construed the science concepts. In other words, as learners develop a multimodal sequence of representations, they revisit the science concepts as they work (e.g. translate) between modes or ‘semiotic resources’ (O’Halloran et al 2013). Kress (2010) called this ‘transduction’, which is an important process as learners make sense of the content knowledge through developing a connected sequence of multimodal representations. In the development, the learner must make decisions about what to represent and consider what each mode signifies, and then overall, the connected sequence must make sense as an explanation for a specified audience. For example, when preservice teachers develop slowmations, they make decisions to use different modes such as still images, moving images and labels to complement the narration, while deliberately attending to the sequencing of representations to explain a science concept for children. Such attention should result in modal coherence. Making design decisions and sequencing representations in the explanation are two important facets of multimodal learning that can be examined through the social semiotics constructs of field, tenor and mode (Halliday and Hasan 1985). Field, tenor and mode are aspects of the situational context in which a text is
constructed and interpreted, all of which shape the semiotic choices made by meaning makers. In this study, field influences the vocabulary choices, specifically scientific vocabulary, which should become increasingly sophisticated as learners progress deeper into fields of knowledge. Tenor refers to the relations set up between the ‘writer’ or ‘composer’ and shapes choices such as the use of dialogue to exchange ideas with others and the degree to which an expert scientific voice is taken up. Mode, in our work, enables us to think about the meaning making resources at hand—language and image—and how these are integrated to make a coherent, scientifically accurate text.

While the three register variables (field, tenor, mode) work together, so too the linguistic metafunctions of ideational, interpersonal and textual meanings. Ideational meanings are of particular relevance for the current paper, since these are represented by language and indicate what the creator has chosen to represent. We seek a close analysis and draw from what Kress and van Leeuwen (2006) called ‘representational meaning’. While our work does not involve picture books, the elements of their framework help us to examine the structure of the digital media products in terms of what is represented. In particular, there are three elements, each of which is identified at the clause level of a text: participants include who or what is depicted; processes are actions or relations that are depicted; and circumstances illustrate when, where, how and with what. Identifying these elements provides insights into the nature of the field knowledge represented; the activity sequences depicted in the blended media; the relationship(s) between meanings and processes; and the text itself as a pattern of meanings.

3 Method

Students in a third-year pharmacology subject contributed to the study. This subject was of interest in the current study because the instructor has been developing the digital explanation task over the last two years. He was seeking ways to support the students to engage with digital technologies and hoped that they would develop their communications skills in utilising the format of the digital presentation to attend to the audience as non-experts. In addition to being a ‘Graduate Quality’ in the Sciences faculty, effectively communicating complex scientific information is important translational work for future health practitioners within their degree programs. However, such emphasis in the degrees is not obvious, nor is it often intentional.

The case students each developed a blended media presentation to summarize a literature review they conducted to answer a question such as “Is ferroquine an ingenious antimalarial?” or “Is agamatine a novel neurotransmitter in the brain?” These questions are contemporary areas of investigation in the field of pharmacology and thus, the student’s investigation complements lecture material in the subject. While the literature review task is a typical scholarly piece of writing that reviews relevant literature in the field, the blended media was intended to summarise this material for a non-expert audience. The final digital media presentation is constrained to 5 minutes, and students are encouraged to use online resources to develop their ‘blended media’ including sites such as www.digiexplanations.com.au, www.slowmation.com.au and www.creativecommons.org.au. Students also had a one-hour workshop on various techniques to create different media forms such as digital story, slowmation or blended media. Thus, students had wide-ranging choice in terms of which media to use to develop their explanations. We collected the blended media products as data in the current study and prepared a verbatim transcript of the audio portion of the blended media.

4 Analysis

We have a research interest in describing student meaning-making through creating a digital explanation. As such, analytic tools for such description are needed to help understand the significance of design choices when selecting or creating representations as parts of the knowledge being explained. Social semiotics approaches cognition as meaning making, hence the modal choices made by students provide insight into how they construe the content of the subject or topic. Field is realized through choices from ideational systems of meaning. Students’ choices thus indicate how they understand the topic – its nature, its relations to other fields, the degree of abstraction or technicality involved, and the relations between ideas. In other words, the tools of social semiotics offer a theoretically principled means to characterise and analyse the blended media presentations at a number of levels of specificity and precision. To illustrate our analysis process, in this section we focus on one of the blended media products that addresses the question “Is ferroquine a novel antimalarial?” created by Perry (pseudonym) and begin with our step-by-step procedures for handling and organising data.
1. Each transcript was segmented into clauses using conventional linguistic protocols for identifying clauses by identifying main verb groups. For example, the clausing below corresponds to the opening sequence in the malaria/ferroquine blended media (the main verb group is indicated in bold):

   In 2013, 97 countries **had** an on-going problem with the disease with an estimated 3.4 billion people at risk of contracting malaria//

   2012 **reports** an approximate 207 million cases world-wide, with a death toll of 627 000//

   So **what is** Malaria//

   Malaria **is** a disease [[caused by the protozoa parasite, plasmodium]]//

   **and can cause** fever, headaches, chills and vomiting in a patient//

   which ultimately **may lead to** death//

   Malaria **works//**

   by **infecting** the patient’s red blood cells//

   **causing** them to rupture//

   **and release** new parasites//

   It **is transmitted** through an insect parasite, the female Anopheles mosquito//

   Each clause is a unit of meaning for further linguistic analysis. Taken together, clauses build meaning across the text. Analysis can be done at a micro level (e.g. within the clause) or at a stage or genre level to see relations among and between the clauses. A general or more focused view of clausing gives a general description of actors and actions across a text.

2. The clauses within the transcript for each blended media product were matched and time-stamped with basic information about the modal choices made by the designer including image depicted, modality of image (still, moving, slow-moving, video) and representational form (e.g. molecular model, text, symbols). Each clause in the text was aligned with each image in the visual track for this second layer of analysis of image/text relations. Figure 1 below shows the first two frames of the malaria/ferroquine blended media. These displays were collected in a spreadsheet for each blended media product to provide a general illustration of the relationship between the image portrayed and the text of the audio track, which also shows the progression across the entire blended media giving an initial impression of the overall flow through the text. In a general view of this display, an overall assessment can be made of the coherence of the blended media.

   ![Figure 1. Image Aligned with Clause for Image/Text Analysis](image)

3. A further ‘transitivity’ analysis was prepared in an Excel spreadsheet. Transitivity is one analysis system for describing choices in ideational meanings (Halliday, 1975). The system is used to identify participant(s), process(es) and circumstance(s) within each clause. Within each of these ele-
ments are further layers of analysis. Figure 2 shows a small clip from the transitivity analysis spreadsheet for the first two

![Figure 2. Transitivity Clip](image)

clauses in the malaria/ferroquine blended media. Each of the system elements can also be more narrowly defined. For example, participants can be actors/doers, goals, carriers, identifiers or sensors. Processes are ‘happenings’ or ‘states’ (Derewianka and Jones 2012), which reflect the experience of the participant(s). Circumstances specify additional information about events and happenings such as location in time and place, manner and reason etc. Participants, processes and circumstances are resources in Halliday’s system of transitivity and constitute the meaning in clauses. We can also apply these linguistic categories to images and in this way consider the nature of the field under construction in both visual and verbal modes. More focused analysis can identify shifts among these resources through the progression of the blended media.

4. The blended media texts and transcripts were subsequently uploaded into the software program “Multimodal Analysis Video” (MMA) (O’Halloran, 2013). MMA is a specialized software package developed by O’Halloran and her team for the explicit purpose of conducting multimodal analysis of complex texts, such as video and other digital artefacts. MMA is preprogrammed with a catalog of networks of options (or systems) derived through systemic functional linguistics theory (SFL) (Halliday & Matthiessen 2014) and developed further by O’Halloran to include choices relevant to semiotic resources other than language. In keeping with SFL theory, we identified field-related meanings through examining choices from ideational systems; tenor-related meanings through interpersonal systems; and mode-related meanings through textual or compositional systems. There are hundreds of choices across the three metafunctions to be made from the pre-defined catalog, which researchers choose according to the theoretical stance for the project. For the current research, a project-specific catalog is being developed and trialed with a range of different blended media products, driven by our larger analytic aim to capture register shift and characterise meaning making in the construction of the blended media texts. Coding data is a fine-grained process using the MMA program, which identifies nodes corresponding to clauses and shows them in the transcription window. A running Film Strip plays the video, while the Sound Strip portrays the frequency variations of the sound track. The Dialog Strip shows the clauing. Each of these windows can be seen simultaneously enabling views across the modalities and catalog systems.

Through the layers of this analysis process, we move successively deeper into the blended media text. To date, our systems only include the ideational function. Through these layers, we can characterise the meaning that has been constructed by the student in terms of the patterns that become apparent. For example, the malaria/ferroquine blended media begins with statistics about the disease displayed as text that appears as the words are stated. The information includes the number of countries and people affected around the globe and situates the disease as a major public health issue globally. Later, the blended media moves to parts where more action is portrayed. This corresponds to a move to language that is less technical and more colloquial. For example, when prevention strategies are presented, the synthetic drug ferroquine is introduced as a possible replacement for chloroquine, which is currently the most common and cheapest option to treat malaria, even though its efficacy is diminishing over time. The less technical language corresponds to simple images
shown on screen. In other words, Perry uses simple language and imagery to convey complex meaning. We propose that the combination of these two modal choices (image and text) in the blended media represent a ‘transductive move’ where a challenging concept can be ‘unpacked’, which is the essence of a good explanation. His shifts that simplify both what is shown visually and what is said in the narration align very well, which reduces the overall technicality but is also coherent in terms of image/text relations. We believe that this is an important aspect of a good explanation. As we work into additional blended media examples, in different contexts for science learning in university, we will watch for this sort of pattern in the blended media products.

5 Findings and Discussion

In this research, our interpretive process is intertwined with handling the data. Significant preparation goes into the steps of clauing the transcript; sorting and aligning images with text; conducting the transitivity analysis; and coding the blended media for semiotic choices across the ideational, interpersonal and textual metafunctions in MMA. These steps enable deeper levels of analysis and begin our search for patterns across the set of blended media explanations. As we continue to work with a growing data set, our ultimate aim is to explore meaning making while learners construct a digital explanation, drawing from literature on semiotic resources, multimodal learning and the experiences of these high level science learners as they translate information in the literature review for a non-expert audience. Developing an explanation for less-expert others is an interesting task for advanced science learners and our analytic strategies will enable a deep understanding of how creating the blended media is valuable for student learning.

6 Conclusions

Analysing student-generated digital explanations as a manifestation of learners’ participation in the wider culture, but also as science learners in the context of tertiary science learning are aims of the larger project of this research. The ubiquity of powerful digital technologies means that we need tools to understand how to engage learners with the technology but also utilise it for meaningful learning. Developing an explanation for others is also likely a good way to develop understanding of effective communications skills. The types of analyses being utilized to examine the blended media texts are adopted and adapted from scholars working in visual literacies and media studies. Some of these analyses (e.g. MMA) have been used to analyse expert videos as teaching resources. Part of our work is currently evaluating the analytic strategies outlined here in order to refine them so that we can look across blended media as a genre. As we begin to develop ways to describe the digital products, we can also begin to theorise how and in what ways this helps us to understand what the production means in terms of student learning, communication skill development or new ways to engage with science, all of which are significant for the field of mobile learning as we continually seek ways to utilise the richness of the wide range of technology tools for learning in different contexts. Developing robust analytic tools and approaches is a key first step in our wider research agenda where we hope to uncover patterns perhaps based in the structure of disciplinary field knowledge; multimodalities to represent this knowledge; and learner engagement with science more generally.

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Changing Use of Social Media Tools by Preservice Primary Teachers to Learn Science

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Abstract. In this study, we draw from data gathered at two points of preservice primary teachers’ B.Ed. program to gain an understanding of how their use of social media for learning science changed over the degree program. The preservice teachers (PST) completed the Social Media and Science Learning Survey twice, in their first year science methods subject and again during an environmental education subject in the fourth year of the program. We use descriptive statistics and tests of significance to analyse the data set. Results suggest that these science learners use many of the same sorts of social media tools and behaviours in their learning and everyday use. To some extent, they also utilized a wider range of social media tools by the fourth year of their studies. As mobile technologies and social media tools become increasingly ubiquitous, understanding how science learners actually use social media for learning can help teacher educators to better utilize the learning potential offered, particularly in terms of engaging with the teaching profession.

Keywords: social media, science learning, preservice primary teachers

1 Introduction

Many students in teacher education programs have experienced the ubiquity of social media and mobile technology throughout their school careers. Claims about this generation of learners suggest that they have a preference for active over passive learning (Oblinger and Oblinger 2005); they expect to receive information quickly (Prensky 2001); and that they are skilled multi-taskers (Brown 2000). Other researchers have said the claims are unfounded theoretically or empirically (Bennett, Maton and Kervin 2008; Jones, Ramanau, Cross and Healing 2010). The reality is that social media tools such as smartphones, tablets and the millions of available apps provide a level of connectedness unimaginable until only recently. In this context, our understanding of how such tools are used to support learning is quite limited. Further, how such tool use changes over the course of a teacher education degree program is unknown. Thus, this study investigates how social media practices to learn science changed for a particular group of science learners (e.g. preservice primary teachers) over the four years of a B.Ed. program.

2 Theoretical Perspectives

In order to consider how preservice primary teachers use social media tools to learn science, our theoretical perspectives are grounded in complexity thinking (Davis and Sumara 2006). From perspectives in complexity, we characterize learning systems as complex systems, which means that actors or agents are nodes in a network that have an infinite number of interconnections even as some are featured and wired together more strongly than others. Mobile technologies connect these agents to each other as well as to wider networks of information, technologies and more distant others. Complex systems operate under “enabling constraints”, which are conditions that both constrain possibility and allow for creativity within the system’s boundaries. Characteristics of complex systems allow the components to interact in ways that mean the system is more than the sum of its parts. This enables us to examine the conditions for emergence (Johnson 2005) where learning is the result of new ways of working and thinking with tools or each other. Importantly, a learning system moves beyond connectivity toward connectedness, which Moll, Nielsen and Linder (2015) argue is the potential inherent in the connections between learners and information through social media and Web 2.0.
In studying preservice primary teachers as learners in science, we need to consider that both their science knowledge and confidence to teach science are generally weak (Appleton 2006). This has implications for them as classroom teachers and their future students if these considerations go unremediated. In other words, as preservice teachers, they are learners of science in their university studies in teacher education who are also future teachers who will support their students’ learning. They are also learners (and future teachers) of other Key Learning Areas such as literacy, numeracy, music and history, all of which incorporate information and communications technology capability as an area of ‘learning across the curriculum’ (NSW BOSTES 2012). Since 2008 with the introduction of the Digital Education Revolution (DEEWR 2008) and a 1-to-1 laptop program, all schools in NSW have filtered wireless networks (Stavert 2013). Further, there has been a subsequent rise of BYOD programs at primary schools (Johnson et al 2015; Stavert 2013). Thus, as future teachers, preservice teachers learn with and about technology during the initial teacher education program. Because graduate teachers will step into highly wired classrooms, the teacher education program needs to facilitate the development of knowledge and skills for these teachers to fully utilise the available educational technology tools for rich learning goals. However, the extent to which a common understanding and facility with mobile technologies is translated into developing teaching practices through the degree program to become rich learning opportunity for children is unknown. While we believe connectedness ought be the aim in promoting the use of social media tools to learn science in initial teacher education, we need to better understand how learners actually use social media within our preservice teacher education programs so that as future teachers, they can better utilize the learning potential and connectedness possible with social media tools and mobile learning technologies.

3 Method

Our key aim in this research is to understand how preservice teachers as science learners use social media for learning science and in what ways this may have changed over the four years of a Bachelor of Primary Education degree. To support this aim, we utilized a new tool, the Social Media and Learning Science Survey (Moll and Nielsen 2016) and administered it to one group of preservice teachers at two points during their B.Ed. program: 1) during their first year science methods subject in Spring 2012 (n=119) and, 2) during their fourth year environmental education subject in Autumn 2015 (n=61). Survey completion was voluntary and anonymous and followed protocols reviewed the Human Research Ethics Committee (Behavioural) at the University. Sampling this group near the beginning and near the end of their teacher preparation program enables us to capture changes and patterns in use of social media tools to learn science over the course of the B.Ed. program. It should be noted that preservice teachers take one subject devoted to ICT and have the option of elective subjects in the area as part of the B.Ed. degree. All subjects across the degree embed ICT into pedagogy in the subject, and this is also the case for teaching and learning in school subjects.

Acknowledging that educational technology as a field is developing and changing very quickly, the Social Media and Learning Science Survey gathers information about social media use in generic categories of use such as social networking, document management or microblogs and more particular uses for science learning while using common, freely available platforms such as Facebook or Google Docs. Proficiency of use is self-reported across three contexts in the survey: everyday, high school science and the current science methods subject. The same group of questions is asked about each context: frequency of use of a range of social media tools (such as communications, social networking, document management or social bookmarking); frequency of use for particular science learning behaviours (such as using Facebook chat for assignment work or collaborating with a classmate using google docs); and, which resources are used most frequently when stuck on a learning task (such as search google or bookmark a good learning science site). The survey was developed through an inductive approach with both university and high school science learners (see Moll and Nielsen 2016 for validation work). Basic demographic data are also gathered, including age, gender and which devices are commonly used to connect to the internet.

4 Results and Discussion

In this paper, we present findings from our analysis of the data sets for the years 2012 and 2015 where the same group of B.Ed. students took the Social Media and Science Learning Survey. Analysis includes descriptive statistics such as means and standard deviations, as well as t-tests for significant differences between the two years of survey data. While the sample size is smaller in 2015 (n=61 vs. n=119 in 2012), the
distribution by gender is similar (21% males in 2015 vs. 19% in 2012) and we note that only two males accounts for this difference through being present (or absent) during the class period when the survey was administered.

There was significantly more use of smartphones/mobile phones and iPads/tablets in 2015, while use of computers remained stable between the two years of data. Table 1 reports the percentages of preservice teachers who used these devices to connect to the internet. Many students ticked multiple devices, thus we see a range of different devices used, as well as much use of multiple devices. It is interesting that the use of stationary devices has not changed, while the use of mobile devices has grown over the time of this study. This is perhaps not surprising given the wider societal use of mobile devices.

<table>
<thead>
<tr>
<th>smartphone</th>
<th>iPad/tablet</th>
<th>home desktop</th>
<th>laptop</th>
<th>on-campus desktop</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>82%</td>
<td>26%</td>
<td>50%</td>
<td>93%</td>
</tr>
<tr>
<td>2015</td>
<td>98%*</td>
<td>49%*</td>
<td>51%</td>
<td>95%</td>
</tr>
</tbody>
</table>

*indicates significance at P<0.05

Tables 2, 4 and 5 summarize participants’ social media use to learn science in 2012 and 2015, where we highlight frequency of use, how social media tools supported science learning and which social media tools were used when stuck on a problem. We also discuss the changes between 2012 and 2015.

The survey asks respondents to label their use by type of user for a variety of social media tools (non-user, infrequent user, frequent user, contributor). Data in Table 2 represent a summed percentage of participants who indicated their use of that social media tool as “Frequent” or “Contributor”. From these data, we can see that there is a significant increase in level of use for communications purposes, while all of the other social media tools were used significantly less frequently. We note that this pattern is echoed in the data for ‘everyday’ use of social media applications, as shown in Table 3. While the differences reflect similar usage patterns in comparison to everyday use, actually using communications tools for science learning activity is significant. It should also be noted that the preservice teachers by 2015 have done several group work assignments through the degree program and thus likely use communications tools more often as they work on classwork or projects together. We might also speculate that they should also have developed proficiency with other sorts of collaboration tools, but it appears that they rely on the ones with which they are most familiar. We could also question why the use of discussion forums or other platforms enabling learning activity are so infrequent.

<table>
<thead>
<tr>
<th>Communication</th>
<th>Wiki</th>
<th>Video</th>
<th>Live cast</th>
<th>Music Sharing</th>
<th>Discussion Forums</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>18%</td>
<td>19%</td>
<td>47%</td>
<td>11%</td>
<td>5%</td>
</tr>
<tr>
<td>2015</td>
<td>56%*</td>
<td>12%*</td>
<td>33%*</td>
<td>0%*</td>
<td>0%*</td>
</tr>
</tbody>
</table>

*indicates significance at P<0.05

<table>
<thead>
<tr>
<th>Communication</th>
<th>Wiki</th>
<th>Video</th>
<th>Live cast</th>
<th>Music Sharing</th>
<th>Discussion Forums</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>47%</td>
<td>5%</td>
<td>78%</td>
<td>51%</td>
<td>24%</td>
</tr>
<tr>
<td>2015</td>
<td>95%*</td>
<td>19%*</td>
<td>59%*</td>
<td>15%*</td>
<td>3%*</td>
</tr>
</tbody>
</table>

*indicates significance at P<0.05

Data in Table 4 are from a survey item that asks respondents to indicate the ways that social media tools have been used generally to support their science learning. The items provide information on the frequency
of particular types of learning behaviours using different social media tools to learn science, beyond the frequency of using categories of applications (as in Table 2). For example, respondents indicate ‘never’, ‘sometimes’ or ‘regularly’ on such items as “Use Facebook chat (or MSN or texting) to contact a friend to get help with a class assignment” or “Store apps on my smartphone that are useful for learning science”. Response choices for items were coded 0, 1 or 2 for never, sometimes or regularly, respectively. Table 4 presents means and significance for the frequency of using each social media learning strategy. Most of the listed items show that mean use of these tools has significantly increased between the two survey administration points, however, the use of Wikipedia or Q&A forums declined significantly. We note the near doubling of use of online document sharing and strong increases in the use of Facebook Chat and Facebook Groups.

Table 4. Social Media Tools Used to Support Science Learning

<table>
<thead>
<tr>
<th>Mean</th>
<th>Use FB chat to contact a friend</th>
<th>Collaborate with classmate using document sharing</th>
<th>Create or join a FB group with classmates</th>
<th>Apps on phone</th>
<th>Access Wikipedia to read about a science concept</th>
<th>Ask a question on an online forum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1.31</td>
<td>0.29</td>
<td>1.17</td>
<td>0.15</td>
<td>0.84</td>
<td>0.31</td>
</tr>
<tr>
<td>2015</td>
<td>1.58*</td>
<td>0.56*</td>
<td>1.57*</td>
<td>0.28*</td>
<td>0.63*</td>
<td>0.07*</td>
</tr>
</tbody>
</table>

*indicates significance at P<0.05

A more general measure of online learning behaviours is made through a survey item that asks respondents to indicate how frequently they engage in particular kinds of behaviours when working on assignments in their science subjects. Items include: “I actively search the internet for resources (links, videos, websites) that will help my science learning” and “I search the internet for the answers to particular assignment questions. When I find the answer I stop looking”. Response choices for items were coded 0, 1 or 2 for never, sometimes or regularly, respectively. Table 5 presents these data for items that changed significantly over the two survey administrations.

Table 5. Online Science Learning Behaviours

<table>
<thead>
<tr>
<th>Mean</th>
<th>I actively search the internet for links, etc to help my science learning</th>
<th>When I find a good online science resource I bookmark it</th>
<th>I use collaborative tools to work with friends on classwork or projects</th>
<th>I share online resource with my classmates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>1.35</td>
<td>1.18</td>
<td>0.28</td>
<td>0.50</td>
</tr>
<tr>
<td>2015</td>
<td>1.63*</td>
<td>1.42*</td>
<td>0.57*</td>
<td>0.78*</td>
</tr>
</tbody>
</table>

*indicates significance at P<0.05

Data in Table 6 include the top three response choices to a survey item that asks respondents to indicate what they do when they become stuck on a science problem. There is a notable increase in use of online chat and organizing a study group, while emailing a friend decreased. The use of online chat tools has changed, likely due to the near ubiquity of mobile devices such as smartphones and tablets. We note that both categories showing increases in Table 6 are ways to engage with wider groups. Emailing a friend represents information exchange between two people, while exchanging information using an online chat or through a study group means that more people are potentially involved and hence represents the possibility of learning behaviour that is significant for a wider community.

Table 6. Choice of Social Media Tools when Stuck on a Science Problem

<table>
<thead>
<tr>
<th></th>
<th>Online Chat</th>
<th>Organize a study group</th>
<th>Email a Friend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>68%</td>
<td>25%</td>
<td>59%</td>
</tr>
<tr>
<td>2015</td>
<td>90%</td>
<td>39%</td>
<td>49%</td>
</tr>
</tbody>
</table>
5 Conclusions

Changes in social media behaviours to learn science between 2012 and 2015 may be a direct reflection of everyday social media practices suggesting that preservice teacher participants in this study may be moving beyond connectivity toward connectedness (Moll, Nielsen and Linder 2015). However, simply using communications applications more often does not mean that these learners are more adept at utilizing the affordances of mobile learning technologies beyond simple communicating or sharing. This suggests the need to attend more specifically to the notion of connectedness as a concept describing engagement with a community of learners. Data on frequency of use or proficiency with different tools shows that this group of preservice teachers are very well connected, and becoming increasingly so, but their preferences for choice of tools (and by extension, the types of learning behaviours) may be narrowing, even with the explosion of new applications and devices available. The changes reported in the current study, however, seem to reflect the wider societal use of mobile technologies.

In terms of learning behaviours, changes between the two years as data points in the current study suggest that this group of preservice teachers are using some of the social media tools in ways that may link them together beyond pairs or very small groups. Thus, there appears to be evidence in this study that preservice teachers are, to some extent, connecting to wider networks for their science learning and perhaps gaining access to knowledge and skills indicating participation in a wider community of learners. Herein represents an important aspect of mobile learning technologies in preservice teacher education: using familiar (and ubiquitous) technologies could enable these learners to be part of a professional network that builds knowledge collectively. This is important because they are novices in a profession that is based on social constructivism. In other words, as educators, their ability to connect with colleagues serves the important purpose of engaging collaboratively with the profession and collectively building understanding about learning and teaching.

When virtually all preservice teachers use smartphones as their primary device for accessing the internet and communicating with friends and family, we might expect that learning behaviours will continue to evolve to both gain access to knowledge networks, but also to become contributing members of the knowledge community. We see this with Facebook Group membership, but we are also beginning to see deliberate effort to use social media tools to access wider groups beyond the invited membership ones such as Facebook. Patterns evident in our data suggest these learners are beginning to use the social media tools in ways that facilitate their learning rather than just to be connected and share information locally. When they use the available social media tools to develop connections more widely, they are beginning to show signs of connectedness and thus open to forms of emergent learning that we as teacher educators hope to foster during the preservice program. Thus, this study adds to our understanding of how changing social media practices among preservice teachers could be better utilised to help build their knowledge as future teachers and members of a professional community, and as teacher educators, we can more deliberately draw on mobile technologies for learning, which is also a key aim for educational technologists more generally.

6 Acknowledgement

We wish to thank the Faculty of Education at the University of Wollongong for financial support for this research and the anonymous reviewers who provided helpful feedback on earlier versions of this paper.

7 References


Encouraging Faculty Development through Micro-Credentialing

Lisa O’Neill

Teaching Commons, York University, Toronto, Canada

Abstract. This paper describes the design and development of a badging framework to recognize and reward faculty who invest in educational development practices, and the mobility built into the design, which is expected to reach faculty where they are ‘at’ in their development. This short paper begins by framing the project’s guiding questions and assumptions, and then details the design and development approach employed. The project, once complete, hopes to expand upon the types of personal and professional learning that ‘count’ not just to faculty but to their institutions.

Keywords: flexible learning, mobile communities or practice, faculty development, micro-credential, reward and recognition.

1 An Overview

The Teaching Commons (TC) at York University is responsible for enhancing the institutional culture of teaching and learning by implementing professional development programs for new and experienced faculty, and disseminating evidence-based good practice in teaching in higher education. To meet these responsibilities, our department, and centers of teaching and learning in general, offer formal training and events, which mirror much school activity. For many faculty however (I include myself within this group), the recognition of “strategies for intuitive reasoning, resolving issues, and negotiating meaning that individuals develop through everyday activity can feel absent” (Hengstler & O’Neill, 2002, p. 72).

‗Seat time‘ in a workshop or seminar does not fully attend to ‘real world’ learning and application. To respond, the TC has reviewed reward system implementations to see where we could improve our dissemination of good practice. One study reviewed expressed teacher concerns about foregrounding teaching techniques, by recognizing mainly workshops and conferences, which teachers felt “overshadowed more intangible complex processes of learning in practice” (Fenwick, 2009, p. 4). This study confirms the need for centers of teaching and learning to recognize the myriad of approaches faculty take to improve their practice. In June of 2016 the TC began a 12-month project to implement a reward and recognition program, which honors these complexities, in faculty development, at York University. This short paper introduces the projects purpose and assumptions, and identifies the approaches used to design and develop the program. Work will continue through the 2017 implementation and evaluation phase to develop a report of findings and recommendations for an expanded, institutional implementation.

Since deep learning can extend across multiple contexts, experiences and interactions, and faculty improve their practice in a multitude of ways, it is vital to design and implement educational development activities to include them (Gibson, 2013). Amundsen, and Wilson (2012), through their meta-study of almost 30 years of educational development literature, identified five areas of educational development practice3 that captures the complexity of faculty development (Amundsen & Wilson, 2012). These five areas (skill, method, reflection, disciplinary, institutional, and action research or inquiry) will be considered in the design of the reward and recognition system that the TC will implement to assure we meet our mandate of disseminating evidence-based good practice in ways that support these areas. These same multitudes of context, experience and interactions call out for increased flexibility and mobility in everything we do. The design and development will also look at ways to integrate rewards into the social networks our faculty and staff use most often (LinkedIn, Wordpress blogs and faculty pages, etc).

3 Amundsen and Wilson (2012) use the term ‘educational development practice’ to summarize the variety of terminology utilized in the body of literature reviewed in five educational development clusters (Amundsen & Wilson, 2012).
Overarching Question

How will the TC, to encourage experimentation and growth, reward educational development in flexible ways that honor the complexity of educational development practices?

Design and Development Questions

- What approaches to rewarding experimentation and growth encourage further experimentation and growth?
- What badge attributes and approaches contribute to the legitimacy of micro-credentialing at an institutional level?

2 Designing a Framework

Re-envisioning Educational Development

Many models of self-directed learning recognize context/situation as key to effective learning because a situative perspective does not separate knowing from that which is known; “rather, there is an assumption that practice, meaning, and identity constitute and are constituted within context” (Garrison, 1997; Barab & Kirschner, 2001, p. 6). Transforming the higher education learner experience, by encouraging faculty experimentation and growth, will require formative functions to be guided by modern constructivist theories of learning, while many transformative functions will likely require emerging situative theories of learning (Hickey, 2012). Constructivism, seeing no knowledge independent of the meaning attributed to how it is experienced (we only construct knowledge for ourselves as we learn), will guide where rewarded developmental practices occur (Dewy, 1938). Also, as mobile devices like smartphones become more prevalent in higher education development and delivery practices, the TC must adapt our faculty development practice to model incorporation methods. A situative perspective will help faculty reconsider their definition of ‘classroom’ as they experience developmental activities in location, which utilize mobile and flexible teaching and learning practices.

As a way of connecting self-directed learning to the provision of formal services that the TC offers, maps have been developed which attempt to capture the complexity of TC services available to institute faculty. Facilitated discussion identified/added self-directed activity, not yet rewarded, to the map. This larger map respects faculty choice and motivations to invest in developmental activity. Micro-credentials (commonly known as badges) are expected to measure and recognize skills that are valuable in many contexts at a finer level (Bowen & Thomas, 2014; Paul & Chandler, 2015; Gibson, 2013). The department can now move through a process of creating badges for faculty who wish to be formally recognized for improving their practice in large and small ways. Two design assumptions underpinning this project are that i) by making the self-directed, informal and formal ways that faculty improve their practice explicit, we create pathways that encourage long term participation in educational development practices (generally), and ii) by adding rewards for self-directed and informal activity to our current formal workshop credentials/rewards we will increase faculty participation in formal TC activities, and in emerging TC conversations that connect educational practices to varied contexts (specifically).

Creating Leverage through Reward, and Community of Practice Participation

The key to the sustainability of instructional interventions, if you look to the literature on personal change, is to choose small change first, within the program of instruction, and through the faculty member (Austin, Connolly & Colbeck, 2008). This idea is reinforced within the organizational change literature of Hegel III, Brown, and Davison (2010) when they speak of creating leverage. Rather than seeking massive change at the outset, the focus should be “on defining pragmatic paths to institutional change in ways that deliver near-term value to strengthen champions of change and neutralize resistance of entrenched interests” (Hegel III, Brown & Davison, 2010, Intro, Sec 6, pp. 6). There is a growing belief in the academic community that badges are one approach to inciting faculty to be this leverage (Hegel et el, 2010; Gibson, 2013). Unfortunately, strong course evaluations ratings, grant approvals, and publications are still the prominent method of determining tenure with very few institutions recognizing faculty engagement in technology or the incorpo-
ration of new forms of pedagogy (Warger & Dobbin, 2009; Bates & Sangra, 2011). It is challenging to incite change when faculty are disinclined to experiment while job security is perceived to be at stake. By building a badging system and revising our mobile application, to guide their integration of new forms of pedagogy and reward their investment in change practices, we aim to create leverage in this area. This projects analysis and reporting phase will seek to connect improved practice to improved course evaluation and publication opportunities, and generate guiding principles for larger scale implementations at York University.

Although “badges can be a pointer or reference to a process by which a learner engages in and receives validation from a community that practices authentic assessment” (Gibson, 2013, p. 461), one study found that teachers were more interested in sharing their digital badges with their school administrators than through their social networks (Grunwald and Associates, 2015). The TC currently communicates faculty and graduate students through a mobile iOS application to announce formal workshop calendars and conferences, and to introduce new faculty to our team and services. The badging system will be incorporated in to this application to change the app from its primarily disseminating function to an interactive assistant which connects members, aids users in moving through development pathways, and collects/stores badges to an application backpack, where badges can then be reposted to twitter and/or LinkedIn.

Connecting the Dots

Stronger connections between digital badges and other relevant innovations such as competency-based education, e-portfolios, credit for prior learning, and stackable credentials seem like promising directions for increasing the perceived value of open badges. (Educause, 2015, p. 1)

When designing the badging system, a crucial first step was to better understand how we offer faculty opportunities for experimentation and growth. “Like a black box [our offerings] appear immutable and inevitable, while concealing all of the negotiations that brought it into existence” (Fenwick, 2009, p. 5). This required a scan of our workshop calendar and website to capture what we say we do/offer. We then captured our less formal consultation services. Other ways that faculty development occurred with and without the centers involvement were then identified and added to the map. The mapping process helped to cluster offering into recognizable skillsets, and by creating levels of badges, we could reward faculty for shorter investments (moderate a session at a TC event, post or reply to a TC blog reflective question, creative commons license an asset, etc). The final map, shown in Figure 1, makes explicit how practice and knowledge emerge through relations amongst events as well as people in joint action (Davis & Sumara, 2006). This map also functions as the taxonomy for the badging addition to our ios application.

Through a system of micro-credentialing, educational development activity, now recognized at multiple levels, should encourage a variety of faculty practice improvements. This should strengthen our relationships with these individuals over time. Threaded throughout the badging system, and made available through the mobile app, are community of practice points of entry, and informal discussion/contributions of community members as they share their growth with each other, from where they are ‘at’.

Another key byproduct of the badging system development project is a refined and standardized data collected system. Historically the response rate on end of course surveys (our primary summative feedback mechanism), has been far lower than 100%. To improve upon the response rate in our surveys we incorporated badging system mechanisms to help. The release of a badge to a faculty member will occur upon receipt of a badge request form. Faculty will review criteria in the form, and confirm that they have met all requirements before submitting their request. For formal workshops where a badge is issued, faculty must confirm the summative workshop survey was completed. If they have not yet done so they are redirected to the survey. Also, our summative workshop surveys have been revised to inform faculty that they may qualify for a badge, linking them to the badge request form to review criteria. For more significant badges, which require an earner to share in-practice perspectives, the badge request form includes 2-3 reflective questions, which ask faculty to share how the educational development practice changed their perspective on teaching and learning. Responses to these questions will be analyzed to respond to these project design and development questions.
3 In Summary

Through the linking of current structures (formal training, informal consultation, assessments, and feedback) and future structures (flexible reflection, reward and recognition) the TC should better support, and improve upon the positive impact of each. The project will continue throughout 2016 as data is collected from faculty and institutional leadership. Summative feedback, reflective question responses and educational development and reward focus groups will further refine our reward and recognition program.

Academic models are often at odds with the ways we learn in every day activity. Bates and Sangra (2011) want our focus on change driven through “our assessment of the needs of students in the twenty-first century, and not by the existing institutional requirements that they must fit into” (p. 477). Educational development activity therefore should employ “a myriad of different visions, to meet the diversity of learning environments” (Bates & Sangra, 2011, p. 477). Faculty development models, appropriate to current teaching and learning environment, require a change in methods and process.

The TC badging system at York University supports 5 of the 12 identified trends in mobile learning for the near future (summarized in Table 1) (Kochattil, 2016).

To emphasize “the collective, situated and provisional nature of knowledge” (p. 18), a practice lens “offers insights into the dynamics of knowing and learning… by focusing on the way work gets done and on how knowledge is generated and applied in the process” (Sole & Edmondson, 2002, p. 4). Acknowledging and rewarding the informal and self-directed learning that faculty invest in, should improve upon the educational development practices the TC encourages. The expectation from the integration of a badging system to the educational development practice of the TC is community growth, and deeper learning, in increasingly flexible ways, which meet faculty where they are at, and motivate their continued growth and development.
Table 1. Adapted from Top Mobile Learning Trends for 2016 (Kochattil, 2016)

<table>
<thead>
<tr>
<th>Flash to HTML5</th>
<th>Device agnostic design approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile app analytics</td>
<td>“Analytics will play a major role in providing insights into the interaction pattern and behaviour” of the badging function in our iOS application during its inaugural year so that recommendations can be made to ‘scale up’ the system (pp. 8).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multi-screen usage</th>
<th>Responsive web design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bite-sized learning</td>
<td>Because “information does not always come in large chunks anymore; they come in tiny pieces that are easily digestible called “snippets” or &quot;nuggets”’ the badging function in our iOS application will be linked to areas of the TC website that provided self-directed ‘just in time’ support to faculty and staff (pp. 11).</td>
</tr>
<tr>
<td>Competency-based learning</td>
<td>Professional competency development, using mobile videos and simulation, will be linked to other available self-support resources to recognize these efforts more accurately (using analytics to identify ways to link site elements most effectively).</td>
</tr>
<tr>
<td>Gamified learning</td>
<td>Because “gamification has revolutionized mLearning by making it more fun, engaging, and convenient” the badging system mapping process has applied game logic to help users of the system ‘level up’ (pp. 13). This is expected to keep faculty and staff coming back as new opportunities to learn and socialize are added.</td>
</tr>
<tr>
<td>Geo-location sensitive learning</td>
<td></td>
</tr>
<tr>
<td>Augmented reality</td>
<td></td>
</tr>
<tr>
<td>Social mobile learning</td>
<td>Discussions, events, and groups focused on the scholarship of teaching and learning will participate in brainstorming and discussions through functionality in our iOS application to keep our Community of Practice connected, with the aim of “transforming social interaction among learners and how they share knowledge” (pp. 16).</td>
</tr>
<tr>
<td>Wearable technology</td>
<td></td>
</tr>
</tbody>
</table>

4 References

Armundsen C and Wilson M (2012) Are we asking the right questions? A conceptual review of the educational development literature in higher education. Review of educational research, 82(1) 90-126


A Mobile Sensor Activity for Ad-Hoc Groups

David Parsons, Herbert Thomas, Milla Inkila

The Mind Lab by Unitec, New Zealand

Abstract. Designing mobile learning activities requires us to consider which key affordances of mobile devices can support the optimum learning experience. This short paper reports on the design and testing of a BYOD mobile learning activity that was based on an analysis of affordances and a survey of student preferences. It outlines the affordances and preferences that were identified and how these were included in a broader set of design requirements. It explains the choice of tools adopted for the activity, and how they were integrated into the overall learning experience based on using mobile devices to find locations and gather sensor data. Some interim observations are made around the experience and the collaborative data set gathered by the participants.

Keywords: sensors, affordances, GPS

1 Introduction

Mobile learning benefits from certain affordances that can be leveraged by a combination of mobile devices, mobile learners and environmental contexts. These affordances include portability (Naismith et al., 2004), data gathering (Orr, 2010), communication (Liang et al., 2005), interaction (Lai et al., 2007), contextual learning (So, Kim & Looi, 2008) and outdoor environments (Tan and So, 2015).

In a previous study (Parsons, Wishart & Thomas, 2016) we undertook an analysis of mobile learning affordances and embodied these into a survey of in-service teachers undertaking a part-time postgraduate course in an effort to identify which of these affordances should be included in a specific mobile learning activity aimed at these mature, professional students. The results of this survey indicated that the respondents would prefer an outdoor activity over an indoor one, would like to use device sensors, and would like to engage with QR codes rather than GPS location. Using these results as a guide, but also taking into account a number of other factors that influence the teaching and learning space, we analyzed the design context for the mobile learning activity. From the results of the survey, we aimed to develop a collaborative, outdoor, sensor based activity. This activity would be based on a Bring Your Own Device (BYOD) approach, since this was the normal policy of the course on which the teachers were enrolled. The activity also needed to fit into the curriculum and schedule constraints of the course delivery. Thus it needed to integrate into a 30-minute ‘station rotation’ blended learning class context (Staker & Horn 2013), where the activity would be combined with others happening at the same time. There was limited setup time so the software tools for the activity had to be easy to install and use. Another constraint on the tools was that they had to be free to use, so that the teachers enrolled on the course could use similar activities in their schools with their own students without additional cost. A further constraint was that the course runs over six different sites across the country, and local setup had to be kept to a minimum. As a result of this constraint, despite the results of the survey, we designed the activity to use GPS rather than QR codes, since these could be set up virtually and did not require someone at each physical site to locate printed QR codes outdoors.

2 Collaborative, Contextual, Outdoor, Data Gathering and Visualization

Given the mobile affordances that we wanted to take advantage of during the mobile learning activity, we had to find some way of enabling outdoor navigation that would include the gathering and sharing of data, communication, interaction with different devices, and learning related to context. We also had to identify the purpose of the activity in terms of its learning outcomes and how we might gather evidence of this. We decided to focus the activity on learning about sensors and how they might be used to measure environmental factors. The addition of multiple new sensor types has been one of the most significant changes to mobile
device capability in recent years. Today’s mobile device is a powerful sensing platform that enables the user to distill meaningful views of their activities (Cardone et al, 2013). There are three generic types of sensor fitted to mobile devices; motion, environment and position (Android Developers, n.d.) Position sensors can be used to guide learners to different locations, while environmental sensors allow learners to explore and measure their environment, e.g. weather, noise pollution, light and shade, geography (orientation, elevation) etc. Motion sensors can be used for some types of measurement, and also for control of other devices, such as robots. For this learning activity we chose to focus on position and environmental sensors, and on enabling our students to explore the availability, reliability and potential uses of such sensors on their devices.

**Collaborative Data Gathering and Analysis with BYOD**

To integrate collaborative communication into the activity, students were divided into small groups, and each group was tasked with taking a set of environmental measures at three specified locations and sharing these on a single Google spreadsheet, thus allowing all learners to pool their data and be able to compare and contrast the results from multiple sites and locations on different days. From this, it was hoped that they would gain some insights into how sensors can be used to measure the environment, what types of measures are available, and what kinds of interpretations might be made of these measurements. We wanted them to realize that their own smart phones are not only communication devices, but also powerful computing units with rich sets of embedded sensors, introducing the concept of mobile decentralized sensing based on smartphone capabilities (Cardone et al, 2013).

**Outdoor Navigation App - ARIS**

Given the need for the activity to take place outside, some kind of navigation software was needed, preferably one designed specifically to support mobile learning activities. Key selection criteria were that it had to be free (so that it could easily be used by our students in their own schools), it had to be able to trigger geolocated events, it had to enable the same activity to be run in multiple locations and it should not be aimed at a particular age group, since the teachers enrolled on the course taught at all school levels. After an extensive review of the potential tools available for this purpose, the ARIS application was selected. There were a number of reasons for this choice. First, it is a rich environment for creating location-based mobile learning activities. Second, it was developed by a university (the University of Wisconsin) rather than a commercial organization, and, as such, is not only free to use but free from adverts or other commercial components. Third, it has an extremely useful facility of allowing mobile learning activities to be duplicated and modified very quickly. Given the multiple sites over which this activity was to take place this was a particularly useful feature. Since client applications are only able to run on iOS devices, it was clear that not all members of the group would be able to run this application on their BYOD devices. However, we turned this to our advantage by creating a collaborative mobile learning activity where only a minimum of one member of each group would need to have the ARIS app running on a device. Figure 1 shows some screen captures from the ARIS activity, showing its main features.

**Sensor App - Sense-it**

The other software component that was important to the activity was something that would enable device sensors to be used. The best tool that we identified for this purpose was Sense-it (Sharples et al, 2015). Unlike many of the alternatives, it can recognize and utilize every available sensor on the device. Sense-it runs only on Android devices, which had the advantage in our context of balancing out the fact that ARIS only works on iOS devices, thus members of each mobile learning group were likely to be able to run either ARIS or Sense-it, regardless of whether they had an iOS or Android device, emphasizing the benefits of collaboration in a BYOD environment.
3 Data Gathering and Analysis

During the activity, the participants explored their own devices and took whatever measurements they were able to. The number of different measurements that were taken, and the data ranges, fell under eight categories as shown in Table 1.

<table>
<thead>
<tr>
<th>Sensor Readings Taken</th>
<th>Units of measurement</th>
<th>Number of measurements taken</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>lux (lx) equal to one lumen per square metre</td>
<td>64</td>
<td>589.2 lx to 1977.7 lx</td>
</tr>
<tr>
<td>Sound</td>
<td>decibel (dB)</td>
<td>75</td>
<td>from 42 dB to 88.4 dB</td>
</tr>
<tr>
<td>Temperature</td>
<td>degrees Centigrade (°C)</td>
<td>63</td>
<td>15.2 °C to 30 °C</td>
</tr>
<tr>
<td>Atmospheric pressure</td>
<td>hectopascal (1 hPa = 100 Pa) equal to one millibar</td>
<td>46</td>
<td>982 hPa to 1022 hPa</td>
</tr>
<tr>
<td>Humidity</td>
<td>percentage (%)</td>
<td>51</td>
<td>from 50% to 80%</td>
</tr>
<tr>
<td>Compass</td>
<td>relative orientation</td>
<td>41</td>
<td>-10 meters above sea level to 298 meters above sea level.</td>
</tr>
<tr>
<td>Elevation</td>
<td>meters above sea level</td>
<td>36</td>
<td>N/A</td>
</tr>
<tr>
<td>Wind speed</td>
<td>Kilometers per hour (kph)</td>
<td>18</td>
<td>range 0.3 kph to 38.4 kph.</td>
</tr>
</tbody>
</table>

As might be expected, the affordances of different devices enabled the collection of different environmental measures, with the result that the range of measurements recorded varied considerably from one learner to the next. Over the course of the activity, 42 teams of 101 learners participated across six sites, so they were able to compare their combined results across multiple readings from three locations locally and across sites.

4 Outcomes

As a result of the mobile activity and post-hoc discussion, the participants gained increased awareness of different sensors on smartphones, their potential for mobile learning activities, and various limitations on
accuracy (Rana et al, 2015). They also saw the opportunities using different devices in a collaborative BYOD approach provides for problem solving and data gathering. They also gained some experience of elements of the uses of smartphones for crowdsourcing data (D’Hondt, Stevens & Jacobs, 2013), by pooling their resources for shared analysis, and the role of affordances in contemporary mobile learning.

Our experience in running this first pilot activity has given us insights into new directions that we can take this type of sensor-based learning experience with future cohorts.

5 References


Conserv-AR: A Virtual and Augmented Reality Mobile Game to Enhance Students’ Awareness of Wildlife Conservation in Western Australia

Luke Phipps, Victor Alvarez, Sara de Freitas, Kevin Wong, Michael Baker and Justin Pettit
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Abstract. Conserv-AR is a mobile game application that employs virtual and augmented reality concepts alongside games design in order to increase awareness and knowledge surrounding environmental conservation in Western Australia. This paper discusses the rationale behind our use of virtual and augmented reality, game design elements, mobile technology and wearable devices. It also explores the design and implementation of the current application, as well as the current status and future direction of the project.

Keywords: augmented reality, virtual reality, mobile learning, education, wearable technology

1 Introduction

Augmented Reality (AR) and Virtual Reality (VR) are concepts that have gained – and are forecasted to continue gaining – momentum in recent years (Merel 2015). AR and VR can be applied to an array of devices, including smart phones and wearable technology (Antonioli et al. 2014). As the idea of mobile applications that use AR and VR has increased in popularity, a plethora of studies have been conducted, delving into how the technology can be leveraged for education purposes. The application of these technologies is viable for traditional and blended classroom environments, allowing students to engage with topics in a personal and immersive way (Antonioli et al. 2014). Consequently, the paradigm shift away from the lecture-style of teaching that has been experienced recently (Eagan et al. 2014) is conducive to these technologies becoming more popular.

Conserv-AR is a mobile game developed by students from the School of Engineering and Information Technology at Murdoch University. Conserv-AR uses elements of Augmented and Virtual reality in order to raise awareness and educate students about wildlife conservation in Western Australia. It has been implemented using Android smart phone devices, as well as Epson’s wearable smart glasses, the Moverio BT-200. Conserv-AR was designed to be a serious game, striving to blend education with entertainment. With that goal in mind, there are elements of storytelling and dialogue that seek to enhance the engagement that is already inherent to AR and VR applications (Serio et al. 2013).

2 Rationale and Related Work

Augmented Reality technology has seen success in traditional middle school classrooms, showing that it can increase student attention and satisfaction – and therefore task completion rates – when compared to a “slides-based learning environment” (Serio et al. 2013). Mobile and location-based AR applications that make use of Quick Response (QR) codes have also been shown to promote student learning and engagement in a university setting (Lucia et al. 2012). Additionally, studies show that education methods that utilize AR are effective at mitigating the negative effects of learning disabilities such as Attention Deficit Disorder (ADD) (Dunleavy et al. 2009).

While classroom teaching is subject to financial and resource constraints, off-campus teaching requires that technologies be affordable and easily accessible to regular students, as well as portable and easy to use without supervision. Since the number of people that own mobile devices has increased to the point where a
majority of Australians now own smart phones (Deloitte 2015), utilizing this technology for off-campus education addresses that concern.

There are advantages to using more expensive equipment such as wearable technology when delivering AR and VR mobile educational content. A study published in Computers & Education suggested by facilitating first-person perspective and allowing hands free access, wearable devices could allow students a high level of immersion in their education (Bower and Sturman 2015).

Serious games design has emerged as a major field of interest in the education body of knowledge (de Freitas and Maharg 2011). Research shows that game elements can enhance user interest and engagement with learning for an array of topics, both in and out of school environments (Bredl 2013).

It is the aim of the Conserv-AR application to synthesize these elements and deliver a product that leverages the benefits of current technologies and applies them in an educational context.

3 Project Context, Design and Implementation

Conserv-AR is a student project for a unit called 'Game Development' focused on the development of video games using serious games theory. The development had the supervision of the unit coordinator and an expert in educational technology acting as the “client” for this project. The development methodology followed an iterative process with regular meetings with the client to ensure the adequacy and quality of the deliverables. The storyline and content design were supported by experts in environmental conservation from Murdoch University.

As the main purpose of this game is education and learning, concepts from serious games: context, convergence of play-representation and reality-representation, experiential learning, role-play and feedback/reward (de Freitas and Maharg 2011) are incorporated, aiming at supporting a transition from instructed-learning to a self-centred learning experience. Conserv-AR makes use of Augmented and Virtual Reality concepts, as well as borrowing ideas from video game design, such as storytelling, scoring and interactive gameplay. Features of AR and gaming are used to increase learners’ motivation (Bower et al. 2014). VR adds an extra layer of immersion, providing an engaging way for students to visualize their progression.

Conserv-AR takes the players on a field-trip using GPS coordinates. The player chooses an animal and topic that they wish to learn about, and then the excursion begins. The player is guided by a dynamic map and a waypoint arrow. Once the players reach a waypoint location, they are alerted and tasked with searching the location for a target image. This target image acts like a QR code and displays a virtual 3D object in real space using the software plugin Vuforia (Vuforia 2016). This 3D object provides the player with a short text-based passage of information about the chosen knowledge area. The player then enters a virtual dialogue with a game character, who asks them three multi-choice questions based on the information provided. Once the player has answered these questions, they will carry on to the next waypoint. In the current version there are four waypoints per excursion.

Figure 1. The Primary Field-Trip User Interface
When an object is collected during a field-trip, it will be stored in a virtual reality environment that the player can access at any time. This virtual environment serves as a means of reviewing information without having to be on location every time. Players can review the information they have collected multiple times in a self-directed manner. One of the important design considerations is the incorporation of an evaluation module into the game to allow tracking learning objectives. Quizzes are used to fulfill this requirement. Moreover, the game has a data collection module to assess and give feedback about the progression in the game. Player’s information is stored locally on a profile account. This allows students/learners and their supervisors to visualize the progress in specific knowledge areas.

### 4 An Example of Application in Environmental Conservation

Conserv-AR addresses the potential of using mobile, Augmented and Virtual Reality technologies in natural environments for education and community awareness. Conserv-AR has been applied to environmental conservation at Murdoch University, specifically focusing on the Carnaby’s Black Cockatoo, an endangered WA bird species.

The first version of Conserv-AR was developed for the Android operating system and deployed on smart phones and the Epson Moverio BT-200 smart glasses. While the use of the Moverio BT-200 benefits from being a wearable device, the current cost and limited availability of smart devices means that in practice, the smart phone will be the preferred device for any larger scale implementations. Additionally, smart phones have demonstrated more flexibility and better reliability in rendering mixed AR/VR visualizations.

The use of smart phones makes it possible for teachers to incorporate Conserv-ar in the classroom and assignments in a seamless and cost-efficient manner. The current implementation reads from a text file that specifies the points of interests/waypoints (GPS coordinates), knowledge/information (≈350 characters) and multiple-choice questions (≈30 characters question plus four possible answers with one correct). By editing this text file, teachers can easily modify the contents and scope of the activity.

While the effectiveness of Conserv-AR as a teaching tool has not yet been assessed, the first prototypes have been met with great enthusiasm by academics and practitioners at Murdoch University and The University of New England. Conserv-AR was also presented at the ACS WA Young IT Bright Sparks competition at Curtin University and it will be showcased and discussed in other academic and research events across Australia.

### 5 Current Status and Future Work

Conserv-AR is an ongoing project that is currently in development. The application focuses on educating in environmental protection and raising awareness of conservation issues facing Australia’s southwest, and how Murdoch University is contributing through participation in wildlife conservation programs. The game content is currently limited to the Carnaby’s Black Cockatoo, however in the future we will increase the number of animals and topics covered. This game also provides a starting point for future expansion into ‘citizen science’ (Cohn 2008) as well as topics outside of environmental conservation.

In future versions we will incorporate automated log registering and tracking information to facilitate analyzing students’ interaction with the system. Additionally, interviews and surveys will be useful to gaining insights about interest, motivation, usability and acceptability aspects of this application.

Finally, we also consider integration with Ariane (Alvarez et al. in press), a web-based authoring tool for the design of outdoor AR learning activities, would allow for more flexibility and adaptability in the conceptualization and assessment of the activities/assignments. This would assist teachers and practitioners with little to no programming experience in using the tool effectively and place the content as the primary focus of the instructional design.

### 6 References


Bring-Your-Own-Device or Prescribed Mobile Technology? Investigating Student Device Preferences for Mobile Learning

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Abstract. This paper contributes to the growing body of scholarly inquiry into the BYOD (‘Bring Your Own Device’) versus prescribed (minimum standards) technology for learning by reporting on findings of a mobile technology trial. The study investigated student experiences with and preferences for mobile devices, depending on whether those were loaned or owned. Student participants were loaned a Samsung Tablet and instructed on how to use it for various learning activities throughout a teaching period. Data collected via online survey and face-to-face interviews revealed that students tended to use their owned and loaned devices simultaneously and in a complementary manner rather than choosing to use one device for all learning activities. As most student participants already owned personal mobile devices and used those for some learning activities of their choosing, students did not think they acquired any new skills as a result of this initiative. However, students felt that using the loaned Table had overall improved their digital literacy skills such as typing and reading speeds as well as enhanced their productivity and ability to multi-task. Drawing on findings, we offer considerations on how to fully leverage mobile learning technology in the classroom, regardless of whether mobile devices are loaned or owned.

Keywords: BYOD; prescribed technology; digital literacy; mobile learning

1 Introduction

Student-owned personal mobile devices might be ubiquitous on university campuses but mainly are still “hidden in students’ pockets”, remaining under-utilised in the classroom (Herrington, Herrington, Mantei, Olney, & Ferry, 2009, p. 12). The potential of mobile technology for learning remains promising: technology-enabled or enhanced learning (mobile learning, or m-learning) can give students better control over their educational experiences, help them personalise learning based on their needs, interests and locations and support their inquiries by enabling collaboration, peer review, timely feedback and authentic assessment (Jones, Scanlon, & Clough, 2013).

Student adoption of m-learning practices presents an important area of inquiry (Park, Nam, & Cha, 2012). Park et al. (2012) identified such factors as students’ attitudes towards m-learning, their perception of its relevance to their academic disciplines as well as to their future job prospects as significant. However, mobile device distribution is not always uniform. According to a study conducted on a regional Australian university campus (Farley et al., 2015), students who studied on campus, those who were in their first year of study and those who were unemployed or from non-English speaking households were less likely to own a personal mobile device (such as a smartphone). The statistic that lower socioeconomic status (SES) students are less likely to own a smartphone than higher SES students (Anderson, 2014) is of importance to Australian universities where lower SES students tend to be over-represented (Shah, Bennett, & Southgate, 2015).

Addressing the disproportionate device ownership, universities introduce initiatives aiming to provide students with devices or to help educators better utilise devices their students already own. These initiatives may include BYOD and prescribed device programs or a combination of the two. While the abbreviation BYOD is relatively new (Field, 2011) – the trend itself is not. Situated within the context of the consumerisation of Information Technology, BYOD (or ‘Bring Your Own Device’), is now a common occurrence in the lexicon of organisations, including higher education institutions. As such, references to BYOD can be found in educational policies, teaching and learning plans and other strategic documents identifying an institution’s preferred approach to the use of personal mobile technologies present on campus (Afreen, 2014). Within the
higher education context, the BYOD policies are articulated and adopted to facilitate the use of personal devices across learning contexts, the primary aspiration behind it being the creation of what Pegrum, Oakley and Faulkner (2013) refer to as ‘seamless learning spaces’ where learning is not fixed in space and time (Looi et al., 2010). On the opposite end of a personal technology use spectrum is a prescribed (or minimum standard) approach which indicates the institution’s drive to better monitor and control how students and other stakeholders utilise technology by prescribing what devices they can or should use on campus.

In the actuality, however, universities rarely specifically commit to either BYOD or a prescribed approach but rather tend to have a non-specified hybrid approach in place as far as mobile technology on campus is concerned. Furthermore, academics who are engaged in teaching are likely already leveraging the presence of personal mobile technologies in their classrooms, whether it is for student engagement, motivation, peer collaboration or other reasons (Carroll, Diaz, Meiklejohn, Newcomb, & Adkins, 2013; J.-C. Woo, 2014; K. Woo et al., 2008; Zheng, Niiya, & Warschauer, 2015). However, what remains unclear is how either of the approaches to the use of personal mobile technology on campus impacts on various aspects of student learning.

This paper contributes to the growing body of scholarship concerned with issues around BYOD and prescribed technology for learning. It reports on findings of an institutional case study of a mobile learning initiative undertaken throughout 2014-2015 at an Australian university. The project investigated student experiences with BYOD and prescribed technology approaches to the use of personal mobile devices for learning. Student participants were loaned a Tablet device and instructed on how to use it for learning activities throughout a teaching period. Students were then invited to fill out an anonymous online survey about their experiences with and preferences for technology for m-learning. Four students who filled out a survey were also interviewed to generate deeper insights. Findings shed light on the question of how students used their owned and/or loaned mobile devices for learning, what kind of skills they developed as a result and what determined their device choices. While it could be contended that the issue of BYOD vs. prescribed technology is primarily a policy question, concerned with administrative preferences and costs, we argue that it is rather the question of how to take advantage of mobile devices already present in the classroom while at the same time ensuring that access to devices for learning is equitable. While policy is indeed an important consideration in this debate, there are also direct implications for learning where students’ ownership of or preferences for devices are concerned.

2 Mobile Learning Trends in Education

Mobile devices in educational contexts have been found to increase students’ levels of engagement in learning and boost their confidence, while also helping academics to be more creative in their teaching (Rankine-Venaruzzo & Macnamara, 2015). Among the benefits of adopting an official institutional approach to m-learning are increased mobile accessibility within the institution and more opportunities created for students to personalise their learning and for staff to explore diverse ways of teaching in a technology-enhanced mode, as well as a higher level of control over how students access resources and interact with devices’ interface (AirWatch, 2014). Pachler, Cook and Bachmair (2010) position the general concept of m-learning as the process of appropriation where learning is a mode of appropriation which follows the same rules and processes of the internalisation as the use of any other (cultural) product.

However, adopting an official approach to m-learning also warrants a need for clear(er) guidelines, policies and terms of use in order to guide learners and other education stakeholders in their engagement with m-learning (AirWatch, 2014). In particular, students need to be given more than one option of how to engage with m-learning activities as not everyone would be willing to use their personal devices for learning. Issues of technical assistance, security and safety of all users must also be considered (Armando, Costa, Verderame, & Merlo, 2014). It is likely students already have some kind of anti-virus software installed on their personal devices (Armando et al., 2014), however if it is not the case, it is unclear whose responsibility it is to provide such software – students or institutions – and on what basis. Therefore, having compared benefits with possible risks of either BYOD or prescribed approach, an institution then may prefer to have some kind of a prescribed technology program where the university has more control over the devices students use for learning.

Examples of institution-wide m-learning transformations come from such projects as a three-year iPads-for-learning initiative (2012-2014) at the University of Western Sydney (UWS) and University of Cincin-
nati’s (2011) mobile technology course redesign initiative among many others. In the former, UWS purchased 45,000 iPads for distribution among staff and students (Rankine-Venaruzzo & Macnamara, 2015) while Apple offered capacity-building and professional development m-learning opportunities for academic staff. In addition to empowering students to access learning anytime-anywhere, iPads were utilised in a number of imaginative ways, such as by enabling augmented reality activities around campus landmarks to enhance site visits and boost students’ creativity. In turn, students, who were positioned as both creators and curators of diverse digital content situated within the institutional Learning Management System (LMS), appreciated the flexibility iPads afforded (Rankine-Venaruzzo & Macnamara, 2015).

Similarly to the UWS’s institution-wide m-learning strategy, the University of Cincinnati’s College of Nursing endeavoured to redesign its courses to leverage iPad technology (University of Cincinnati, 2011): a small number of iPads was introduced in-class allowing students to use mobile applications (apps) such as iTunes, iBooks, eReader and others. The app codes were distributed to students, regardless whether they were using a loaned iPad or their own device. This BYOD/prescribed combined initiative led to a significant cost-saving for students who did not have to rely as much on printed textbooks; while the marketability of the nursing program has increased, followed by the tuition revenue growth. The active use of both loaned and owned devices allowed students a curated access to many relevant apps, such as SharePoint, FaceTime, email, group meetings, e-text, journal articles, note-taking, and audio/video recording and, as a result, an online community of learners emerged around using these apps.

In regards to the theoretical models of m-learning, the SECTIONS model (Bates & Poole, 2003) and the Planning Framework which builds on it (Centre for Teaching Learning and Technology, n.d.), encourage the consideration of questions in eight key areas in regards to technology use: students, ease of use, costs, teaching and learning, interactivity, organisational issues, novelty and speed. These areas are brought into focus through a process of reflective analysis consisting of four parts: define; assess; implement; and refine. In our study based on an m-learning trial with Advertising students, a richer Blended and Flexible Learning (BFL) experience was proposed where assessment tasks and tutorial activities were given a mobile learning ‘bias’ before being implemented.

Using the SECTIONS and Planning Framework template we have reviewed recent BYOD literature and, as a result, developed a conceptual model of BYOD/prescribed approach which has driven our project’s design and implementation (Table 1).

![Table 1. BYOD vs. Prescribed: Benefits and Drawbacks](image)

<table>
<thead>
<tr>
<th>Feature</th>
<th>BYOD</th>
<th>Prescribed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Portability</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Familiarity</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Acceptable cost</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Acceptable low cost</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Interactive learning experience</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>‘Differential’ instruction potential</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Integrated into personal life experience (ubiquity)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Connectedness - speed of learning</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Facilitates better learning</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Access to industry/professional expertise beyond the classroom</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Equity</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Consistent learning experience</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Security/institutional control over patterns of use</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

As our interpretation of the model shows, BYOD and prescribed m-learning approaches share a number of similarities. However, the prescribed approach has a number of benefits that BYOD approach does not offer, such as a more equitable access to education enabled via mobile technologies available at a low cost or no cost at all to students, as well as a higher level of security it affords both to the technology user and the institution. Keeping in mind these considerations, we have developed our m-learning trial. Findings and considerations arising from this project are presented next.
The Study

The university where this study was located has an unofficial preference for a BYOD policy over a prescribed approach, where the institutional approach is guided by such principles as the ‘creation of a technology environment in which teaching, learning and research will flourish’. Academics are generally encouraged to use educational technologies in their teaching as articulated through the institution’s aspiration to foster innovative teaching practices. Whilst the university’s 2013-2020 Plan makes no formal mention of BYOD, it does refer to the importance of ‘mobility and agility’ stating that ‘a strategy which takes in our desktop infrastructure, mobile access, and ubiquitous wireless’ is favourable. Arguably, this ambiguous statement neither openly supports BYOD nor encourages prescription – a sentiment further endorsed in the university’s 2020 Plan in relation to the significance of connectivity arguing in favour of ‘a flexible and consistent access to applications and resources from all devices, independent of location, wireless and wired’.

Located within this institutional context, our study was guided by the following questions:

- How do students perceive their access to learning material, study experience, engagement, and collaboration, with and without prescribed technology?
- Do students’ perceptions of the above change when they have access to a loaned mobile device?

The study participants were recruited from a larger cohort of students enrolled in an Advertising unit taught by the first author during two semesters in 2014-2015. Due to a limited number of devices available for this trial (22), the recruitment was on a first-come first-serve basis. Participants were loaned a Samsung Galaxy Tablet and instructed on how to use it for various learning activities in this unit. The activities were directed by the unit’s lecturer who guided the students in their use of mobile apps (Feedly, Twitter, Google, ScoopIt, Flipboard, etc.) and other online resources. Students were also given an option to take all their quiz assessments online using the prescribed device whilst in-class as well as to engage with fellow students in online work groups.

An anonymous online survey (N=22) and four in-depth interviews were conducted with participants in the end of the trial. Data, combining quantitative and qualitative elements, was analysed to gauge students’ past and present experiences with m-learning, and their preferences and perceived benefits and drawbacks of using an owned and/or loaned devices for learning. As we were limited in time and resources, we chose not to utilise observation and other ethnographic methods, instead opting out for a more time-efficient way of data collection. The combination of surveys and interviews allowed us to discern general trends as well as gain deeper insights into students’ experiences with personal mobile devices for learning.

The Participants

Half of students who filled out the survey were in the 18-20 age group, and another half in the 21-29 age group, suggesting an equal split between direct school leavers and a more mature cohort of learners. Gender balance was reached with 50/50 split for both survey and interview participants. The largest group of survey participants (32%) have completed 2-3 years of university studies, while another significant group (27%) was in their first year of study and have not completed a full year of studies at the time of the survey. Two groups of student participants (each comprising 18% of the total survey sample) completed 1-2 years and 3-4 years of study respectively, while another 5% completed more than four years of study. Half of all survey participants majored in Advertising, the rest split between Marketing (18%), Media Studies (18%) and Public Relations (14%), with a few students studying a double major degree. Chosen from the survey sample, four students (2 women and 2 men) were invited to take part in a follow-up interview. These students were selected based on their survey answers, deemed representative of different types of technology users. The first male interviewee had a preference for using his own device (iPad) for learning, while another male interviewee was predominantly using the prescribed/loaned Samsung Tablet; and two female interviewees used a combination of owned and loaned devices for learning.

General Experiences with Mobile Learning

Survey participants were unanimous in their response that they were not familiar with the concept of m-learning prior to taking part in this trial. However, majority (86%) owned at least one personal mobile device, which in addition to its other uses was also utilised for learning. It was found that student participants...
tended to use an assortment of devices (desktops, laptops, Tablets and smartphones) simultaneously in a variety of ways to enable their learning. Participants emphasised that their use of all available devices was shaped by their immediate needs and technological habits: they used all of their available devices in such a way as not to duplicate but rather supplement their learning activities. For example, a male interviewee who predominantly used a prescribed Samsung Tablet for learning found that he was using the Tablet to access the apps, while at the same time he “personally prefer[ed] using [his] own laptop [for other aspects of learning] due to better functionality and time required to complete a task.”

Almost all survey participants (95%) found it was easy to operate a prescribed Tablet and over half (55%) did not have to spend any additional time learning how to operate the Tablet. A large group (40%) found they only had to spend about an hour of their personal time early on in the trial to familiarise themselves with the new device and its functionalities. Majority of survey participants (91%) felt they received adequate technical support and guidance to use their loaned tablets for learning. Time required to familiarise oneself with a new device (a “learning curve” as one participant termed it) was also mentioned in the interviews as an important factor when choosing one device other another. Two factors emerged as having a significant influence over student choice of a device for m-learning: student’s prior experience with same or similar device and how fit-for-purpose the device was perceived to be.

A user loyalty to a particular brand or a preference for an operational system were also among key deciding points in how students engaged with mobile technology for learning. For example, interviewees who owned an Android device said they were more likely to engage with the prescribed device offered in this trial because the prescribed device was also Android. Similarly, Apple users were more likely to continue using their own device for m-learning activities as ‘transitioning’ from Apple to Android was perceived as a waste of valuable time.

**Learning New Skills**

Majority of survey participants (77%) did not think they learnt any new skills during this prescribed technology trial. However, most commented on the usefulness of having a ‘prescribed’ device for learning: some noticed an improvement in their typing and reading speed, while others appreciated the guided learning process the lecturer used to familiarise them with appropriate social media language. All students felt that having an extra device helped them multi-task better and overall improved their productivity and efficiency. Both survey and interview participants emphasised how they tended to use their multiple available devices simultaneously and in a complementary manner. For example, they used smaller mobile devices for reading, accessing social media and apps while devices with larger keypads were preferred for typing and submitting assignments. In fact, the convenience of larger keypads (and external keyboards) for typing emerged as a key deciding factor determining which device was used for such activities as writing and submitting assignments.

An interviewee who mainly used a prescribed Tablet but who also owned a personal Android device felt that technical and practical skills (such as setting up the wireless Internet and user profiles, as well as linking up all online accounts and identifying useful apps) were main skills gained during the trial. This interviewee also insisted that students would naturally use a device they were the most comfortable with and this was in turn defined by their previous experiences with technology and preferences they had developed over time (such as a preference for a particular typing method, like touch-typing, using external keyboard or a stylus pen). In fact, a preference for a particular typing method appeared to be among the main deciding factors in a student’s choice for a device for learning. On another hand, a device that offered the best functionality and compatibility with the institutional LMS was also more likely to be chosen for any tasks performed within the LMS, such as assignment submission.

Another advantage of having a prescribed device at their disposal was that participants felt the more versatile they became in using technology, the more beneficial it was for their future employment and professional prospects. This versatility was also perceived useful in students’ academic endeavours outside of this unit of study: students felt that post-trial they became more comfortable with using technology for learning, especially where digital assessments (quizzes), apps and social media were concerned. Over half of survey participants could see a relationship between what they have learnt during this m-learning trial and their performance in other units as digital skills they were required to demonstrate in their studies were virtually the same across all units.
However, distractions brought on by the mobile devices’ 24/7 connectivity and the easy access to social media were found to be drawbacks by participants who felt their attention was redirected from learning to entertainment: in one interviewee’s words, “Facebook in particular [was] frustrating in that it [was] such a distraction, but all of the group projects… at university, it has also been used as a collaboration tool. So it very much is a double-edged sword… Anecdotally… people don’t want to have Facebook but they also don’t want to miss out on events and messages and stuff. It’s almost like a burden for some people.” This issue is in line with studies finding that using personal mobile devices can indeed distract students from learning (Kobus, Rietveld, & Van Ommeren, 2013; Salmon, Ross, Pechenkina, & Chase, 2015). Further, a Charles Sturt University based study found that most discrepancies in student use of mobile devices for learning were due to a lack of guidelines and relevant resources (Charles Sturt University, 2014). Our study participants also expressed a general need for guidance and instructions on how to use their devices most effectively for m-learning.

Most survey participants (82%) felt that the guided use of mobile devices for learning – regardless of whether a device was prescribed or BYOD – helped them better integrate knowledge from the unit; while 86% believed using a mobile device enhanced their learning experience in this unit. As a rule, students “tend[ed] to use what… they need[ed]” for various learning activities, recognising that with “any technology, specific aspects are designed for separate purposes.” In this regard, students felt that personal mobile technology’s main benefit was in enhancing their learning experiences by enabling quick access to the institutional LMS, apps, e-textbooks and PowerPoint slides. Students valued the personalisation of learning personal devices afforded, specifically acknowledging such mobile-technology enabled features as bookmarking, search and annotation in e-textbooks used for clarification and revision purposes. Access to PowerPoint lecture slides was also appreciated as it allowed students to review the study materials later on if the instructor moved too fast or if they missed a lecture. This ability to learn with a mobile device “anywhere, anytime”, including on a busy commuter train or in between classes was highlighted as a major positive aspect of m-learning.

4 Conclusion: Designing an Effective Mobile Learning Experience

A university-adopted prescribed device approach has a potential to address issues around equity, access and digital exclusion. However, as a result of our m-learning trial we have found that whether a device is BYOD or prescribed did not have a significant effect on how students engaged with m-learning tasks. In fact, students’ device choice was dictated by other factors, including previous experiences with technology, brand loyalty and preferences for a device and operating system. Hence, understanding students’ device preferences prior to embarking on a m-learning initiative is important.

In regards to a desired guidance around the effective use of mobile devices, student wished for more examples on “how and where” to use technology in the course of their study. Students also wanted their “[learning] outcomes [to be] tied to mobile devices” use rather than “just doing it for the sake of doing it.” Hence, it is not only important to outline tasks and learning activities students are required to do on their mobile devices, but also to draw clear links of how these tasks are related to students’ overall outcomes in this unit.

Another important consideration arising from this m-learning initiative is concerned with how students decide which device to use for each learning activity. While a Tablet or smartphone might prove useful in surfing the Internet for information or answering a quick online quiz, it may not be a student’s preference for typing and submitting their assignments. In this regard, functionality of the institutional LMS and its device compatibility must also be taken into account. These key considerations – technology user preferences, guidance and structure, and how fit-for-purpose a mobile device is – are the main contributions our study makes to the BYOD/prescribed technology discussion. With benefits specifically associated with prescribed (minimum standard) mobile technology approach limited, further research is recommended to evaluate the impacts of BYOD versus prescribed technology on student learning.

5 References


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How a Blended, M-Learning Approach to Student Evaluations Increases Participation Rates

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\textbf{Abstract}. As universities have transitioned from paper to online student evaluations, concerns have been raised regarding falling or low survey participation rates. We report on our recent study that explored how blended survey methods could increase participation rates in online student surveys. At the heart of our methods was the use of personal devices by students within class time to complete the surveys. We found that this method significantly increased the number and rate of students participating. In some cases, the response rate was higher than those of traditional paper surveys. We also outline the design behind how the blended surveys were administered and list some future lines of enquiry for the research.

\textbf{Keywords}: student evaluations, participation rate, m-learning methods, blended approach to surveys

\section{Introduction}

With student evaluation surveys transitioning from paper to online over the past 10+ years, concerns have been raised regarding falling or low survey participation rates. In the age of big data, these low participation rates have had universities, lecturers and administrators scratching their heads about the resulting “small data” regarding their courses, programs and teaching – and wondering how to increase response rates and engagement between students and universities (Anderson et al, 2006).

The topic of response rates has been discussed by Nulty (2008), who presented some statistically-underpinned guidelines regarding the question of adequacy of response rates and also suggested that universities should seek to obtain the highest response rates possible to all surveys.

There have been a variety of suggestions in the literature on how to raise response rates to online surveys. This includes: sending regular reminders to the students via email or social media (IDEA, 2015); using class time where the students complete the survey on their personal device (Berk, 2012; IDEA, 2015); or offering incentives for students to complete the survey, such as prizes (Crews & Curtis, 2011).

Morrison (2013) also compared paper and online survey results, advocating caution in assuming that the same online and paper evaluations yield similar results.

We report on our recent study that explored how blended survey methods could increase participation rates in online student surveys. By “blended” we mean that students had the choice and flexibility to complete the online surveys within face-to-face class time or outside of class time (for example, if they were not present). At the heart of our methods was the use of personal devices by students within class time to complete the surveys. We found that this method significantly increased the number and rate of students participating. In some cases, the response rate was higher than those of traditional paper surveys. We also outline the design underpinning how the blended surveys were administered, share some guidelines for those wanting to try the method, and list some future lines of enquiry for the research.

\section{Scope and Scale of Project}

Our project was framed within the Faculty of Science at UNSW which is a large, research-intensive Australian university. The study included courses and lecturers from following Schools: Physics; Mathematics & Statistics; Materials Science; Aviation; Psychology; Biological, Environmental & Earth Sciences (BEES);
Optometry & Vision Science; Biotechnology & Biomolecular Sciences (BABS); with the Science Learning & Teaching Unit co-ordinating the work.

In addition to science students, the Schools across the Faculty of Science also teach a range of non-science students from a variety of majors and disciplines, including business, medicine and engineering. Thus, the student cohort for this study was very diverse and seems to suggest that the ideas from this work have the potential to transfer to other situations and faculties.

The project involved two kinds of student surveys under the university’s Course And Teaching Evaluation and Improvement (CATEI) initiative. They were: Course Evaluation surveys (known as CATEI “Form A”); and Teaching Evaluation surveys (known as CATEI “Form B”).

Course Evaluation surveys present students with an opportunity to give feedback on their experience of a course by providing ratings on broad aspects of the course. Teaching Evaluation surveys afford students a chance to provide feedback on their experience of the teaching within a course.

In many cases, there are two separate evaluations associated with each course: one CATEI Form A for aspects of the course such as curriculum and assessment; and one CATEI Form B for the quality of teaching. We have included screenshots from Form A and B surveys in the Appendix to illustrate the specific questions.

The scale of the project involved

- 58 courses with a Course Evaluation survey (known as “CATEI Form A”);
- 51 courses with a Teaching Evaluation survey (known as “CATEI Form B”).

The duration of the project was one semester (Semester 2, 2015).

3 Survey Administration Design and Method

We took a blended and m-learning approach to survey design and administration. By “blended”, we mean that students had the choice to complete the online survey within class or elsewhere at another time. This differs from traditional mutually exclusive approaches where students either complete the survey in class (usually on paper) or they complete it online in their own time. By “m-learning” we mean that students could complete the survey on their personal devices such as: smart phones; tablets or laptops within class. (Around 99% of students owned at least one of these devices, but those who did not own one could use the university’s computers to complete the surveys outside of class.) Benefits of adopting this blended approach include:

- Capturing survey participation from those who attend the class and from those who do not attend, unlike traditional paper surveys;
- Providing economic savings in processing digital survey data when compared with the processing cost of traditional paper surveys;
- Having the convenience of student comments in digital format for analysis, rather than collecting traditional handwritten feedback.

The online course and teaching evaluation surveys were set up electronically on the CATEI system; with an automated email sent to all students on the day the survey opened encouraging them to complete it.

Three days after the surveys had been launched, in-class time would be set aside so that students could complete the surveys on their personal devices. This would consist of an administrator visiting a lecture hall half-way through a lesson, having the lecturer pause the class (and leaving the room to maintain an arm’s length from the process) and students were asked to complete the survey(s) on their personal devices. The lecturer or administrator would stress the importance of feedback and participation. No other incentives were given for students to complete the surveys within class time. See Figure 1 below for a snapshot of students completing the survey in class on their personal devices.
Figure 1. A Snapshot of Students Completing CATEI Surveys In Class

The online survey would remain open for an additional three days after the in-class survey instance, so that students who were absent from class could still have the opportunity to provide feedback.

As can be seen from the survey screenshots in the Appendix, the questions in CATEI surveys are designed around a three-stage process. Firstly, a landing page gathered the demographic information of the student (Figures 3 and 6). Secondly, the next webpage collected open-ended responses regarding commendations and recommendations from the student (Figures 4 and 7). Thirdly, the final webpage featured 10 broad questions that asked the student to provide ratings based on their experience (Figures 5 and 8).

4 Results and Discussion

We summarize the results via Figure 2 below.

<table>
<thead>
<tr>
<th>School</th>
<th>Total Number of Courses with Blended Surveys in Semester 2, 2015 (Form A and B)</th>
<th>Average Response Rate for Blended Surveys in Semester 2, 2015 (Form A and B)</th>
<th>Average Response Rate for corresponding Non-Blended surveys in Semester 2, 2014</th>
<th>Increase in Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>30</td>
<td>34%</td>
<td>16%</td>
<td>18%</td>
</tr>
<tr>
<td>Maths &amp; Stats</td>
<td>15</td>
<td>37%</td>
<td>19%</td>
<td>16%</td>
</tr>
<tr>
<td>Aviation</td>
<td>6</td>
<td>49%</td>
<td>25%</td>
<td>24%</td>
</tr>
<tr>
<td>Psychology</td>
<td>14</td>
<td>32%</td>
<td>23%</td>
<td>9%</td>
</tr>
<tr>
<td>BEES</td>
<td>7</td>
<td>66%</td>
<td>18%</td>
<td>48%</td>
</tr>
<tr>
<td>Materials Science</td>
<td>34</td>
<td>66%</td>
<td>47%</td>
<td>19%</td>
</tr>
<tr>
<td>BABS</td>
<td>19</td>
<td>44%</td>
<td>25%</td>
<td>19%</td>
</tr>
<tr>
<td>Optom &amp; Vision Science</td>
<td>13</td>
<td>57%</td>
<td>26%</td>
<td>31%</td>
</tr>
</tbody>
</table>

Figure 2. Average Response Rates and Increases across Schools

As can be seen from Figure 2, each School in the project recorded an increase in the overall average student participation for course and teaching surveys (S2, 2015 versus S2, 2014) when using the blended survey approach on m-learning devices.
All Schools, apart from Materials Science, employed fully online surveys for their course and teaching evaluations in S2, 2014. From Figure 2, we see that there has been double-digit increase in participation in each of these Schools, except for Psychology (9%) which we attribute to insufficient time being allocated within lectures when the surveys were administered.

The School of Materials Science used traditional paper surveys in S2, 2014 and we have seen a 19% increase in participation under the blended, m-learning survey approach in S2, 2015. We put this down to the blended survey enabling those who do not attend the lecture to still participate.

Overall, there were 7341 course surveys (CATEI Form A) submitted by individual students in Semester 2, 2015. In Semester 2, 2014 there were 5341 submitted Form As. This represents an increase of exactly 2000 student course evaluations, despite the fact that student load in the Faculty only rose by around 7% over the above timeframe.

We found that around 5 minutes of class time was sufficient for the students to complete one survey on their personal devices, which consisted of: demographic-related questions; 10 questions with rating scales; and 2 open-ended, free-text questions (see Appendix). In many cases, a course survey and a teaching survey could be done back-to-back in class. This took less than 10 minutes on average since students were already logged in to the CATEI web portal after completing the first survey and did not have to log in again, thus saving some time.

As can be seen from Figure 1, students used a variety of personal devices to complete the surveys such as smart phones, tablets and laptops.

5 Conclusion and Avenues for Future Research

We conclude that a blended and m-learning approach to student evaluations has significantly increased the number and rate of participation both when compared with traditional paper techniques, and fully online methods.

We suggest the following avenues for future research:

1. One suggestion to increase participation rates further via the blended, m-learning approach is to schedule the surveys within classes where attendance is part of the assessment (such as laboratories or tutorials), rather than within lectures where attendance can drop off near the end of semester.

2. The blended, m-learning approach will face challenges with fully online courses, as there is no opportunity for class time to hold the surveys.

3. For students using smart phones to complete the blended surveys within class, does a “speech to text” function enable richer or more detailed comments than typing the comments in on a smartphone?

6 References


Evaluate the Course MATH2019

Choose Survey Alternative:
Evaluate the Course MATH2019 •

Select Your Demographic:

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
<th>Unspecified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of Study</td>
<td>Full Time</td>
<td>Part Time</td>
<td></td>
</tr>
<tr>
<td>Residency Group</td>
<td>Local</td>
<td>International</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Landing Page for Course Evaluation - Demographics (CATEI Form A)

Evaluate the Course MATH2019

In this section please provide a rating for each broad aspect of the course listed based on your experience. To provide your rating for each aspect, you are asked to indicate how strongly you agree or disagree with a statement. If you are unable to provide a reasonable judgment about an aspect, please use the N/A response code.

Note: Please do not address teaching staff name in your feedback

Q1. The best features of this course were

Q2. This course could be improved by

Go back • Continue
Evaluate the Course MATH2019

Rate these aspects:

<table>
<thead>
<tr>
<th>Course Aspect</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Moderately Agree</th>
<th>Moderately Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q3. The aims of this course were clear to me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Q4. I was given helpful feedback on how I was going in the course</td>
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<tr>
<td>Q5. The course was challenging and interesting</td>
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<td></td>
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<tr>
<td>Q6. The course provided effective opportunities for active student participation in learning activities</td>
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<td></td>
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<tr>
<td>Q7. The course was effective for developing my thinking skills (e.g. critical analysis, problem solving)</td>
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<tr>
<td>Q8. I was provided with clear information about the assessment requirements for this course</td>
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<tr>
<td>Q9. The assessment methods and tasks in this course were appropriate given the course aims</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Q10. The integration of the different components of the course (e.g. laboratory, tutorials and lectures) was useful</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Q11. I learnt a lot from this course</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Q12. Overall, I was satisfied with the quality of this course</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5. Final Page for Course Evaluation – Ratings (CATEI Form A)

MATH1231 Mathematics 1B : Large Group Teaching evaluation

Part 1: General Information

Evaluate Chris Tisdell

Choose Lecture or Tutorial:

Evaluate Chris Tisdell as calculus Lecturer in Course MATH1231

Select Your Demographic:

- Gender: Male, Female, Unspecified
- Mode of Study: Full Time, Part Time
- Residency Group: Local, International

Figure 6. Landing Page for Teaching Evaluation - Demographics (CATEI Form B)
Evaluate Chris Tisdell as calculus Lecturer in Course MATH1231

In this section please provide a rating for each broad aspect of the course listed based on your experience. To provide your rating for each aspect, you are asked to indicate how strongly you agree or disagree with a statement. If you are unable to provide a reasonable judgement about an aspect, please use the N/A response code.

Note: Please do not address teaching staff name in your feedback.

1. The best features of this lecturer’s teaching were

2. This lecturer’s teaching could be improved by

Figure 7. Second Page for Teaching Evaluation – Open-Ended Responses (CATEI Form B)

Evaluate Chris Tisdell as calculus Lecturer in Course MATH1231

Rate these aspects:

<table>
<thead>
<tr>
<th>Teaching Aspect</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Moderately Agree</th>
<th>Moderately Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q3. This lecturer communicated effectively with students (e.g. He / She explained things clearly).</td>
<td></td>
<td></td>
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<tr>
<td>Q4. This lecturer stimulated my interest in the subject matter he/she was teaching</td>
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<tr>
<td>Q5. This lecturer encouraged me to think critically</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Q6. This lecturer provided feedback to help me learn</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Q7. This lecturer encouraged student input and participation during classes</td>
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<td></td>
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<tr>
<td>Q8. This lecturer was generally helpful to students</td>
<td></td>
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<tr>
<td>Q9. This lecturer made the topic relevant</td>
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<tr>
<td>Q10. This lecturer encouraged me to learn independently</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Q11. The lecturer was well prepared</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Q12. Overall, I was satisfied with the quality of this lecturer’s teaching</td>
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</tbody>
</table>

Figure 8. Final Page for Teaching Evaluation – Ratings (CATEI Form B)
Using Cloud Drive for Collaborative Learning in Adult Training

Hwee Leng Toh-Heng

James Cook University, Singapore

Abstract. In Singapore, at the end of 2015, the smartphone penetration stood at 148.4% while the total wireless broadband population penetration rate was 184.8% (Inforcomm Development Authority of Singapore, 2015). Mobile and digital technology, in tandem with the extensive WiFi networks available in all parts of the country, provide opportunities to implement collaborative learning via cloud drives in adult training classes. The author, who specializes in training adult instructors and trainers, implemented computer-mediated collaborative learning for her workshops. The teaching strategy focused on cooperative learning structures underpinned by Vygotsky’s sociocultural theory of learning, and the facilitative nature of learning in Knowles theory of adult learning. She introduced Google Drive as the online platform in her workshops, eschewing paper handouts in favour of softcopy handouts available to all participants on the cloud drive. She guided the participants to access Google Docs, Google Slides and Google Sheets on their laptops, tablets and smartphones for collaborative learning purposes. Reading and discussion activities were designed with Google Drive as the platform for mediating instruction and learning. She started by having participants, in cooperative learning groups access softcopy handouts for reading and discussion, with the discussion points put up on group Google Slides for presentation. Participants moved from merely accessing softcopy handouts to searching for information online for solving problems related to the specific workshop content to discussing and putting together group reports and presentations, all via Google Drive. Participants experienced both face-to-face and online discussion via Google Drive. Almost all participants were new to the online collaborative learning processes experienced in the workshops. However, familiarity with the personal digital equipment brought by each participant to the workshops enabled the participants to overcome the initial disruption of the newness of the learning strategy. Participants appreciated the personal autonomy the collaborative learning process gave to their learning journey.

Keywords: adult learning, collaborative learning, cloud drive

1 Background

Since 1997, Singapore has seen four master plans for ICT in Education by the Ministry of Education, moving from the provision of infrastructure and core ICT training for teachers to empowering learners with the ability and capacity to develop their own learning via digital and mobile technology, with mobile learning being the latest focus (Chua, 2015; Heng, 2014). This has spawned a generation of young adults and students for whom learning is synonymous with technology. Adult learning, however, has a shorter trajectory along the digital and mobile learning curve.

Adult learning can be defined as the learning that adults undertake, after leaving or having completed formal education and training in educational institutions, to acquire new knowledge and skills (National Research and Development Centre for Adult Literacy and Numeracy, 2010). Most adults, therefore, embark on learning usually for the pragmatic reasons of career advancement, career change or the deepening skills or knowledge for work or personal purposes. This is true for Singapore’s adult learning industry as it is for other adult learning institutions worldwide.

In Singapore, the Work Development Agency (WDA) was established in 2003 as the government driver of adult learning, with the Institute of Adult Learning (IAL) established in 2004 as the service provider of adult learning courses for manpower training across the whole manpower spectrum (Workforce Develop-
E-learning was first mooted as the learning platform for adults in 2001 at the One Learning 2001 Asia Conference & Exhibition by the Info-communications Development Authority of Singapore (Yong, 2001). However, the take up was slow among adult learning institutions. The IAL launched e-learning as the platform for adult learning in 2014 at the Adult Learning Symposium organised by the WDA (Tan, 2014). This finally paved the way for digital and mobile technology as mediators of learning for adults, as it has been for students in schools since the launch of the first ICT master plan in 1997. Mobile learning had finally formally arrived in the world of adult learning.

Mobile learning is defined as learner-centric learning that takes place in any location or place mediated by any form of digital and mobile technology (O’Malley et al., 2003). It is predicated on the constructivist school of learning where learners take ownership for their own learning, facilitated in the learning process by teachers or trainers, enabled by digital and mobile technology (Sharples, Taylor, & Vavoula, 2007). Mobile learning, thus, requires an environment of connectivity that can provide learners with easy and convenient access to knowledge, information and courses online via digital technology.

In February 2015, Deloitte’s Global Technology, Media and Telecommunications published their annual Global Mobile Consumer Survey. The Survey, which polled consumers from 22 countries globally, including the Southeast Asian countries of Indonesia, Philippines, Singapore and Thailand, reported that almost nine out of 10 Singapore respondents had access to a smartphone, the highest globally at that point in time (Deloitte Southeast Asia Ltd, 2015). In Singapore, from 2011 to 2015, smartphone penetration levels have ranged between 149.6% to 156%, with the rate at the end of 2015 at 148.4%. The total wireless broadband population penetration rate at the end of 2015 was 184.8% (Infocomm Development Authority of Singapore, 2016). These figures vindicate the movement toward e-learning as a platform for adult learning. Mobile and digital technology, in tandem with the extensive WiFi networks available in all parts of the country, provide opportunities to implement collaborative learning via cloud drives in adult training classes.

The following case study describes the author’s use of digital technology, specifically Google Drive, to implement collaborative and mobile learning in the adult training classes she has been conducting since 2013. She conducts 3-day courses for an adult training agency where course participants, who are instructors or trainers in their own organisations, are encouraged to use digital technology for learning purposes. Each 3-day course comprises three parts: (1) participants learn within cooperative and collaborative learning structures with face-to-face discussions and the cloud drive as the main platforms for learning processes; (2) participants experience a lesson that uses digital and mobile tools for mediating learning; and (3) participants, in cooperative groups, design lessons using the course content via a mobile learning platform.

2 The Story

Since 2008, the author had been using Google Drive in schools, where she was a teacher, to facilitate learning among secondary and high school students. She had based her collaborative lessons on the Knowledge Building framework of Scardamalia and Bereiter (2010) using cooperative learning structures and constructivist learning (based on Vygotsky’s sociocultural theory) by the students (Johnson & Johnson, 2014). Upon becoming an adult trainer in 2013, she realised the need for moving older adults into the world of mobile learning as the course participants comprised a majority of older adults whose learning experiences involved mainly textbooks and other reading and assessment materials in hardcopies, with a small number of young adults who had experienced the ICT experience in their school and tertiary institution classrooms. She defines an older adult as an individual who had completed formal schooling by 1997, the year in which the first ICT master plan was implemented in schools. In the 2013 courses, this group comprised 70% of course participants.

Many courses for adult learning are designed based on Knowles theory of andragogy. Knowles (1984) had postulated, in his constructivist theory of andragogy, that adults learn best when they are facilitated in their learning processes to include their experiences and past understandings, a major resource for that learning. However, many courses still contain the element of lectures where the trainer, as the font of knowledge, espouses the new skill or content to an audience of adult learners. With the abovementioned implementation of e-learning as a platform for adult learning in 2014, the training agency instructed trainers to move away from that teaching format to one of facilitation of independent learning mediated by digital technology.

The author had always used a constructivist and cooperative learning approach in her courses where course participants constructed their knowledge through reading, processing and discussions in cooperative
learning groups. In 2013, her first year of adult training, she introduced Google Drive as a platform for e-learning on the second day of the 3-day courses. Google Drive was used mainly for course participants to download softcopy reading materials onto their laptops or tablets for reading and discussion purposes within cooperative learning groups. The aim was to introduce the older adult participants to online learning, a platform with which many of them were unfamiliar.

With the formal implementation of e-learning in 2014, she redesigned her courses and completely eschewed hardcopy learning materials in favour of e-learning via Google Drive. Processing and discussion were mediated via Google Docs, Google Slides and Google Sheets on Google Drive. Hardcopy materials were used only for discussion and presentation purposes where these facilitated stronger discussion and processing. Otherwise, course participants used their personal digital tools to access learning via the WiFi infrastructure in place at the premises of the training agency. In that year, older adult participants still made up 70% of course participants in the courses she conducted.

Each 3-day course comprised the following components, encouraging all participants, regardless of individual familiarity with the e-learning platform, to embrace mobile learning as the main form of learning.

Prior to attending the courses, the training agency informed course participants to bring with them their own personal digital devices such as laptops, tablets and smartphones. Most course participants had at least one such personal device, the prevalent device being the smartphone.

Course Processes

Day 1. The author introduced the course participants to cloud drives, specifically Google Drive. She organised the course participants into cooperative learning groups, and then shared her course folder with the course participants via Google Drive. She taught older adult participants unfamiliar with the online platforms, to download apps onto their smartphones and tablets to enable them to edit and create online documents for their collaborative learning activities, requesting the young adults in the groups to help their older adult group members in the learning process. This important step created the equality in learning of each group member, enabling each group member to recognise each other as fully contributing and participating members of the cooperative learning group.

The author introduced course materials via the course folder in Google Drive. Course participants, in their cooperative learning groups, accessed reading materials, audio clips and YouTube and other video clips via the Google Drive. They had time to read, listen and/or view, and to process the new information into new individual knowledge. They had face-to-face group discussions to build new group knowledge which they then entered into Google Docs/Slides/Sheets on Google Drive. The artefacts of collaborative learning took the form of Google Docs/Slides/Sheets on the Google Drive. The aim of this day was to develop familiarity with the online platform via Google Drive.

Day 2. The author continued with the learning processes of Day 1, completing the dissemination of learning materials by lunch time. The group discussions moved beyond face-to-face to online group discussion on Google Docs and Slides. The course participants, through these processes, were presented opportunities to grow their familiarity with online learning via Google Drive.

After lunch, the author conducted a 45-minute lesson based on the course content, using the Google Drive online platform but now allowing the course participants to search for and access their own learning materials. The course participants in this lesson created their own Google Drive folders for collaborative group work. The 45-minute lesson included a problem-solving component that course participants had to address in their cooperative learning groups. The lesson concluded with each collaborative group presenting the artefacts required of them in the lesson plan. This learning process enabled the author, as trainer, to role model to course participants how to conduct a lesson with the course content. It also enabled the author to ascertain the mobile learning ability of the course participants.

The remaining third of Day 2 was given over to the course participants, in new cooperative learning groups, to design and develop a lesson using the course content and mobile learning processes to be presented on Day 3. This lesson that the course participants had to present was the course group assessment component, and is an important process in allowing course participants to put into practice the learning acquired in the course.

Day 3. The course participants had time before the morning tea break to finalise their lesson approach and materials in their respective cooperative learning group. Each group then conducted the lesson,
with the remaining course participants as students/trainees. Peer and trainer assessment took place at the end of each lesson presentation. The last part of the day consisted of course evaluation, and individual and group reflections on the course just concluded. Feedback on the effectiveness of the different processes of the course was collected via the reflections written by each course participant.

3 Analyses

In 2013 and 2014, 70% of the course participants comprised older adult participants who had not experienced ICT as a mediator of learning during their formal schooling years. By 2015 and the first half of 2016, this percentage had fallen to 50%.

The older adult participants in 2013 and 2014 were more familiar with online editing and processing functions on their laptops, and mainly used these throughout all three days of the courses. The participants who were very comfortable with using smartphones and tablets for online editing and processing were the younger adults who had experienced ICT as a mediator of learning when they were still studying in school and tertiary educational institutions. In each cooperative learning group, there would be at least two laptops in use, especially for the problem-solving and group assessment lesson preparation components. There was also a tendency in those cooperative learning groups to let the younger adults take over the online editing and processing on Google Drive, although the older adult participants were comfortable with searching for, reading and viewing online materials and resources.

By 2015 and the first half of 2016, older adult participants showed a higher comfort level with using their smartphones and tablets for online editing and processing. There were still at least two laptops in each cooperative learning group, but the roles of online editing and processing were now distributed more equally among all cooperative learning group members. While a small number of older adult participants, especially those in the fifty to sixty year old age range, still preferred to work offline on their laptops, those in the late thirty to forty year old age range showed more willingness to work online via the Google Drive.

The qualitative feedback received via individual online reflections indicated the initial discomfort the older adult participants faced with online editing and processing. In 2013 and 2014, this form of working was still very new to the majority of the older adult participants. They commented that, while they appreciated the efficiency with which work and learning took place via working online on the Google Drive, they were still more comfortable working offline on their laptops. Reasons given ranged from being new to the Google Drive interface and platform, to feeling left behind by the speed of online work, to finding working on an online platform strange and, therefore, difficult. Some did note the advantages of working online via the Google Drive in terms of efficiency and timeliness of work. One participant commented that “if I continue to do things on Google Drive, I think can get comfortable with it.”

The qualitative feedback from 2015 and 2016 course participants indicated a more positive attitude towards working online, searching, reading, viewing, editing and processing. The older adult participants were more familiar with using functions other than messaging and voice calls on their personal digital equipment, such as using Google Maps to search for locations and directions to locations, accessing social media through Facebook, Twitter and Instagram apps, reading news from news apps, searching for information on Google app, and accessing email via Gmail and other email apps. This meant that they were also more comfortable with downloading the Google Drive editing apps for and editing and processing Google Docs/Slides/Sheets on Google Drive. This familiarity was an important factor in helping the older adult participants in their learning process and in overcoming the initial disruption of the news of the mobile learning strategy. Most encouraging was the comment some of the participants gave indicating their appreciation of the personal autonomy the collaborative and mobile learning process gave to their learning journey. These participants noted that their learning process was made easier as they were able to choose the type of learning (reading/listening/viewing powerpoint presentations and videoclips) that they felt most comfortable with while learning new material. They also commented that being able to collaborate online in their cooperative groups in Google Drive in creating lesson plans and presentation materials in their own time outside of course curriculum time allowed for more efficient and effective collaboration, without the fear of not working on the most current versions of their work.
4 Lessons Learned

One important lesson learned from using Google Drive as the main platform for online learning was that the use of the Gmail account for accessing Google Drive. Participants who had Gmail accounts linked to Yahoo or Hotmail accounts were able to access Google Drive for editing and processing purposes without any difficulty. However, participants whose Gmail accounts were not linked to other email accounts had difficulty access the editing and processing functions on Google Drive. This added to the disorientation from working with an unfamiliar email interface, especially for the older adult participants.

Another lesson learned was the importance of allowing participants to choose the personal digital equipment for accessing Google Drive. Familiarity with the different functions and apps on their own personal digital equipment helped the older adult participants to access the new learning with greater ease. The author, as trainer, had to explain the necessity of downloading the necessary apps for editing and processing, but this was a small hurdle compared to using unfamiliar digital equipment which did arise when some older adult participants borrowed the author/trainer’s tablet (the equipment not being a familiar tool) to use in accessing Google Drive for learning purposes.

5 Conclusion

In Singapore, the extensive availability of broadband and WiFi networks coupled with the high penetration rates for personal digital equipment has paved the way for mobile learning as a common learning platform for adult learning. The use of cloud drives, specifically Google Drive, on personal digital equipment has made mobile learning more accessible to adult learners, even older adult learners who had not experienced ICT tools as a mediator of learning during their period of formal schooling. Participants appreciated the personal autonomy the collaborative learning process gave to their learning journey.

6 References


A Theory of Enhancement of Professional Learning for Aboriginal and Torres Strait Islander Pre-service Teachers in Very Remote Communities through Mobile Learning

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Abstract.
Aboriginal and Torres Strait Islander pre-service teachers in very remote communities in Australia participated in semi-structured interviews on their practices and perceptions about the use of mobile devices in their study. Findings highlighted four educational uses of mobile devices and four andragogic elements of mobile learning. The educational purposes were for accessing content, handling administration, providing and receiving academic support and sharing personal encouragement. The use of mobile devices enabled adults to choose times of study, choose places of study, complete assessment relevant to their course, and achieve a career goal. Based on the research findings a Grounded Theory was constructed to explain the concept of enhancing professional learning through mobile devices. Six categories underlie the concept: fostering access, facilitating customisation, promoting collaboration, enabling networking, completing the course, and empowering agency. The theory contributes to the field of mobile learning by positioning the benefits of the use of mobile devices in tertiary study for non-Western culture groups in isolated locations.

Keywords: Indigenous, remote, pre-service teacher, mobile devices

1 Initial Teacher Education for Aboriginal and Torres Strait Islander people

Aboriginal and Torres Strait Islander peoples’ access, retention, success and completion rates in Initial Teacher Education (ITE) are below those of the general Australian population (Patton et al. 2012; Teacher Education Ministerial Advisory Group 2014). In the period 2005-2012 the completion rate for degrees in the field of education across Australia was 74% (Department of Education and Training 2014, pp. 9, 11). However, data for Aboriginal and Torres Strait Islander people studying ITE over the years 2007-2011 indicated 37% completed their course (Patton et al., 2012, p. 24).

One mode of provision of ITE is community-based delivery, in which a support teacher lives in a community and provides assistance at a learning centre. Pre-service teachers come to the learning centre to seek help from the tutor, use desktop computers with Internet services and access other resources. Two such programs have been operating for over 25 years in different states of Australia: one in South Australia and the other in Queensland. Data from the Queensland program for the period 2007–2011 indicated a completion rate of 15 per cent (Mitchell & Linkson 2012, p. 26); no publicly available data on completion rates in the South Australian program was located, but anecdotal reports suggest these were lower than the Queensland program.

In many of the communities where these ITE programs operate, mobile devices are increasingly common. Referring to remote communities, Kral (2014, pp. 6-7) stated “people, predominantly young people, [are] buying laptops, mobile phones and even iPads or Tablets.” Australia wide, 70% of Aboriginal and Torres Strait Islander people own a smart phone, and in remote communities 43% of Aboriginal and Torres Strait Islander people own a smart phone (McNair Ingenuity Research 2014). This research took up the opportunity outlined by Vosloo (2012, p. 35), who stated: “There is a significant opportunity to more fully explore how mobile technology can support teachers and contribute to their training, motivation and retention within the teaching profession.” The aim of the doctoral research underlying this paper, was to investigate how the use of mobile devices might enhance the professional learning of Aboriginal and Torres Strait Islander pre-
service teachers in very remote communities. No other research has compared data from these two community-based ITE programs for very remote pre-service teachers. Hence, this paper fills a gap in the literature.

This first section provided background about ITE for Aboriginal or Torres Strait Islander people, and the contribution of low completion rates in community-based ITE programs to below-parity levels of Aboriginal or Torres Strait Islander people in the schooling workforce. This is followed by an outline of the methods and theoretical approach utilised in the research. The third section presents data regarding educational and andragogic uses of mobile devices. The fourth section describes a theory of enhancing professional learning for Aboriginal and Torres Strait Islander pre-service teachers in very remote communities through mobile learning.

2 Methods

The research focused on four key questions:

1. What elements of content material, administrative support, and personal encouragement for their ITE training do Aboriginal and Torres Strait Islander people in Very Remote communities use or want to see provided by mobile technologies?

2. In what ways are andragogical methods affected by the use of mobile technologies in the delivery of ITE to Aboriginal and Torres Strait Islander people in Very Remote communities?

3. In what ways do Aboriginal and Torres Strait Islander people in Very Remote communities think the use of mobile technologies could affect their rate of progress towards completion of an ITE qualification?

4. How do features of mobile learning align with Aboriginal and Torres Strait Islander cosmology, ontology, epistemology and axiology?

The participant population was restricted to Aboriginal and Torres Strait Islander pre-service teachers in two community-based ITE programs in different states of Australia, along with Aboriginal and Islander Education Workers employed in schools from one state. This gave a population size of about 180. I collected data from 15 sites: five in South Australia and ten in Queensland. There were 64 volunteer participants. This comprised a sample size of 36% of the population, and so compares favourably to research among Aboriginal and Torres Strait Islander people in South Australia which aimed for a sample of 15% (Marin et al. 2015, p. 3). There were four groups of participants: 15 ITE students from very remote South Australia, 11 ITE students from very remote Queensland, 19 ITE students from other places in Queensland, and 19 Aboriginal and Islander Education Workers employed in schools from very remote South Australia.

Semi-structured face-to-face interviews and focus groups were conducted using a set of 13 questions. Participants could choose not to answer questions and could also withdraw their consent to participate at any time. Interviews were conducted in English with audio recording from which transcripts were made. Occasional comments made in vernacular by participants in SA were later transcribed and translated to English.

In approaching the research, the following issues were anticipated: data from this research would likely express socially constructed realities; participants would probably indicate that knowledge is determined relationally; the values of both the researcher and the participants would be important to the research. Consequently, an interpretivist stance was selected as the most appropriate perspective. Throughout data collection and data analysis I employed a phronetic approach to constructing Grounded Theory, as advocated by Bainbridge and colleagues (2013, p. 276), who claimed “the integration of phronetic research epistemologies and constructivist grounded theory methods works alongside ethical and decolonizing practices in Aboriginal research agendas to create new knowledge.” During field visits, as impressions and analytic ideas occurred to me, I jotted these down. My brief field notes constituted my methodological journal and included memos and intuitive impressions. I used these to guide emphases in interviews from day to day. In between field trips I did initial data analysis, which led to theoretical sampling (Charmaz 2014) on subsequent trips, as I pursued information about concepts and categories.
3 Findings

As indicated in the first section, findings presented below are delimited to the very remote pre-service teachers.

Educational Uses of Mobile Devices

In this research, responses from participants indicated they viewed the topic ‘encouragement’ as having two distinct categories: personal or social aspects, and academic support. Thus there were four areas of usage: content, administration, personal encouragement and academic support.

The following table (Table 1) presents a comparison of very remote ITE pre-service teachers in the two programs regarding educational uses of mobile devices.

<table>
<thead>
<tr>
<th>ITE Program</th>
<th>Sample</th>
<th>Content</th>
<th>Administration</th>
<th>Personal Encouragement</th>
<th>Academic Support</th>
<th>Any</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Australia</td>
<td>15</td>
<td>13</td>
<td>27</td>
<td>0</td>
<td>20</td>
<td>33</td>
</tr>
<tr>
<td>Queensland</td>
<td>11</td>
<td>82</td>
<td>64</td>
<td>64</td>
<td>55</td>
<td>82</td>
</tr>
</tbody>
</table>

Data from the two programs was compared using Chi-Squared Tests. Queensland very remote students used mobile devices significantly more than South Australian very remote students for content ($\chi^2(1)=12.19$, p=0.00), personal encouragement ($\chi^2(1)=13.06$, p=0.00), and any of the four uses ($\chi^2(1)=6.00$, p=0.01). The significant difference overall (i.e. for any of the four uses) can be explained in two ways. First, the South Australian ITE program did not use online learning so there was no need to use mobile devices for educational purposes. Second, most South Australian students (13 of 15) came from communities with no mobile network service, and so were not able to use the full functionality of mobile devices on a daily basis. This restricted their ability to use them for educational uses, and their dearth of experience with using the gamut of capabilities of mobile devices also limited their ability to think of potential educational uses.

Andragogic Elements of Uses of Mobile Devices

Research participants indicated the use of mobile devices was facilitating or could potentially enable them to be self-directed in their learning regarding time and place of study. Queensland students stated the use of mobile devices was relevant to completing obligatory study tasks, i.e. finish assignments, organise yourself, manipulate files, format material, locate content, create different kinds of files, capture data, participate by looking, listening, speaking and touching, search the Internet, and access the course provider’s website. Participants affirmed the use of mobile devices was a boon to them achieving their goal of completing a university qualification in order to become a registered teacher.

The following table (Table 2) presents a comparison of very remote ITE pre-service teachers in the two programs regarding andragogic elements of uses of mobile devices.

<table>
<thead>
<tr>
<th>ITE Program</th>
<th>Sample</th>
<th>Time</th>
<th>Place</th>
<th>Tasks</th>
<th>Goal</th>
<th>Any</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Australia</td>
<td>15</td>
<td>40</td>
<td>40</td>
<td>0</td>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td>Queensland</td>
<td>11</td>
<td>82</td>
<td>91</td>
<td>100</td>
<td>64</td>
<td>100</td>
</tr>
</tbody>
</table>

The relationships between variables were explored using Chi-Squared Tests. Queensland very remote students mentioned andragogic elements of use of mobile devices significantly more than South Australian very
remote students in every category: for time ($\chi^2(1)=4.55$, p=0.03), place ($\chi^2(1)=6.95$, p=0.01), tasks ($\chi^2(1)=26.00$, p=0.00), goal ($\chi^2(1)=9.67$, p=0.00), and across any of the previous four ($\chi^2(1)=10.09$, p=0.00).

The significant difference can be explained similarly as above regarding educational uses of mobile devices: the non-use of online learning meant no need to use mobile devices by South Australian students, and the lack of mobile network services for most South Australian students limited their daily experience with mobile devices. Nevertheless, 40 per cent of students from very remote South Australian communities could envisage benefits about time and place regarding use of mobile devices.

4 A Theory of the Enhancement of Professional Learning

This research investigated the beliefs and behaviours of Aboriginal and Torres Strait Islander pre-service teachers in community-based ITE programs about the use of mobile devices in tertiary study. A model of the theory of enhancing professional learning through the use of mobile devices is set out in Figure 1 below. This is oriented horizontally to indicate the passage of time through a tertiary degree.

![Figure 1. Enhancing Professional Learning through the Use of Mobile Devices](image)

At the left of the diagram are three elements that impact on the educational use of mobile devices (i.e. context, precursors and catalyst). Firstly, the context in which a pre-service teacher tries to study is important, and encompasses all other aspects of the diagram. Each student faces competing demands and allocates priorities. I classified participants’ comments into 11 factors which affect their study: employment, health, home life, mourning, sport, religious activities, cultural activities, pregnancy, domestic violence, other people using drugs and visitors. Secondly, precursors precede the adoption of mobile devices for educational purposes. I identified six factors: cost of device, supplier location, mobile network services, operating costs, Internet filters, and the institution’s use of online learning. Thirdly, a catalyst prompts the uptake of mobile devices for educational purposes. I propose that the catalyst is the perceived alignment of features of mobile learning and aspects of cultural philosophies. Features of mobile learning are based on work by Kearney and co-authors (2012), who identified three features: authenticity, collaboration and personalisation, along with the use of space and time. Ideas about cultural philosophies are drawn from writing by Arbon (2008) and other Aboriginal and Torres Strait Islander academics and use common categories of cosmology, ontology, epistemology and axiology. The congruencies between cultural philosophies and mobile learning are discussed in the author’s earlier articles (Townsend, P.B. 2015a, 2015b; Townsend, P. B., Halsey & Guenther 2016). Succinctly put, Aboriginal and Torres Strait Islander pre-service teachers use mobile devices because they fit with their culture.
Using a constructivist Grounded Theory approach, I identified codes, and then organised some into categories. First, three categories at a subsidiary level are considered. Of central importance to a student is being able to obtain the content material of the course. Codes relating to connection with content material through mobile devices were subsumed to create the category Fostering Access. Students also need to handle a range of administrative tasks. Codes associated with improving efficiency of administration through customisation of mobile devices were combined to create the category Facilitating Customisation. In addition, most students will need academic support throughout their course in order for their understanding to be deepened. Codes pertaining to assistance and working together on mobile devices between students and staff were pooled to create the category Promoting Collaboration. Together, these three subsidiary level categories of Fostering Access, Facilitating Customisation, and Promoting Collaboration underpin the main category Completing the Course. In order to progress through their course, students must complete compulsory assessment. Codes relating to using mobile device to work on assignments were grouped to create the main category Completing the Course.

The second main category is called Enabling Networking. A host of factors can affect study, some positively and some negatively. If the latter become overwhelming, then a student might withdraw from study. However, if a person receives personal encouragement, then he or she is more likely to persevere as a student. Mobile devices provide many ways for people to keep in touch and give praise and emotional backing to one another. Codes relating to personal encouragement were clustered to create the main category Enabling Networking.

The third main category is called Empowering Agency. Community-based ITE programs generally operate within learning centres. However, many reasons prevent students from attending the study facilities during operating hours. Mobile devices provide freedom from the learning centre and enable study to continue in various locations. Similarly, mobile devices provide flexibility from the opening hours of the learning centre and enable study to continue at other times. Codes relating to alternate places and times were collected to create the main category Empowering Agency.

The three main categories of Completing the Course, Enabling Networking, and Empowering Agency form the core concept of Enhancing professional learning through the use of mobile devices. This theory accords with a recent report which pointed out that use of mobile devices

is enabling students to learn using the technology with which they are already familiar and comfortable, providing them with a greater sense of ownership over their learning. .... today’s students expect to be able to use whatever devices they choose to access learning content, take notes, gather data, and communicate frequently with their peers and instructors (Johnson et al. 2016, p. 36)

5 Categories Supporting the Theory

The six categories presented in Figure 1 above, are now discussed. As the South Australian institution did not use online learning, the anonymous quotes provided here as evidence the categories are grounded in the data, are drawn from very remote Queensland participants.

Fostering Access

Eighty-two percent of Queensland very remote participants mentioned at least one use or potential use of mobile devices for connecting with content. This student spoke about using a laptop to access study material through the institution’s website, online tutorials, web conferences and quizzes:

I do have a laptop at home which I do use a lot after hours. ... but I use that at home and log in through there, from home, through to university and do all my work from there.... So then I take a lot of work home, like assignments. I have online tutes and sessions that I need to catch up with and quizzes. (Participant 31, 42-52).

Another student commented on spontaneously browsing the Internet on her mobile phone to access information: “When teacher asks a question, and I just went on Google on my phone and checked it and answer it. Or when we debate about something … and you argue about it, so you just Google the answer” (Participant 30, 300-302).
The evidence from this research aligns with recent literature about students connecting with content material through mobile devices. Sung and colleagues (2016, p. 295) stated the benefit of mobile devices over desktop computers: “The overall effect of using mobile devices in education is better than when using desktop computers or not using mobile devices as an intervention.” Mi and co-authors (2016, pp. 73-4) stressed the advantage of mobile devices: “All selected studies reported the advantage of instant access to a variety of resources via mobile devices.” Witt and colleagues (2016) investigated tablet use and noted improved access to information through mobile devices: “Our findings suggest that participants found value in having consistent and constant access to … information, with convenient availability ‘on the go’. … this consistent access is reported as having enhanced information gathering.”

Facilitating Customisation

Sixty-four per cent of Queensland very remote participants mentioned at least one use or potential use of mobile devices for handling administration. Pre-service teachers can customise mobile devices so emails from the institution are rerouted, they can create alerts and add apps which enable them to communicate with staff of their institution at convenient times and places, and they can add phone, email and social media contacts. One person mentioned the convenience of using a mobile device:

*It’s always with me in my hand. OK, like, if I’m out somewhere and … if I get a phone call that I need to do something like go online, you know, it’s right there in my hand and I just use that. Yeah very quickly and it’s like, helpful* (Participant 32, 89-97).

A different person described the way staff contact students through mobile devices:

*Yes. There was a lot of emails. They did keep … the lecturers did keep in constant contact with you, by emails. Like there would often be daily from them about all sorts of stuff. Whether its deadlines are approaching or you need help or this next Elluminate’s [web-conferencing session is] coming. So that’s good, because they were constantly in contact* (Participant 25, 157-160).

Pre-service teachers can deal with matters as they arise. Through the use of mobile devices they become more efficient at handling administration.

The evidence from this research aligns with literature about customisation of mobile devices. In the context of digital media, Sundar and Marathe (2010, p. 301) distinguished between personalisation and customisation, and pointed out that “User-initiated customizable systems do not tailor content on their own, but instead feature a number of affordances that allow users to make changes to the form and content of the interfaces. They give high priority to user control and involvement.” Aryana (2013) investigated cultural aspects of customisation.

Promoting Collaboration

Fifty-five per cent of Queensland very remote participants mentioned at least one use or potential use of mobile devices for academic support. There was a high frequency of interaction between peers using mobile devices, as in the following quote:

*Just help each other, because everybody is in the same boat and doesn’t know if they are going the right way. … We often daily kept in contact. Whether it was by phone, text message … to give each other a hand* (Participant 25, 181-186).

Students use several modes of communication on mobile devices to seek and offer academic support in order to deepen their understanding, work together and help one another, as expressed by this pre-service teacher: “[We’re] always on the phone, email, Facebook even, we get on and Facebook each other [about assignments]” (Participant 29, 182-184). Mobile device use fosters both sharing of data and creative output between two or more people.

The evidence from this research aligns with literature about using mobile devices for collaboration generally and in pre-service teacher education. Online and mobile forms of collaboration are receiving increased attention (Cilliers 2016; Mbodila, Ndebele & Muhandji 2014; Tucker 2015), and terms such as online pro-
fessional communities of learning (Rehm et al. 2016) and communities of practice (Kidd 2013; Kietzmann et al. 2013; Stoszkowski & Collins 2015) have been used.

**Completing the Course**

All one hundred per cent of Queensland very remote participants mentioned using mobile devices to complete learning tasks. Students can use a variety of apps and software on mobile devices to work on assessment tasks, as indicated by this student who described uses of her laptop: “I’ve used it mostly with Microsoft Office, Microsoft Word to type essays and stuff like that – do up PowerPoints” (Participant 27, 40-41). This student strongly affirmed the benefit of a mobile device to completing her work when she was injured and unable to attend the learning centre:

> I could do it [my study] because I had a broken ankle for quite some time and couldn’t come in; so I just used mine [my laptop] at home. … [If I didn’t have my laptop] I would have struggled. I wouldn’t have been able to probably complete the course, or fallen well behind, because I wouldn’t have been able to get to TAFE, to this RATEP office, to complete my course (Participant 25, 54-60).

Another student stated that without a mobile device she would not have the opportunity to do her course: “[If I didn’t have my laptop] it would be very difficult for me. … I guess I wouldn’t have the opportunity to do it” (Participant 29, 101-104).

The evidence from this research aligns with literature about use of mobile devices for completing study. Mishra (2009, p. vi) identified three educational uses of mobile technologies that affect course completion: “Reminding students of deadlines, giving words of encouragement and providing bite-size learning snippets have a beneficial impact on motivation and make it more likely that students will complete and pass the course.”

**Enabling Networking**

Sixty-four per cent of Queensland very remote participants mentioned at least one use or potential use of mobile devices for personal encouragement. Mobile devices can be used to initiate friendships with fellow students in other communities, as indicated by this student: “You really create friendships by a mobile device. You meet them once, or you don’t even have to meet them and you can still develop … a friendship as such through text message, through phone calls, through emails” (Participant 25, 373-376). Through mobile devices students can share the personal details of their lives as described in the following two quotes: “We all stay in touch pretty much the whole group of us [through our mobile devices]. And we’re all going through so well. Sort of stay in touch with each other and share life and stuff” (Participant 29, 177-178), and “It’s our little community and we’re contacting each other [on our mobile devices] - checking up on what we’re up to; and we’re going to continue” (Participant 28, 193-195).

The use of mobile devices among a cohort of students enhances morale to persevere, as expressed in the following quote:

> [If they have a mobile device] they would still have access to be able to keep in contact with other students and their teacher coordinator to help them stay focussed. Because … you’re away from something for a couple of weeks … you’ve got extra work to catch up with. It can become overwhelming and possibly [you might quit]. Yes. It’s easier just to stop doing your course than to complete it. So really having a mobile device with you so you can still … you’ve still got that motivation there, you’ve still got something to access it, so it’s not hard. … you’ve got it there with you where you can still continue wherever you are (Participant 25, 220-232).

The evidence from this research aligns with literature about using mobile devices for networking. Mobile devices enable people to link to social networking sites which Soomro and co-authors (2014, p. 278) described as “sites that establish and maintain connections with others.” Vorderer and colleagues (2016) examined university students’ use of mobile smart devices and stated: “The behavioral data shows that the smartphone has become a device that serves as major interface for interacting with others, especially at times when communication partners are not physically available” (p. 702).
Empowering Agency

Nine-ten per cent of Queensland very remote participants mentioned at least one aspect in which the use of mobile devices is currently facilitating or could potentially enable them to be self-directed in their learning regarding time or place of study.

Providing Freedom

Data from interviews indicated pre-service teachers using mobile devices are not restricted to studying only in the learning centre in their community. Instead, they now have freedom of location for study. This student referred to taking an iPad everywhere and writing study notes: “I use the iPad for easy access I suppose because it’s everywhere you go ... Especially when you’re doing studying, it’s there, and also there’s a notebook in it and you can drop down notes” (Participant 33, 103-107). Study is no longer static. Place is no longer a limiting factor. Another person enthused about Internet connectivity on mobile devices: “You can have access to the Internet wherever you go! That’s what I love about it!” (Participant 31, 302). In this quote, the student pointed to the convenience of mobile devices in situations where people are obliged to travel: “I did need a laptop and I bought one, especially. Especially when we go down for our [residential] blocks. .... I can do my tables and essays and all that at the motel room” (Participant 28, 49-53). Mobile devices empower pre-service teachers to choose where they will study, and gives freedom from the walls of the learning centre.

Enabling Flexibility

Participants indicated that use of mobile devices for study is not restricted to during the business hours of the learning centre. Instead, they now have flexibility of time for study. One student asserted the benefit of mobile devices: “I reckon it does help, a lot, because you can do it in your own time as well, instead of just rock up to [the learning centre on week days], and then over the weekends” (Participant 28, 134-135). Another student stated: [I use my laptop for study] Every night until about 3 o’clock in the morning! And any spare time that I’ve had. But quite often I was up to 1 or 2 o’clock in the morning doing my study. (Participant 25, 64-65) Study is no longer bound by clock times. Opening hours are no longer a limiting factor. People can study when it suits them, as shown in this quote:

After hours when I am at home, if I got homework to do or if I need to do like assessments and that, I do that at home [on my laptop] ...or when days like I can’t make it in, ... [if I am] sick or you might be busy through the day and you can’t be here, so you can work from home (Participant 32, 138-142).

Mobile devices empower pre-service teachers to choose when they will study, and gives flexibility from the opening hours of the learning centre.

Together, the temporary concepts of Providing Freedom and Enabling Flexibility demonstrate that the use of mobile devices enhances the professional learning of Aboriginal and Torres Strait Islander school educators in very remote communities by empowering them with agency in their contexts. The evidence from this research aligns with literature about agency. Common frameworks for viewing agency tend to emphasise either individualised or socialised perspectives. However, Biesta and Tedder (2007, p. 137) claimed their concept of agency is “an ecological understanding in that it focuses on the ways in which agency is achieved in transaction with a particular context-for-action, within a particular ‘ecology’” [emphasis in the original]. Priestly and co-authors (2012, p. 211) also encompassed the larger context in their thinking about agency: “We have taken the view in this article that teacher agency is largely about repertoires for manoeuvre, or the possibilities for different forms of action available to teachers at particular points in time.”

In this research with predominantly women Aboriginal and Torres Strait Islander pre-service teachers, elements of an ecological perspective and notions of room to manoeuvre are seen to be relevant, given the competing priorities upon their time and energy through family, community and cultural responsibilities.

6 Conclusion

This paper outlined a theory describing ways in which the use of mobile devices enhance the professional learning of Aboriginal and Torres Strait Islander pre-service teachers in community-based ITE programs in very remote communities. The six categories underlying the theory could be used in designing or evaluating
the introduction of mobile devices for educational purposes in tertiary settings. The small number of participants from very remote communities is a limitation of this study, and replication with a larger sample size is warranted. The high use of mobile devices for both educational purposes and andragogic practices by pre-service teachers from very remote communities in Queensland indicates their engagement with study is facilitated through mobile devices, and enhances their professional learning. I suggest that as these practices are continued by future students and endorsed by institutions, then the use of mobile devices is likely to lead to improvement in completion rates for pre-service teachers in community-based ITE programs in very remote communities.

7 Acknowledgements

The work reported in this publication was supported by funding from the Australian Government Cooperative Research Centres Program through the Cooperative Research Centre for Remote Economic Participation (CRC-REP). The views expressed herein do not necessarily represent the views of the CRC-REP or Ninti One Limited or its participants. Errors or omissions remain with the author.

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Enhancing Workplace Learning through Mobile Technology: Barriers and Opportunities to the Use of Mobile Devices on Placement in the Healthcare and Education Fields

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Abstract. Workplace learning (WPL) and mobile learning are each major priorities for Australian universities. Yet, they rarely intersect in practice. We report on a multi-university project that explored how WPL can be enhanced through the use of mobile technology on placement. The aim was to better understand the barriers and opportunities of using mobile technology for WPL. A combination of surveys and in-depth interviews was used to collect data from students, academics and workplace educators about their practices in using mobile technology and their perceptions of how it could enhance their learning and teaching on placements. The findings show that there was a high use of mobile devices and high confidence in their use among all participant groups. Academics saw many opportunities to use mobile devices, and their potential to have a positive impact on students’ learning. However, data also highlighted technical and cultural barriers and the need for better preparation and training, responsible implementation of social media policies and guidelines, more reliable internet access, broader integration of mobile and WPL and a greater focus on individual and organisational perceptions of the value of mobile technology for WPL.

Keywords: workplace learning, mobile devices, workplace culture, professional education

1 Introduction

Within the Australian university context, both workplace learning (WPL) and mobile learning have become major priorities (Johnson et al. 2012; Orrell 2011; Patrick et al. 2008). We define WPL (also known as work integrated learning, internship, practicum, clinical experience, fieldwork, etc.) as formal and informal learning in an authentic workplace under formal or informal supervision. WPL is an essential element of vocational and professional education. It presents opportunities for students, as ‘apprentice’ professionals, to make connections between what they learn in university classes and the exigencies of the workplace. We use the term ‘mobile technology’ to refer to software tools and digital devices, including smartphones, tablets and laptops, whose portability means they can be carried around from site to site, and whose affordability means they are increasingly used as personal mobile devices (PMDs) rather than university-owned or employer-provided devices. The user-centeredness and adaptability of these devices mean they can be customised, used flexibly and can sync information and communication across educational, workplace and social spaces. According to Orrell (2011, p. 12) “Technological development provides new possibilities and challenges to the traditional conception of a WIL program”.

The benefits of WPL for students include enhanced work-readiness and employability (Coll & Zegwaard 2011), socialisation into one’s future professional role and identity (Higgs, 2012) and better integration of academic and professional knowledge and skills (Jackson 2014). WPL is distinguished by its situated, contextual, embodied, authentic, physical, relational, informal and unpredictable character. It gives students an opportunity to experience incidental and tacit learning, as well as opportunities to navigate new workplaces, master the ‘tools of the trade’ and working with others, including in multiple overlapping communities of practice or practice networks (Higgs 2012).

However, these rich opportunities also come with challenges. Effectively integrating placement experiences with academic learning requires adequate student preparation before, communication and support dur-
ing, and collective reflection after placement experiences (Billett 2011b). Learning in workplaces may distance students from their personal and academic support networks and learning spaces; many students report feeling isolated, unsupported and stressed (Gracia 2010; Howard et al. 2014; Mackay & Harding 2009). Students also experience difficulty in transitioning to placements and are uncertain about what to do when feeling upset or anxious (Robinson et al. 2009). WPL can be perceived as disruptive, complex and risky—not entirely under universities’, students’ or placement hosts’ control. In addition, workplace environments are not necessarily conducive to supporting student learning. Workplace educators (WPEs) are primarily employees of the host organisation and, generally, only secondarily are they educators. Moreover, this role often goes without reward or recognition, and the training of WPEs by universities is sometimes inadequate (Clarke, Killeavy & Moloney 2013). In difficult work environments, such as those institutions experiencing staff shortages, students are perceived to be a burden or risk to productivity (Trede et al. 2014) and WPEs’ ability to support student learning is correspondingly limited. The consequences for students include: a lack of engagement and participation; reluctance to ask questions (Trede & Smith 2012); and fragmented conceptions of work versus learning, theory versus practice and formal versus informal learning (Ball 2000).

These WPL challenges highlight that students cannot learn in isolation in the workplace and instead need to be actively engaged with and progressively integrated into professional (academic, professional and social support) networks (Carvalho & Goodyear 2014). Mobile technology in WPL has the potential to help customise placement learning, communication and support to more effectively meet the needs of both the individual and the workplace, and simultaneously catalyse a networked, collaborative, integrative learning experience.

By providing opportunities for staying connected, establishing mentoring and peer support systems, and providing students with enabling, personalisable tools and resources, mobile technologies offer solutions to some of these challenges in WPL (George et al. 2010).

These potential benefits do not automatically flow on; they need thoughtful planning, preparation and implementation. As Ertmer, et al. (2012) found in their study of teacher’s beliefs about the integration of technologies for learning, there are two orders of barriers to the flow on effect: external barriers (e.g. access, support and culture) and internal (e.g. personal beliefs and attitudes). These orders of barriers also apply to the uptake and implementation of mobile technology for learning. Frequent users of mobile devices do not necessarily use them effectively for learning. Learning with technology requires much more than just sharing information (Lea & Callaghan 2011) or being connected. Also, there are professional, disciplinary and workplace differences in what constitutes acceptable practice around the use of PMDs. In some workplaces, PMDs are prohibited while, in others, their use is widespread and expected. However, both technology and workplace cultures are rapidly changing, as are the general expectations and practices. Therefore, helping stakeholders in WPL construct richer understandings of, and capacity to, use of mobile devices to support WPL is an important undertaking. Unfortunately, the literature is stronger on speculative visions of the future than it is on well-theorised proposals for enhancing WPL through the use of mobile technology. As Littlejohn and Margaryan (2014) stated, there is a gap at the intersection of technology-enhanced learning and professional learning.

With this paper, we aim to make a contribution to the emerging field of research and practice into mobile learning, in which WPL is under-represented, and technology use for learning is poorly understood (Pachler et al. 2010). We aim to improve the knowledge base that can be used to improve design for WPL, and specifically to focus on how mobile technologies can be used to enhance student agency in WPL.

Our overall approach reflects three main concerns. First, we recognise that a successful approach to helping students effectively use mobile technology in WPL needs to acknowledge and enhance students’ agency (Billett 2011a): students need to possess the confidence, skills and knowledge required to make their own decisions. Secondly, we focus on a design-led approach (Goodyear & Markauskaite 2012), which places student activity at the centre of learning and offers a realistic way of conceiving of the scope and limits of teachers’ agency, especially when teachers’ work is expressed through the resources. Thirdly, we need to acknowledge the richly entangled relationships between learning, technology and work (Moen, Mørch & Paavola 2012). This is a prerequisite for identifying and cultivating a more expansive understanding of what takes place in technology-mediated WPL. We need sharper conceptions of learning with technology, learning to participate in technology-mediated practices, and learning to create environments in which one’s own learning—and the learning of one’s colleagues—can prosper.
2 Enhancing WPL through Mobile Technology

Study Aims

This study explores the underpinning problem of how students can make the best use of PMDs for learning on placement. The overall aim of the project was to help students, academics and WPEs achieve a shared understanding of ways in which students’ PMDs can best be used for learning on placements. There were two phases: phase 1 aimed to explore the practices, perceptions and self-perceived confidence of students, academics and WPEs in using mobile technology for WPL and phase 2 trialed a set of resources developed from findings in phase 1 to help students, academics and WPE achieve a shared understanding of using PMDs to enable richer WPL experiences. This paper reports on phase 1 only, which posed the following research questions:

- What are current practices in using mobile technology for learning?
- What are the expectations, perceived benefits and barriers of using mobile technology to enhance learning on placement?

Methodology

Rich data was gathered on students’, academics’ and WPEs’ use of mobile technology in WPL. It involved the use of pre- and post-placement surveys with students, a one-off survey with WPEs and in-depth interviews with academics and WPEs.

The survey design was informed by a pilot study conducted at the lead partner university which demonstrated how technology in WPL can be used as a bridging device between different learning spaces (classroom, workplace and virtual) and to enhance collaboration and strengthen communities of practice (Trede et al. 2013).

Inclusion criteria for student participants included completion of at least one professional placement experience and enrolment in a health or education professional entry course in one of the four participating universities. Participating students were administered a pre-placement survey (Survey 1) between three and one weeks before they went on WPL placement. Survey 1 consisted of 27 questions grouped into four sections. The questions were designed to elicit general information about student participants’ demographics and course/program enrolment; their levels of digital literacies and existing use of PMDs for learning; their WPL experience; and expectations in terms of use of PMDs for learning on future placements.

A post-placement survey (Survey 2) was administered up to one month after students completed a WPL placement to compare their expectations with their actual use of PMDs for learning on placements. Demographics and course program information was collected in both surveys to allow students to participate in Survey 2 without having completed Survey 1. Survey 1 and Survey 2 responses were linked using identifiers provided by students.

The WPE survey contained 31 questions grouped into four sections: demographics and professional context; supervision experience; levels of digital literacies; and use of PMDs for learning and supervision.

In-depth interviews were conducted to gather detailed information about academic participants’ experiences of using mobile technology for WPL. A series of semi-structured questions explored participants’ professional involvement with WPL (context and scope); their general experiences using PMDs for work, supervising and learning; and levels of interactions with students using PMDs. The questions were also used to frame a discussion about what motivated participants to use PMD and their pedagogical insights drawn from using PMDs for learning and supervising students for WPL. Only academics who were involved in teaching WPL components in health or education courses were eligible and all practitioners in the area of health care practice and teaching who supervised students in their workplace were eligible. The student and WPE survey data were collated and open-ended answers were analysed for themes. Interviews with academics were recorded, transcribed and analysed for themes. Themes were generated by individual team members and then reviewed and discussed collectively.
Recruitment and Participants

Academics, other university staff and WPE participants were recruited via email invitations sent through the project team’s networks. Student participants were recruited via an invitation posted on their institution’s learning management system or forwarded to them by an academic. Ethical approval was obtained from the lead university and endorsed by all three partner universities.

Surveys were completed by 31 students before placement and 28 students post-placement. 6 students completed both surveys (pre- and post-placement). 13 WPEs completed the one-off survey and interviews were conducted with 8 academics. Because of this small sample size, we emphasise that the data cannot be seen as representative or generalisable. Rather than judging this as a limitation, we focused the analysis on qualitative survey responses and interviews, which provides deeper insight into experiences and practices, and illustrates the key issues of enhancing WPL through mobile technology. We triangulated quantitative and qualitative data by firstly extrapolating themes from the quantitative survey data and then comparing this with qualitative survey data and interview themes. All six authors were involved in this triangulated comparison process. In the following section, we present and discuss survey results and interview findings under the following three headings: mobile technology use, barriers and challenges, and benefits of using mobile technology during placements.

3 Mobile Technology Use for WPL

Pre-placement student survey responses revealed a high use of mobile technology for learning in academic settings. Students reported that they used several types of mobile devices and technology: 93% smartphones (with apps, internet, email); 76% laptops; 66% tablets (iPad, Slate, etc.); 10% mobile phones (with text messaging capability, no internet); and 10% eBook readers (Kindle, etc.). Post-placement survey data corroborated this result.

Confidence in using mobile technology was high (92%), with students stating that they felt ‘very confident’ or ‘confident’ in using mobile technology.

Students used their PMDs mainly for communicating and accessing information and less for reflecting. The use of mobile technology to communicate with others and access information appeared to be a more common use for learning. Using PMDs for these can be seen to help bridge workplace and classroom settings. The use of PMDs by students to engage in reflection was less common. This suggests a missed opportunity, given the importance of reflection in supporting students make deeper meaning of placement experiences and integrate knowledge (Trede & Smith 2012). In relation to access e-learning resources, respondents stated that they preferred viewing videos of mini-lectures through their university or through other platforms, such as through YouTube or Google (627%) (see Figure 1).
A high percentage of respondents (86%) stated that they would have liked to use their PMDs on placement, and only 5% stated they would not. This result matches Dahlstrom et al. (2015) findings that students expect to use PMDs for learning in the classroom. However, it was striking that not one respondent in our study expected to be asked to use PMDs on placement for learning or assessment. Our student participants’ low expectation regarding their use of PMDs for WPL was further supported by the fact that respondents mostly anticipated using their PMDs for communicating and connecting (67%) rather than reflecting and assessing.

Only 39% respondents had access to internal resources, support or training to use mobile technology for learning in the workplace, leaving the majority (61%) without. Results from the pre-placement survey showed that students were confident and wanted to use mobile devices for learning on placement, but also that they had little to no preparation on how to use them effectively.

Most student respondents of the pre-placement survey believed that the use of PMDs would not be permitted (48%) or did not know whether it would be permitted or not (38%). Only 14% thought it would be allowed. Surprisingly, the post-placement survey revealed similar findings: that most students (44%) still did not know their host organisation’s policy on the use of mobile devices, while the remaining responses indicated that the use of PMDs was: not permitted (31%); allowed (19%); or actively encouraged (6%).

These findings mirrored findings from the WPEs survey that only about half (54%) of WPEs’ organisations had a policy for mobile technology use in the workplace, with 23% reporting no policy, and 23% of WPEs who did not know whether there was a policy or not.

Post-placement data revealed that students’ use of apps to interact with other students, WPEs, academics, friends and family during WPL was lower and less varied than respondents had anticipated in the pre-placement survey. This could possibly be due to respondents regularly making use of established university online platforms and/or forums while on placement.

The types of PMDs used by WPEs were similar to that of students’ use. WPEs’ responses showed that the types of mobile devices most frequently used with students in the workplace were laptops (62%), smartphones (31%) and tablets (iPad, slate, etc.; 31%) (see Figure 2). In contrast to student respondents, WPEs’ confidence in using mobile technology was lower and evenly distributed, ranging from very confident (31%), confident (23%), somewhat confident (23%) to neither confident or unconfident (23%).

In relation to apps, WPEs mostly used email applications to interact with students, other WPEs, university staff, colleagues and/or clients. Second Life, virtual labs, Skype, Pinterest and Blogs were not used at all. Given a range of apps and software types to choose from (email, Skype, chat, university online platform / forum, Facebook, Instagram, Pinterest, Twitter, other social network, blog, wiki, virtual labs, Second Life,
other simulation, other specify), WPEs stated that they were used to interact with students, other WPEs and university staff for:

- Communication
- Documentation
- Drug calculations and knowledge
- Emailing (feedback; important information; tasks to do for the day)
- Interactive games for student engagement
- Multimedia texts for use when teaching
- Photography/Filming
- Research - to show students relevant articles, vodcasts, websites, apps, etc.
- Social Media especially Twitter
- Show video clips etc for education purposes

However varied the types of interactions with students might have been for the 13 WPEs who participated in this study, their reliance on more conventional professional apps (email and university online platform / forum) could be explained by the kind of roles they had when working with students: 92% supervising; 85% giving feedback; 69% mentoring; 77% assessing; 62% inducting; and 31% coordinating placements and orienting students to their workplace (see Figure 3).

![Bar Chart: WPEs' Roles with Students](chart.png)

**Figure 6: WPEs' roles with students**

### 4 Barriers and Challenges in Using Mobile Technology while on Placement

The challenges of using PMDs to support learning on placement fell into four closely interrelated categories: technical, financial, pedagogical and cultural. Most often, technical challenges related to internet access: “[not] having Wi-Fi in the hospital” or “internet ability in rural [areas]”. In Australia, rural access to the internet remains an issue, “When the internet was not accessible technology was not viable”, but cost is also a barrier: “As students we sometimes have to fork out at least $1000 just for accommodation, therefore, Wi-Fi (dongle) is just another added cost”. Placements often incur costs for students and the additional cost to connect to the internet can be a financial burden that students are unable to carry. Academics also reported they experienced these technical barriers of internet access and cost.

Students reported barriers that highlighted the complex entanglement between organisational, professional and individual practices and preferences. Some students felt that WPEs might have believed that PMDs were
not for learning and interpreted students’ use of PMDs as a sign of not being engaged in WPL as this quote highlighted: “Other members of staff believe I wasn't interested in my job because I was studying while on placement during times when there were no patients. I had to explain that I didn't like sitting around and doing nothing and that by studying during breaks between patients I was learning something valuable”. Also, according to post-placement student respondents, the workplace’s policy on the use of mobile devices was not explained to all students (explained in only 44% of cases).

Half of the WPE respondents found the use of PMDs to be a challenge. Some of the challenges associated with students’ use of PMDs pointed to some of the WPEs’ lack of experience or confidence in using the device: “It frustrates me just because I am not as knowledgeable as the students in using all the devices”. This was often compounded by WPEs limited understanding of the potential benefits of using devices in practice, seen as “Not useful for a clinical role”. Some believed the use of PMDs to be a distraction: “students are sidetracked by personal communication”. Others felt they were less in control of a situation whenever PMDs were involved: “the student may learn in other ways”.

WPEs also reported that students needed to understand that learning in professional settings is different to learning at university and, hence, should abide by workplace policy and guidelines: “NSW Health is policy driven, students need to work within their scope” and/or management preferences: “Upper management acceptance of mobile devices [is a challenge]”). Further, for those organisations that had a policy, they broadly aimed to restrict the use of mobile technologies, as one respondent explained: “Generally, we don't have many mobile devices available apart from personal smartphones which aren't meant to be carried around and accessed at the patient bedside. It is accepted that smartphones may be used for work purposes away from the bedside.” Finally, WPEs found the prospect of making changes to accommodate the use of PMDs to enhance WPL as overwhelming: “We would need to develop and introduce a policy. We also would need to assist current staff with this”.

Academics also raised professional conduct challenges, especially around privacy and confidentiality issues. One academic interviewee recommended her students not to use them at all because she was concerned that patients may perceive the use of PMDs in hospital settings as unprofessional or unhygienic. Other professional and cultural barriers included conservative workplaces that sought to protect internal practices from the outside world, as this quote illustrates well: “[there are] legitimate concerns within institutions about leakage. Classrooms are quite protected spaces and having a device that creates a gap, an opening, to the outside world in that space can be quite threatening”. Other control issues were raised, such as the lack of understanding of what students actually used their PMDs for while on placement and a suspicion that the use might not be work- or learning-related. The difficulty of not knowing what students were using their PMDs for often led to an outright ‘no use’ policy for PMDs. This issue was closely related to a generational issue as another academic interviewee stated: “a generational gap and that older WPEs do not use mobile technology”.

Some academics reported that the internet could be an impediment to students’ engagement and learning during placement on several accounts. First, they saw it as a potential ‘escape’ mechanism for students who encounter difficulties engaging with practitioners on placement. Though access to the internet can provide students with the means to connect with the outside world it may also distance the student from the physical context of their placement organisation, and disengage them from practice and practitioners. Second, academics saw mobile technology as a potential distraction from learning, for example when used as a central rather peripheral element of the work ecology.

5 Benefits of Using Mobile Technology for WPL

The most common type of benefits students associated with the use of PMDs for WPL pertained to anywhere, anytime access to resources: “I don't need to walk to a computer lab or a library where there probably won't be a computer left for me to use. I can just use my own device and sit anywhere”. “I was able to study a lot while at work (when there were no patients) and was able to do more assignment work. Was able to look up resources if I was unsure”). Students valued on-time access: “When on placement, I always keep my phone in my pocket so I can look up unfamiliar things or refresh on stuff. It's far easier than trying to access a fixed computer, especially when they're in demand, slow or difficult to access as a student”. Students also valued repeated access: “Technology has allowed me to revisit course content as many times as I like (e.g. watching lectures a second time to further my understanding)”.

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The other types of benefits related to the management of time and activities: “Having my smartphone makes life a lot easier as I receive emails to notify me when the university site has had any changes.”; or the capacity to stay connected: “I used my smartphone to keep in contact with family and friends. Things would have been very difficult without them!”. One student enjoyed the use of PMDs because “It is a good change from looking up books etc while on placement”. Most of these findings are commensurate with Gikas and Grant’s (2013) findings around rapid access, the variety of ways to learn and flexible access that allows control over when and how often to learn.

Though WPEs did not necessarily make extensive use of PMDs in their interactions with students, a great majority believed in their usefulness in the workplace and enjoyed using mobile devices for work (85%). WPEs who used mobile technology as part of their regular work activities (46%) used it in a range of ways: to communicate with colleagues, to work with patients: “I use apps on my iPad for patient education”, to access information when needed, to manage the day: “Refer to my iPad for my to-do list, calendar, resources for the wards etc.” or to record actions for future recall: “photography, filming, voice recording”. Most of the 13 WPEs thought that change was required to encourage and better integrate their use in practice: “It is the way forward and certainly the future. We just need to manage the change”. The change required also included the need for more support and training, as most had no access to these in the general course of their work (77%).

The few WPEs who used PMDs with students reported positive experiences. The following quote describes mobile technology use as a way of better engaging with students: “I think as an old person and working with young students, who just love their devices, it is great when they can show me things and teach me things and leads to great interaction between us because they then know that I am human”. This last point is also highlighted in Williams et al.’s (2014) study on undergraduate students’ perception of technology at a large Midwestern research institution in the USA. Citing Wankel and Blessinger, the authors argued that the use of technology had the capacity to encourage students “to positively express their individuality and build student-to-student, and student-to-educator relationships”.

Some WPEs also found that the use of PMDs in WPL had a positive impact on learning because it helped students access relevant information quickly: “[students are] usually guaranteed to find the answer they are looking for and within reasonable time” and because it allowed students to use a tool most familiar to them.

Academics discussed practical and pedagogical benefits in using mobile technology in WPL. Practical reasons for using mobile devices in WPL included the fact that they are light, portable and cost-effective. In relation to pedagogical benefits, PMDs enable on-time access to information, documentation, immediate feedback and interaction. Our study also showed that academic interviewees believed this to be a benefit and encouraged students to locate quality information for a rapid response while on placement, record themselves in practice for later recall and reflection, and to use apps for patient education. Benefits of using mobile devices for students’ learning during placements also included the capacity to connect different elements, to research for information on the internet, and to help students do things they could not do before.

For academics, another impact and benefit of using mobile devices during placements are around maintaining contact with students. This allows a better understanding of what is happening with students during their placement, more timely contact and flexible ways of communicating with students and the possibility of conducting collective reflection as mobile technology “becomes an extension of your ability to communicate”. It was also seen as useful to send announcements.

### 6 Implications and Conclusions

The increasing trend of mobile technology use for academic learning (Chen, et al. 2015) is slowly finding its way into WPL as well. Despite persisting concerns about blurring private, public, professional and learning spheres and professional misconduct on the internet, PMDs have the capacity to add value to student learning on placements with purposeful designs that emphasise good preparation, integrated learning and support to overcome barriers.

Our findings point to existing cultural barriers and varying degrees of uptake of mobile technology in workplaces. Expectations and perceptions of the value of PMDs range from strong advocacy to resistance and to PMDs’ ban in some workplaces. The power of workplace policies and professional relationships between students and WPEs plays an important role. It is important to acknowledge that the evidence regarding
the value of using PMDs for learning remains limited and contested especially in the area of WPL and persistent technical obstacles are not helping the advancement of PMDs use.

An implication of our findings is the need to develop a greater awareness of the tensions that pervades disciplines, workplaces and individuals around the use of PMDs. For example, hospitals are a highly regulated workplace and provide a very different context for the use of PMDs than, that of an advertising company.

This exploratory study of current practices also highlighted the obvious lack of explicit attention to the integration of PMD into WPL curriculum and potential lack of pedagogical “know how” for doing this. This will be addressed in stage 2 of our project, which aims to develop a set of pedagogical design patterns to help academics and WPEs design diverse (appropriate for specific contexts) student learning experiences and develop their understanding and skills for productive use of PMDs in their work and learning.

To advance effective pedagogical ways of using PMDs for learning, it is important to steer clear of unhelpful mobile technology practices that do not enhance learning or support work practices. Enabling access to devices and tools as part of work practices will help transition to their use for learning as well. The more mobile technology is entangled with learning and working, the more integrated the use of PMDs in WPL will become. In workplaces where the use of PMDs for WPL is in its infancy, it is paramount that students, WPEs and academics are involved in negotiating a shared understanding of its value and use for learning. Preparation before placements and agreed protocols for placements is a sound starting point. Students should not be made solely responsible for brokering the use of mobile technology, just as WPEs cannot be expected to lead the way. Academics cannot prescribe the use of PMDs in WPL without agreement from the industry just as they cannot control the learning environments of placements.

Possible solutions need to include designs for learning that make good pedagogical use of the affordances of mobile technology and help plan learning experiences. All WPL stakeholders need to be able to initiate a dialogue to clarify expectations and articulate planned use of PMDs for learning. Practical solutions are most promising when all stakeholders benefit from them, such as collaborative explorations of innovative ways of using PMDs. During placements, students can create online resources that enhance and provide evidence of their learning and at the same time are useful products for the workplace. Such activities contextualise the development of students’ digital literacy and professional online presence. These activities also provide evidence of successful use of PMDs in WPL. Information and Technology departments could be involved in adding a secure layer to the design solutions put forward in future research.

A good start to enhancing WPL through mobile technology is to help students understand the complexity of learning in professional settings. For this purpose, we have already developed an online resource that named the ‘GPS for WPL’, a type of global positioning system to help students navigate their way around the use of PMDs through the WPL landscape. There are multiple cultural layers that shape the use of mobile technology as barriers or opportunities. These layers include occupation-specific cultures, workplace cultures and individual preferences. Further research could explore the occupation-specific use of mobile technology for work. Occupations with rapid and widespread uptake of technology, such a medical imaging and paramedicine, might experience a smoother transition to using PMDs for learning. Our next research project could investigate what information students access and what they communicate about and if/how they promote reflection. Further research could also critically explore the affordance of PMDs to enhance or hinder students’ agentic learning on placement. Finally, research could explore how the use of online communication potentially changes the student-WPE professional relationship and how it impacts on students’ developing interpersonal communication skills.

Adopting a critical perspective to selectively harness opportunities afforded by PMDs in WPL, connect and bridge different learning spaces and generate resources and activities relevant to students’ discipline and/or context, will not only enhance their WPL experience but, ultimately, increase their agency and professional identity development for future practice.

7 References


Does the Mobility of Mobile Learners across Locations Affect Memory?

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Abstract. Memory is essential for learning, but it is context-dependent. Memory’s contextualization implies that we remember information more easily in the original learning context than in a different one. Mobile technologies support learning in different contexts. As their adoption increases, the likelihood of learning something in contexts different from the one we intend to use it in increases too. Therefore, contextualization seems discouraging for mobile learning. Conversely, decontextualization may occur after learning in multiple contexts instead of just one, removing memory’s dependence on context. This paper suggests that the challenge posed by contextualization should be explored in mobile learning contexts, in parallel with decontextualization triggered by learners’ mobility as a potential solution.

Keywords: mobile learning, environmental context, mobility, memory

1 Introduction

Learning new information, understanding concepts and taking tests require our long-term memory – the ability to encode, store and retrieve knowledge (Naveh-Benjamin, 1990). However, memory is context dependent (Smith, Glenberg & Bjork, 1978; Smith & Vela, 2001; Terras & Ramsay, 2012). We focus on environmental context – the location, its physical elements and the sensory stimuli that a person can perceive, such as objects or sounds (Smith, Glenberg & Bjork, 1978). Memory’s dependence on environmental context implies that elements of the learning environment may be encoded along with the information and act as cues to help us remember when we go back to that context (Smith, 2013; Metzger, 2002). However, if we attempt to remember in different contexts, there may be no cues to help us retrieve the information from our memory, or other memories may interfere (Metzger, 2002).

Mobile learning is studied by Sharples, Arnedillo-Sánchez, Milrad & Vavoula (2009) as “the processes (both personal and public) of coming to know through exploration and conversation across multiple contexts amongst people and interactive technologies” (p. 237). The authors propose research should examine the flow of learning across different contexts, as the learners move across the physical, technological, conceptual, social and temporal dimensions and their transitions should be supported. The physical dimension is particularly relevant to this paper, since mobile devices facilitate frequent mobility across physical space – from one location to another. These locations may be conceptually relevant to the information to be learned, such as museums - enabling contextual learning - or purely incidental, as learners try to fill gaps in their daily lives (Sharples et al., 2009). In either case, each location provides a different collection of stimuli, creating different environmental contexts for the learner.

Although much enthusiasm surrounds mobile learning, learners’ mobility from one location to the next and the different contexts created may entail challenges (Kissinger, 2013; Terras & Ramsay, 2012). In particular, mobile learners will probably need to recall information in contexts different from the original learning ones, so – due to memory’s contextualization – they may have difficulties remembering it (Terras & Ramsay, 2012). This view seems discouraging for mobile learning. Conversely, memory researchers are also exploring whether context variation - learning in multiple contexts instead of just one – can benefit learners, by decontextualizing the memorized information - removing memory’s dependence on learning context cues to make it accessible even when these cues are not present (e.g. Smith & Handy, 2014; Smith & Handy, 2015). In this case, learners’ mobility across the physical dimension could be supportive, as the different locations would lead to context variation, decontextualization and finally, easier remembering for the learn-
ers. However, the implications of memory’s contextualization and decontextualization have been underexplored in mobile learning.

The need to explore if memory findings generalize to learning – even in traditional settings – is not new (Naveh-Benjamin 1990), but results for the two phenomena are still unclear (Smith, 2013). The increasingly mobile nature of today’s learning raises this need even further. This paper describes the phenomena and their implications and suggests that mobile learning research should investigate them in parallel, to understand their actual influence on mobile learning. We propose that the solution may lie within the learners’ mobility itself.

2 Contextualization and Decontextualization

Memory’s contextualization indicates that information learned in a particular environmental context will be accessible to the learner if that context is reinstated, but not as easily retrieved in different contexts (Smith, 2013; Bjork & Bjork, 2011). In relevant research, context has been operationalized in various ways, including physical space – such as different rooms –, individual environmental elements - such as odors, audience, background music – combinations of elements, or artificial environments like pictures, videos and virtual reality (Smith, 2013). Environmental context elements are encoded into learners’ memory along with the learning material and if they are also present in the testing context, they can act as cues to help learners remember – if not, this cueing is not possible (Smith & Vela, 2001; Metzger, 2002).

Learners and educators probably hope learned information is accessible in contexts different from the original learning one, but the contextualization phenomenon suggests otherwise (Smith & Vela, 2001). Mobile devices may support learners’ memory by permitting them to learn in the exact location where they will need the information, provided the location is accessible. However, confining learning to that location alone goes against the nature of mobile learning, since it would reduce learners’ mobility, not allowing them to avail of the opportunity to learn “anywhere” else. If they do, the difference between learning and testing contexts may disrupt their memory (Terras & Ramsay, 2012).

Strategies that may counter contextualization’s negative effects include mentally reinstating the original learning context, suppressing the surrounding context (Smith & Vela, 2001) or decontextualizing knowledge by varying context through mobility across locations (Smith, Glenberg & Bjork, 1978) or artificially (Smith & Handy, 2014). Mental reinstatement may be possible for particularly memorable learning activities. However, people’s abilities to mentally alter their context differ, while individuals who regularly learn in multiple similar locations may not remember where they learned each piece of information to successfully reinstate that context (Smith, 2013). Suppressing context may be difficult, while for locations conceptually relevant to the learning material, it would thoroughly limit the learning activities’ value.

Varying the learning contexts may decontextualize learned information, leading to better retention and accessibility in new contexts; since learners often need to remember information in contexts different from the original learning one, decontextualization implies that learning in multiple contexts may be preferable than learning in only one specific context (Smith & Handy, 2014; Bjork & Bjork, 2011). This view seems more encouraging for learners’ mobility, as it would reward their learning efforts that take place "anywhere", with knowledge independent of contextual elements they can also use anywhere. Even if a learning context is conceptually relevant to the learned material, decontextualization may still help retention (Smith & Handy, 2014). However, not all learners study in multiple locations (Rapetti, Picco-Schwendener & Vannini, 2011), therefore they may struggle with contextualized information they cannot recall.

3 Discussion

Mobile learners that learn “anywhere” probably think that they can also use the information “anywhere” they need it. However, memory’s contextualization suggests that they will remember it more easily in the location where they learned it, because they will use environmental elements as memory cues, but they may struggle in different contexts (Smith & Vela, 2001; Metzger, 2002). Conversely, learning in multiple locations removes the memory cues’ support, which may lead to slower acquisition but better retention, decontextualizing memory so learners can also remember the information in new contexts, not only the original one (Smith & Handy, 2015; Bjork & Bjork, 2011).
Much memory research is confined to laboratory settings; tightly controlled contexts, educationally unrealistic materials and simplistic testing methods may be necessary to understand how memory processes work, but do not reflect the complexity of real instructional materials and knowledge application required of learners (Naveh-Benjamin, 1990). Therefore, we do not know whether the findings extend to learning of factual knowledge or skills in realistic mobile learning contexts and how contextualization influences the effectiveness of mobile learning. Research can explore realistic learning materials (e.g. Smith & Handy, 2015; Smith & Rothkopf, 1984) and different activities (e.g. Smith & Handy, 2014; Smith & Rothkopf, 1984) in less controlled settings, as they may produce different results (Naveh-Benjamin, 1990). Mobile learners encounter a variety of contexts containing combinations of diverse stimuli that could be investigated as a whole. Explorations could focus on understanding how much mobility is required to facilitate decontextualization (e.g. Smith & Handy, 2015), while artificial context manipulations like Smith & Handy’s (2014; 2015) could also be combined with real environmental ones, to discover how the two contexts interact. Finally, as learners can sometimes influence their contexts (Terras & Ramsay, 2012; Smith 2013), exploration of elements learners can manipulate may aid in understanding how learners can counter mobility’s detrimental effects by reinstating or varying their own context.

It is important for learners, instructors and educational technology developers to be aware of context’s effects on memory during learners’ mobility, so their choices are well informed. As the phenomena have been underexplored in mobile learning, the question of whether we should really be learning “anywhere” remains effectively unanswered. Therefore, an investigation of contextualization in parallel with decontextualization using authentic mobile learning materials, activities and contexts may help in better understanding how to organize learning across locations and design mobile learning technologies that support transitions across learning contexts. Should the mobility across contexts have an impact on mobile learning, it would be useful for self-directed mobile learners who learn anywhere, to know what strategies to employ for effective learning. Instructors could integrate such information in their teaching, while developers of educational technologies could use it as guidelines for the implementation of their learning applications.

4 Acknowledgements

The authors would like to acknowledge the financial support of the Eduworks Marie Curie Initial Training Network Project (PITN-GA-2013-608311) of the European Commission’s 7th Framework Program.

5 References


Let’s Learn Business Japanese with Learning Log System and E-book

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Abstract. This paper describes a case study where a technology enhanced mobile learning was introduced with a learning log system and an e-book to a career design and business communication class for graduate students at university in western Japan. One of the objectives of this class was to support foreign students’ job hunting in Japan. There are quite a few technical terms used throughout the job hunting process which are rarely used in daily conversation so even advanced learners of Japanese are yet to learn them. The questionnaire result showed that the function called ‘re-log’ (see Section 3) in the system gained the highest score. It also turned out that the usability of the overall system was good, but that e-book system had a problem in its usability. Our future work includes dealing with browser issues with the refinement of e-book contents.

Keywords: Business Japanese, e-book, learning log, mobile learning

1 Introduction

The number of foreign students who study in Japan is 208,379 as of May 1st, 2015 (JASSO’s survey). The Japanese government plans to increase the number of inbound foreign students up to 300,000 by 2030 (“Plan for 300,000 Exchange Students”). They plan to increase not only the number of inbound foreign students but also the number of foreign workers who continue to stay in Japan after graduation. However foreign students who are seeking for a job in Japan have been in a struggling situation. 61.3% of foreign students sought for a job in Japan after graduation and only 30.6% of them could get a job successfully (MITI2011). Therefore, support for job-hunting foreign students has become an urgent issue to tackle with. In fact, it is a recent trend that Japanese universities start providing foreign students with career support classes such as business Japanese, business communication and career design. The course reported in this paper is among them.

Since Japanese job hunting process is rather peculiar, most foreign students have anxieties about it. The survey conducted by Uosaki et al. (2015) revealed that the top two anxieties that foreign students had about job search in Japan were 1) language-related anxieties: writing CVs and entry sheets (writing skill) and job interviews (listening and speaking skills) and 2) anxiety about how to get information.

There are job-search related terms that are rarely used in daily conversation and that even advanced Japanese language learners are yet to learn. Besides the survey result showed that more than half of the questionees selected “I don't know how to get information”. It means that it is very important to convey necessary information to job-searching students. In order to contribute to solving these problems, SCROLL Career Support System has been developed. Through the system they can learn business Japanese, job-search related terms and information about job-hunting system in Japan. It was introduced to the target class called “Career Design and Business Communication” which was open to graduate students of any majors at Osaka University.
2 Background

The progress of IT technologies provoked new learning strategies such as WBL (web based learning), CSCL (computer supported collaborative learning), and MAL (mobile assisted learning) (Ogata et al. 2012). It enabled collaborative learning that can occur simultaneously with remotely located group of learners connected each other (Zurita et al.2004). Besides, by accessing resources of web sites, or by linking learners and numbers of learning contents, learning has been facilitated (Inoue et al. 2014). The domains of learning seem limitless.

However, career support using IT technologies is still in the stage of emergence. There are some reports on ICT technology implementation to career support or career education such as portal sites for students’ career support (Calitz et al. 2015), the use of ePortfolio in career education (Arame et al. 2013), e-Learning in career development for university students (Teshima et al. 2008) and e-mentoring for career development (Headlam-Wells et al.2005). But no such learning system using ubiquitous mobile technologies to support foreign students’ career path has been developed yet. The objective of this study is to propose an effective career support system to get rid of the two main anxieties of foreign students in Japan. Our ultimate goal is to contribute to the enhancement of their employment rate in Japan.

3 Supporting Business Japanese Learning with SCROLL and AETEL

SCROLL

SCROLL (System for Capturing and Reminding of Learning Log) has been developed in order to facilitate learners to record newly gained knowledge, to remind them, to share and reuse them (Ogata et al. 2011). Figure 1 shows its log-in and home interface on mobile. It is a client-server application. The server side runs on Linux OS. It runs on different platforms such as smart phones, tablets and PCs. It is designed to support every aspect of learners’ learning activity model called LORE (Log-Organize-Recall-Evaluate) (Ogata et al. 2011).

![SCROLL Log in Interface (right) and its Home Interface (left)](http://ll.artsci.kyushu-u.ac.jp/learninglog/signin)

Logging

It facilitates the way learners record their newly learned terms to the server. For example, when a foreign student comes across a new term, “御社” (honorific language meaning ‘your company’, one of typical business Japanese) while he was reading job-search related contents on mobile (Figure 2 left), he can upload it to the system with texts, images, video, or pdf files. Translation is facilitated by Google translator (Figure 2 right).
Organizing

If users learned a new knowledge, and uploaded it to the system, the system checks if the same log or related logs were already uploaded or not and show them as the related terms (Figure 3). When they see other learners’ log and find it useful, they can ‘re-log’ it to make it their own log just like “retweet” in Twitter. For instance, if they want to learn ‘B to C’, which was uploaded by someone else, they click ‘Click to re-log’ button as shown in Figure 4. Then it appears in their ‘My Logs’ page. Therefore, learners can obtain knowledge from others without having experienced it themselves. Using this function, the acquisition of knowledge is enhanced.

Recalling

Four types of quizzes (combination of image and text, multiple-choice and yes-no quiz) are generated automatically by the system. Figure 5 shows interfaces of a multiple-choice image quiz and its result. These
quizzes are generated according to the learner’s profile, location, time and the results of the past quizzes they took. It is reported that quiz function is effective to reinforce their memory (Li et al. 2013; Uosaki et al. 2013).

Figure 5. SCROLL Multiple-Choice Quiz and After-Quiz Interfaces (Image Quiz)

Evaluating

TimeMap proposed by Johnson and Wilson (2009) was implemented so that learners can review and evaluate their learning by viewing it (Figure 6). It is reported that location information plays an important role in retaining memory (Baddeley and Hitch, 1974). It is expected to provide users with better opportunities to review their learning. SCROLL top page includes a dashboard which shows the statistics of learners’ activities (Figure 7).

Figure 6. SCROLL TimeMap (landscape recommended on mobile)  Figure 7. SCROLL Dashboard

The previous evaluation on SCROLL conducted by Uosaki et al. (2015) revealed that 1) ‘Re-log’ button was unclear and hard to find, 2) Important information was buried and hard to find, and 3) The contents were too easy to some users who already had some job-hunting experiences. As for 1) ‘re-log’ icon has been renewed so now anyone can easily find it (Figure 4). In order to solve 2) and 3), we have developed a new function called AETEL (Actions and learning on E-Textbook Logging) in SCROLL.
AETEL

AETEL is an additional system implemented to SCROLL. It runs inside SCROLL. It consists of database and EPUB files. Figure 8 shows its architecture. EPUB-viewer is a main function of AETEL. This function shows e-Book contents to viewers, record learners’ actions as action logs, and record what learners learned from e-Book as learning logs. On EPUB-viewer, learners can take various actions, such as page turning, page jumping, bookmarking, highlighting, adding logs, taking memos, looking into the web dictionary and searching by keywords. For instance, when they come across a new word ‘勤続 (continued service)’ while reading an article on mobile (Figure 9 left), then click ‘Add log’ button, then it jumps to SCROLL upload interface to support their upload (Figure 9 right).

Figure 8. Architecture

Figure 9. AETEL EPUB-Viewer: Viewer Window (left) and Add Log Window (right)

SCROLL Career Support System

The objective of this system is 1) to share business Japanese terminology and job-hunting related information among job-hunters, 2) to organize and reinforce their knowledge. Figure 10 shows the learning scenario. In the target class, the students created SCROLL accounts and viewed contents uploaded by the teach-
er and uploaded their own learned knowledge such as company information, internship information to the system as out-of-class assignments (Figure 11). They presented what they learned in turn during class.

<table>
<thead>
<tr>
<th>1. Preparing contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Uploading job-hunting related contents by the administrator/instructor</td>
</tr>
<tr>
<td>2. Epub-converting job-hunting related contents</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. User registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Create an SCROLL account</td>
</tr>
<tr>
<td>2. Join “SCROLL Career Support” group</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. User activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Viewing and relogging contents</td>
</tr>
<tr>
<td>2. Uploading contents (self autonomous learning)</td>
</tr>
<tr>
<td>3. Taking quizzes (for reinforcing memories)</td>
</tr>
<tr>
<td>4. User interaction (posting questions, sending messages)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Evaluation and feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The administrator watching user activities, answering questions if necessary</td>
</tr>
<tr>
<td>2. Encouraging users to use the system</td>
</tr>
</tbody>
</table>

Figure 10. Learning Scenario

Figure 11. Log Sample ‘ジェトロ (JETRO)*’

*Japan External Trade Organization

4 Pilot Evaluation

Since AETEL is our new addition to SCROLL, the main objective of this evaluation was to have learners to use AETEL function and evaluate it. Most SCROLL functions as explained above were not targeted in our evaluation except ‘re-log’ function, since we improved the ‘re-log’ button after the previous evaluation and encouraged them to use it. Since there were only two international students (1 Angolan, 1 Chinese) in the target class, five more students were recruited (4 Chinese, 1 Iranian). Totally seven foreign students participated in the evaluation. The students in the target class used the system for 4 weeks. The recruited students were asked to use the system for a designated period of time (from one day to two weeks). They had two kinds of tasks: (1) SCROLL activities: i) viewing log information such as how to write Entry Sheet (a kind of CV), job hunting flow in Japan, how to continue job hunting after graduation, and job fair information, ii) uploading newly learned words, iii) re-logging useful logs, (2) AETEL activities: i) view the contents using EPUB-viewer and ii) learn some job-hunting related terms such as ‘B to B’, ‘B to C’, difference between ‘内定 (official job offer)’ and ‘内々定 (early official job offer)’, difference between ‘御社’ and ‘貴社’ (both mean honorific language meaning ‘your company’ but the former used in spoken language and the latter used in written language.). After the evaluation session was over, they were asked to answer the questionnaire as shown in Table I.

Table 1. The Result of Five-Point-Scale Questionnaire

<table>
<thead>
<tr>
<th>Question</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Was it easy for you to use SCROLL?</td>
<td>4.1</td>
<td>1.3</td>
</tr>
<tr>
<td>#2 Was the whole system helpful for you to get career related information?</td>
<td>4.3</td>
<td>0.7</td>
</tr>
<tr>
<td>#3 Did the ‘re-log’ function facilitate your learning?</td>
<td>4.6</td>
<td>0.5</td>
</tr>
<tr>
<td>#4 Was AETEL helpful for you to get career related information?</td>
<td>3.3</td>
<td>1.2</td>
</tr>
</tbody>
</table>

The result of the five-point-scale questionnaire is shown in Table 1. According to the survey result in Section 1, more than half had an anxiety that they don’t know how to get information. Since they scored high on Q2, we believe our system contributed to conveyance of information. The highest point was given to Q3 asking about usefulness of ‘re-log’ function. ‘Re-log’ function made them share knowledge quite easily, and
they seemed enjoying it as shown in the comment #2 in Table 2. Its easiness of sharing would be the contributor to its highest score. Unlike our expectation, AETEL function was rated the lowest. The reason seems to be its user unfriendliness as mentioned in the next paragraph.

Table 2 shows comments from the participants. The first two comments were very positive ones. As shown in the second comment, to let them get familiar with business Japanese language is one of our main objectives. However, the third commentator seemed to have had some difficulties in using it. In fact, mobile Safari does not support AETEL. It means they can log in SCROLL and use SCROLL functions but cannot use AETEL. The recommended browser is CHROME and they were instructed to use it. Since the average overall usability of SCROLL was as good as 4.1, most participants found it easy to use. However making it run in any kind of browsers is among our future works.

Table 2. Impression on using Scroll Career Support with AETEL

<table>
<thead>
<tr>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
</tr>
<tr>
<td>#2</td>
</tr>
<tr>
<td>#3</td>
</tr>
</tbody>
</table>

5 Conclusions and Future Works

A pilot evaluation revealed that the whole system had a high usability. Its re-logging interface was improved and it helped users share job-hunting related knowledge. The system is expected to play an important role as information supplier. However, our newly added function called AETEL did not gain a good reputation. We need to reconsider this function. Besides, there was one user who had a difficulty in using it and our future works include dealing with browser issues. With the refinement of AETEL function, more detail examination of the effectiveness of our system will be conducted. We believe that our system will contribute to the increase of employment rate of international students in Japan.

6 Acknowledgments

Part of this research work was supported by the Grant-in-Aid for Scientific Research No.26350319 and No.16H03078 from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan.

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Introducing Mobile Videos for Academic Support

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Abstract. Although the popularity of the Internet, YouTube and mobile devices in the daily lives of students has increased over the past decade or so, this trend is not always reflected in students’ educational contexts. Mobile devices, when introduced in teaching and learning, are often only used in a haphazard way that does not necessarily contribute to a student’s learning process. Also, when academic support material is created by well-intentioned teachers, students do not always use it optimally and often do not use it outside the formal teaching setting. In this case study, mobile compatible videos were created and uploaded onto both the university’s learning management system and YouTube. The jigsaw teaching method was used to introduce the videos, after which students’ perceptions were gathered by means of an online survey. The overall experience of the students and the perceived benefits of the online videos were positive.

Keywords: mobile learning, mobile videos, YouTube, jigsaw

1 Introduction

The use of mobile devices has increased tremendously in recent years; not only because of their popularity, but also because of their multi-functionality and variety of uses (Moreira et al. 2016). This increase is confirmed by the sharp growth in the sales of smartphones and tablets, which include, amongst others, iPads (Dilger 2014; IDC 2015). The popularity of mobile devices is further demonstrated by the seemingly incessant use of mobile devices by students in higher education. Naismith et al. (2004) support this statement and claim that mobile technology has found its way into the classroom, whether or not intentionally introduced for educational purposes. As such, it is the responsibility of the teacher to aim to integrate the use of mobile technology in a sound pedagogical way.

After years of struggling to have the use of mobile devices accepted in the classroom, certain educational trends nowadays actively encourage the use of mobile devices. For example, through the use of Internet-enabled phones, students have quick access to information, can read the news, use a dictionary or translator, read eBooks and share notes. Other functions of mobile devices allow students to take photos and make videos, and to download and play existing videos that are available on video platforms such as YouTube. Students can furthermore use the Notes function on their mobile phones to take notes, write down their own ideas and share information (Leyden 2015). Additionally, the classroom’s boundaries disappear when mobile devices are used, and the learning environment moves with the student (Martin and Ertzberger 2013).

Researchers seem to realise that the traditional way of teaching is no longer relevant to students who grew up with digital technology (Aleksić and Ivanović 2013; Slabbert, de Kock and Hatting 2011). Nowadays, almost everything students do is influenced by technology, and it is therefore not surprising that technology has infiltrated the learning environment as well. To illustrate this, Laurillard (2012) suggests that students probably use their digital devices more often than they use the university’s library. However, technology should not only be used as a way to teach; it should also form an integral part of the learning process (Aleksić and Ivanović 2013; Slabbert et al. 2011).

Although technologies such as mobile phones and tablets are used in education nowadays, they were not originally designed with education in mind. In a sense, the arrival of digital technology overwhelmed education, and education should now take a step back and seriously consider what technology can offer it (Laurillard 2012). With this in mind, some researchers claim that the use of mobile technology increases anywhere and anytime learning, unleashes students’ creativity, makes learning more enjoyable, and gives students and teachers a chance to customise their own classrooms (Pierce 2015; Smith 2013), while others state that the use of technology has a positive impact on student motivation and engagement, enhances the learning process and gives students access to the global world (Rabah 2015; Wang 2014).
Taking the popularity of mobile devices and their influence on learning into consideration, the question arises how videos on mobile devices can be used to support student learning in and outside the classroom. In this article the use of videos on mobile phones to support student learning will be explored.

2 Background to the Problem

The higher education sector in South Africa is facing challenges with regard to graduate throughput and has to cope with high levels of failure and dropout amongst students in universities (Council on Higher Education 2013). The Council on Higher Education (2013) reports that only one in four students that study at contact universities in South Africa graduates in the regulated time, while approximately 48% graduate only after five years. With this challenge in mind, it is imperative for teachers to ensure that students are provided with the necessary support to give them the opportunity to pass all their modules, subjects and qualifications in the minimum time required.

In one of the practical modules that this study focused on, students were struggling to reach the required 40% subminimum. This was obviously problematic and had a knock-on effect for modules in following years. The university lecturer then decided to support students academically by introducing a series of video clips. The rationale for this was to provide students with just-in-time support outside the formal class structure. This support, in theory, provides students with the opportunity to follow the instructions at their own pace while practising. It also meant that students could watch the videos for revision purposes even when they did not have access to desktop computers.

In a two-year period, the teacher created 74 video clips for the topics dealt with in the first- and second-semester third-year Business Information Systems (BIS) modules. The videos focused mainly on step-by-step instructions for procedures in the practical modules such as Excel, Expression Web, MS Project and Pastel. The teacher chose to use the screen capture software Camtasia to make the videos, as it captures the entire computer screen as well as the voice of the lecturer. The decision to use Camtasia was further based on the fact that the university already had a license to use it.

The video clips were created in such a way that they can be played on a mobile device after being downloaded from the learning management system or from the university’s computer network in the laboratory. The length of the video clips also ensured that they could be downloaded onto a mobile device. The availability of a number of WiFi hotspots on campus meant that students did not need to use their own mobile data for this purpose.

To ensure that the students had access to the videos even when they were not in class or logged into the learning management system, the video clips were later also uploaded on YouTube. The links to each one of the YouTube video clips were then created and saved as a Quick Response code (QR) and printed in the exercise book. The link to the YouTube playlist was also sent to students’ mobile phones through WhatsApp.

The students were informed about the availability of the video clips, and one example was shown in class, so that students could see what it looked like, and learn where and how they could access it. After the introduction, the teacher was optimistic and it was envisaged that students who had previously struggled with the module would be eager to use the videos, if not for regular studying purposes, then at least in preparation for the upcoming tests.

Halfway through the first module, the students were given the opportunity to write a mock test about the work done so far. Much to the surprise of the teacher, students struggled to finish this test in time, and despite the comprehensive lectures and the introduction of the videos, the majority of the students once again did not pass the test. After these disappointing initial results, and in an attempt to answer how videos on mobile devices could be used to support student learning in and outside the classroom, the following subquestions were asked:

1. What pedagogical strategy can be used to encourage students to use the mobile videos?
2. Did the students’ use of the mobile videos increase when another pedagogical strategy was implemented?
3. To what extent did the students benefit from the videos and the fact that they could view them on their mobile devices?


3 Literature Review

To explore how mobile videos could be introduced to support student learning, the TPACK framework was used. According to Koehler and Mishra (2007) the TPACK framework combines three knowledge areas, namely content knowledge, pedagogical knowledge and technology knowledge (see Figure 1).

![Figure 1. TPACK Framework](image)

The framework was used to interpret how these three elements could work together to make support materials accessible to the students in a mobile manner. In the context of this research project, the content knowledge referred to the subject matter at hand (a Business Information Systems module), technology knowledge to the digital tools teachers used to make content accessible (mobile videos), and pedagogical knowledge to the teaching technique used (the Jigsaw method).

The Role of Mobile Devices in Learning

Moreira et al. (2016) are of the opinion that mobile devices on their own do not ensure successful learning. However, as a tool they can support active learning, and increase student motivation and student satisfaction. Mobile devices therefore have the potential to become vehicles for mobility and collaborative learning, since collaborative learning with mobile devices allows students to participate actively in the construction of their own knowledge. Thanks to the technical advances in mobile phones in recent years, students now have their learning materials available wherever they are and they are able to share materials with one another, and to acquire skills that promote working in a group. In this collaborative learning environment the focus shifts from the lecturer and static repetitive content to a student-centred learning process where a critical comprehension of contents that goes beyond the classroom can be appreciated (Moreira et al. 2016).

Ching et al. (2009), supported by Al-Emran, Elsherif and Shaalan (2016) and Koszalka and Ntloedibe-Kuswani (2010), describe a number of characteristics relating to the use of mobile devices in mobile learning, where mobile learning not only refers to the mobility of the learning, but also to the mobility of the technology and the learner (El Hussein and Cronje 2010). They claim that the use of mobile devices for learning could support deep learning (Al-Emran et al. 2016; Ching et al. 2009; Koszalka and Ntloedibe-Kuswani, 2010). Furthermore, if mobile devices are used correctly, social interactions between students can be encouraged. As mobile devices become more cost effective and more students have access to them, these
technologies can be used to reach those who are from disadvantaged socio-economic communities and provide them with information to which they would normally not have had access.

Lastly, Ching et al. (2009) argue that mobile devices and mobile learning facilitate various ways of teaching. For example, real-time teaching can now be enriched with asynchronous discussions using voice, text or multimedia messages. Furthermore, student engagement could be increased in large classes by using the students’ mobile devices as a classroom response system (Dunn et al. 2013). Also, the use of mobile devices opens up opportunities for learners to engage with content outside the prescribed material and the confines of the classroom, especially when they are in situations where they need immediate access to information, want to enquire about new material or need to explore new topics (Koszalka and Ntloedibe-Kuswani 2010). Al-Emran et al. (2016) further claim that the use of mobile devices could increase collaboration specifically in mobile learning in such a way that it inspires students to interact with one another and their teachers. Teachers should keep in mind that the use of mobile devices is not the focus, but that it is rather a vehicle to enable activities that would otherwise not have been possible, or a way to increase the learning benefits for learners (Sharples et al. 2009).

The Use of Educational Videos

Global Internet traffic consists mainly of videos and it is predicted that videos will comprise 79% of all Internet traffic by 2020, compared to the 63% in 2015 (Cisco website, 2015). Many of these videos can be used for educational purposes, such as the ones available from National Geographic, TED talks, and the Kahn Academy. Videos, especially those uploaded on video platforms such as Vimeo and YouTube, make information available to students, and even to other people for whom they were not initially intended. Although YouTube has multiple uses, such as entertainment, news and discussions, the vast majority of learning resources are also available there and can be used by students for self-driven learning purposes (Chintalapati and Daruri 2016).

After investigating the use of videos in the classroom, many researchers agree that videos improved students’ understanding of the work, increased their knowledge retention and ultimately improved their academic performance (Hegeman 2015; Kay 2012; Lancellotti, Thomas and Kohli 2015; Ljubujevic et al. 2014; Nicholson and Nicholson 2010). In addition, Conrad (2015) and Crush (2015) claimed that the use of videos resulted in students engaging with the content, and encouraged engagement with one another. The use of videos gave them a sense of community and enhanced the instructor’s presence in the online environment (Hegeman 2015). Another benefit of videos was that they got content out to people fast, especially when they were user-generated videos that were not in need of major editing and voice overs. However, despite the speed with which videos can be created and shared, the content still has to be compelling if the intent is to benefit learning (Crush 2015).

Lancellotti et al. (2015) created short concept-based video modules, not to replace lectures, but rather to reinforce the concepts dealt with in class. The result of this intervention was that students performed much better than expected in their examinations. Also, 73% of the students preferred the combination of the videos and lectures above only lectures or only online videos. The students confirmed that the videos assisted in reinforcing the concepts taught in the face-to-face classroom. In a similar study about supplementary videos, Ljubujevic et al. (2014) not only found that the student’s results improved, but also that the students were more motivated to learn.

After an eight-year literature review (from 2002 to 2011), Kay (2012) summarised the benefits of using videos for education. He mentions that the use of videos allowed students to control their own learning because they could learn at their own pace, anywhere and at any time, could revisit a particular section of the video, slow it down or speed it up, and so forth. Also, students described the use of videos as useful, helpful, effective, enjoyable, motivating and stimulating. Students’ study habits changed, because they accessed those videos more frequently, especially before a test. Contrary to popular belief, some studies found that class attendance was not reduced because of the introduction of video-recorded lectures. The most important benefit was the evidence that videos had a positive effect on test performance.

The international trend to incorporate the latest technology into traditional classroom practices, the popularity of using videos in teaching and learning, and the research momentum gained in mobile learning were the inspiration for this research into the value of using of videos to support Business Information System (BIS) students in their practical module.
The Jigsaw Method

The jigsaw method is a co-operative technique that promotes learning, improves student motivation and also increases enjoyment of the whole learning experience (Aronson 2000). The concept was coined by Eliot Aronson in the 1970s as a research-based co-operative learning technique that makes students dependent on one another to succeed (Aronson and Patnoe 2011; Doymus 2007).

In the jigsaw method, students are divided into home groups where each member has a specific topic to explore and master to become the expert in his or her group. Once each student feels comfortable with his or her designated content, all the members who studied that particular topic in each of the home groups get together to form an expert group where they then discuss and explore the topic at hand. During this time, the teacher moves from one expert group to another, observes the process, answers questions, and intervenes with wisdom and guidance where necessary.

Once the teacher is satisfied that each expert has mastered his or her section of the work, the students move back to their home groups. Each expert then gets the chance to teach that topic to the other members of the group (Aronson 2000; Aronson and Patnoe 2011; Doymus 2007). The value of this active learning technique is widely acknowledged in literature (Azmin 2016; Tran and Lewis 2012) and works well in an environment that is student-centred and that values co-operative learning.

4 Method

In a constructivist learning environment, students are regarded as active, rather than passive, participants (Sjøberg 2007). The student is placed in the centre of the learning process (Gray 1995) while the teacher facilitates the process and provides advice and guidance. The teacher is thus not involved in the mere depositing of knowledge (Duffy and Cunningham 1996). Although meaning is created by experiences, this takes place not only through individual experiences, but also by means of social experiences (Jonassen 1999). Although the results of the mock test discussed earlier did not yield the intended results, the students also confirmed that they did not watch the video clips. It was obvious that another, more student-centred approach would be required.

Consequently, the teacher decided to introduce the videos as an integral part of her teaching practice in the face-to-face contact sessions with the students. In line with the concept of constructivism, where students are placed in charge of their own learning, and with the argument of von Glaserfeld (1989) that the responsibility of learning should reside increasingly with the learner, the jigsaw teaching method was used to ensure active engagement by all students.

The jigsaw technique seemed to work well in ensuring that students engage with the videos as per the original intent. It also got all students actively involved in the learning process, as the method created a measure of interdependency among class members. For the purpose of this part of the study, we were interested in knowing how the students experienced this approach in the contact sessions and whether they were now more willing to use their mobile phones to watch the video clips outside class in preparation for tests and examinations.

Therefore, the research study was designed in the form of a case study. Both qualitative and quantitative data were collected by means of an online survey. Two groups of third-year students who were registered for the BIS subject in two consecutive years were involved. All the students who attended class were asked to complete the survey. It is important to note that these students all came from a lower socio-economic environment.

Multiple-choice and true and false questions were asked about the capabilities of their mobile phones, whether or not they watched the videos, and which devices they used to watch the videos. Questions were also asked about the difficulties they experienced, if any, and whether the group members participated in the group activities. Some of the questions were followed by an open-ended question. At the end of the online survey, three open-ended questions were asked about the students’ experiences with regard to the use of the videos, the mobile technology, and the teaching activity in class. On completion of the BIS module, 39 (n) students completed the online survey with both closed-ended and open-ended questions. All the open-ended questions were analysed using conceptual content analysis (Babbie and Mouton 2005), which allowed the researchers to draw meaning from those concepts or themes that occurred frequently.
**5 Analysis and Discussion**

Although the videos were originally created to provide richness and additional support to struggling students, they can obviously only be of value if students are able to access the videos with relative ease. As such, it was important to find out whether the students could access the videos from their mobile devices, since a major part of the initial motivation to create these video clips was to enable the students to access the videos outside the contact sessions in class. The online survey therefore explored the issue of students’ Internet access and their ability to access the videos.

In their responses, 85% of the students indicated that they were indeed able to watch the video clips on their mobile phones. It is important to note that this response only relates to their ability to access the videos, and should not be read as an indication of the number of students who did use them for learning purposes. The students did, however, also confirm that the majority of them had Internet access via their mobile phones (92%) by means of a combination of WiFi (89%), data bundles (69%) and airtime that could be converted into data (26%). Given that most of the students who participated in this study came from a disadvantaged socio-economic background, the results can be interpreted as surprisingly positive. The fact that the students did have access to web-enabled mobile devices means that it was indeed theoretically possible for students to access online academic support in their own time, outside of the classroom.

When the students were asked whether they had actually watched the video clips, whether on a mobile device or on a desktop computer, the majority (85%) indicated that they had. What was interesting, though, were the reasons the other 15% of students gave for not watching the clips on their mobile devices. Some students noted that they did not have Internet access and one specifically indicated that he/she did not have airtime. Others mentioned specifically that they only watched the videos on the university computers in the laboratory.

It was, furthermore, important to find out whether the students valued the videos sufficiently to guarantee that they would be used in preparation for tests in future. As such, the next question requested those students who had watched the video clips to indicate whether they found them easy to use and easy to understand, and whether they felt that they had benefitted from watching them. It was interesting to note that all students, apart from the five who did not answer the question, stated that they found the videos easy to use. The majority of the students (97%) also indicated that they felt that they benefitted from watching the videos.

An analysis of the student feedback highlighted a number of themes, which will be discussed below. Some of the students claimed that the availability of videos saved them valuable time. While it is not clear why students experience the use of video as a time-saver, a possible reason might be that the video clip summarised the essential information, whereas the textbook required that students read through detailed explanations and instructions. One of the comments captured the general gist:

> “When time is not on your side the videos are there to assist you, to get more done in less amount of time.”  
> [G2P11]

This comment confirms Vieira, Lopes and Soares’ (2014) stance that a video can explain, in a few seconds, a concept or topic that would need an explanation of a few pages in written text.

The availability of the videos also allowed students to repeatedly practice their skills outside of the formal teaching environment in class, each according to his or her own pace. This notion was highlighted by some students in their feedback:

> “Now I am able to do more exercises on my own at home, when I am stuck am able to go back and watch the videos again for clarification.”  
> [G1P12]

> “If I did not understand anything when I was practicing I could watch them over again.”  
> [G1P4]

Students were of the opinion that being able to watch the videos repeatedly on their mobile phones, enabled them to understand the work better. As one student mentioned:

> “I can now remember the work and [the videos] help me understand better”  
> [G2P19]

It seems as if saving time, coupled with the opportunity to play the video as many times as required to learn a particular concept, made the videos a handy tool to increase the efficiency of learning (Vieira et al. 2014). It is thus safe to say that once the videos had been introduced in class by means of the jigsaw method
and students experienced how easy it was to access and use them, they increasingly started to use the videos when they practised their work at home. Therefore, in preparation for assessment opportunities this time round, they used the videos extensively to prepare before their final test. It thus seems fair to link the success rate that followed the introduction of the videos in class by means of the jigsaw technique to this change in behaviour. The students no longer failed because they did not meet the minimum requirements, which was one of the reasons why the videos had been made in the first place.

Because students could now learn independently, they no longer had to consult the teacher every time they did not understand the work. As one students put it:

“I referred back to the video clips on the things I didn’t understand in class, there is no need for me to go to the lecturer.” [G1P17]

The reality on campus is that lecturers are only available a few hours per week for consultation, which limits the access to lecturer support, especially the much-needed just-in-time support that students typically need before a test or an exam. This research confirmed that the mobile availability of the videos provided the required support to students when they studied on their own. As a bonus, some students mentioned that they passed the subject with good marks as a result of studying with the assistance of the videos. One student remarked:

“I passed...with awesome marks and I actually understand [the work] long after we’re done, so even in future I know I can always refer back to the clips.” [G2P20]

As mentioned before, the reason why the video clips were created in the first place was to provide much needed support to struggling students, and from the above feedback it seemed as if this goal was achieved.

Lastly the students were asked about how they experienced the jigsaw intervention where the video clips were introduced in class. The overall response was positive and students commented about how the method helped them to understand certain concepts better. The use of the jigsaw method, however, also had unintended consequences in some cases:

“It helped us to study in advance so that we can be able to explain, but then again it made us not to come to classes knowing that we have video classes. We can still catch up on what they did in class” [G1P17]

Finally, the students also indicated that they valued the opportunity to practise their interpersonal skills and that they got to share ideas with other students. They once again highlighted the fact that they found the videos helpful and that the fact that they needed to teach the members of their home groups benefitted their own learning.

“All the video clips I explained to my group seem to be the ones I understood best” [G1P2]

Some students furthermore mentioned that class was noisier than usual, but in the same context, concepts like “fun”, “exciting” and “great” were used repeatedly. It thus seems as if the jigsaw intervention, in combination with the mobile availability of the video clips, provided students with a rich learning experience, which, over and above the content that they had to master, also provided them with a unique opportunity to practise their communication and listening skills. The students’ positive experience was further expressed by the following comment:

“... I say, please continue with the video clips, it really helps a lot.” [G2P18]

6 Conclusion

As seen in the literature, most students already own mobile devices and use them everywhere and seamlessly in their daily lives (Laurillard 2012). It is, therefore, not strange to find that the use of mobile devices in formal education has grown in popularity, even though it has not yet reached its full potential (Chen et al. 2014). Students also seem to have access to web-enabled mobile devices, despite being perceived as disadvantaged and poor. This contradicts the notion that students from low socio-economic backgrounds do not have access to web-enabled devices. In fact, it is now possible for these students to access online academic support videos on their mobile devices, in their own time, when needed.
In an earlier research project it was clear, though, that students do not necessarily use mobile video resources if they are only exposed to them in an once-off demonstration during a contact session with the teacher. To answer the first research question, namely what pedagogical strategy can be used to encourage students to use the mobile videos, the videos were introduced in a face-to-face environment using the jigsaw technique. The study has shown that videos can be introduced with great effect using this method. By incorporating the videos in class, students became accustomed to working with them and were therefore more willing to explore the videos using their mobile devices outside the formal contact sessions.

The students reported that they did not only change their behaviour by using the video clips in preparation for tests and exams, but that they also enjoyed the mobile video resource and benefitted from it, which answered the second research question, namely whether the students’ use of the mobile videos increased when another pedagogical strategy was implemented. The fact that the video clips were now available on their mobile devices at all times enabled them to watch the videos whenever they needed to. They also said that they benefitted from having the option to watch the videos repeatedly until they master a particular section of the work. This aspect also reduced their reliance and dependency on the teacher, as the need for consultations decreased, which in turn resulted in more independent learning taking place. A further benefit was that the use of video clips saved them time when they needed to prepare for a test, as the content could be delivered much quicker visually than by having to read through pages and pages of text. These benefits are an indication that the third question (To what extent did the students benefit from the videos and the fact that they could view them on their mobile devices?) was also answered.

To conclude, in this research the jigsaw method was used to encourage the students to use the mobile videos created for their Business Information Systems module. This led to an increased use of mobile videos as well as recorded benefits in using them. The value of the research therefore lies in the combination of the pedagogical knowledge, technological knowledge and content knowledge, as derived from the TPACK framework.

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Learning Official Crisis Communication through Decentralized Simulations enabled by Mobile ICTs

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Abstract. This paper presents a qualitative design-based research (DBR) in-progress that aims to develop both pedagogical designs and simulation software applied in training official communication in different fields of authority. The study is carried out through three qualitative case studies following the iterative cycles of DBR.

Keywords: mobility, simulation-based education, crisis communication

1 Introduction

Crises reveal who we are as individuals and as a society (Hakala 2009). A school shooting or a major traffic accident expose the operational protocols and the working cultures of organizations better than any other situation when officials in medical and social care and rescue services are required to work under pressure in multi-professional teams. As crises are always unpredictable and complicated, they force officials to make fast decisions that sometimes outstrip any existing blueprints.

Managing, surviving, and operating during a crisis are built on vocational proficiency and also on careful official communication, often supported and mediated by mobile information and communication technologies (ICTs). In Finland, this means the use of Terrestrial Trunked Radio (TETRA phone), which is recommended for use in all routine official communication and emergency-rescue situations. TETRA phones are currently used by Finnish armed forces, rescue and health care services, border guards, police, and some private and government companies operating close to these authorities. Their use has also been increasing recently in social services. A TETRA phone resembles a traditional GSM phone and affords common GSM functionalities. Its appearance and technology are designed to endure water splashes and cold, and it can be used even with fireman gloves on. TETRA phones operate in a special digital network for official use called VIRVE. Similar networks also exist in Sweden, Britain, and Belgium, and are currently spreading rapidly into regions of Asia, the Middle East, and South America.

The use of TETRA phones affords multifaceted support for official communication, suiting everyday practices and emergency situations especially in challenging geographical locations with sparse populations such as Finland. Both the VIRVE network and TETRA phones have a high level of data security for sending and receiving confidential information. As they are used by several groups of authorities, they support working in multi-professional teams and enable fast communication in disaster situations through group calls and radio messages. TETRA and VIRVE cover the entire GSM network, but are applicable even if GSM fails and electricity distribution is interrupted.

No matter how sophisticated the devices or technologies are, they do not contribute to managing crises or solving everyday problems by themselves. Often, gaps in official communication protocols are not so much about technological questions—that is, what types of devices would be most useful—but more about developing human processes and working practices. A brief review of some recent major crises and accidents in Finland (e.g., Accident Investigation Board 2005, 2015; Ministry of Justice 2009) indicate that communication between officials was less than optimal. Similar deficits have been reported in other countries (e.g., Garnett and Kouzmin 2007; TRAUMABASE Group 2016). Learning how to communicate in multi-professional teams remains a key goal in official professional development.
Developing Mobile Simulation Pedagogy for Training Professionals

Previously, the use and communication training concerning TETRA phones has usually been carried out through face-to-face instructor-led classes with TETRAsim simulator software installed on desktops. Computer-based simulations have proven to be effective in promoting, for example, healthcare students’ learning in subsequent face-to-face hands-on simulation training (e.g., Poikela, Ruokamo and Keskitalo, 2014). For professionals such as a team of social workers or staff of emergency units, it is rather impossible to train together at the same time during working hours. They need flexible opportunities to participate in simulations, individually or as a team, with or without a facilitator. Simulation practices should be designed to promote learning new skills and updating knowledge on a regular basis. Previously, distributed simulations have been used in healthcare for example for training distributed cognition (Rybing, Nilsson, Jonson and Bang 2015).

This article presents a design-based research (DBR) (Barab and Squire 2004) in-progress, the aims of which are twofold. First, it focuses on developing decentralized simulation pedagogy for official use in medicine, social care, and emergency rescue services. In the pedagogical design principles, mobile learning (Sharples, Arnedillo Sánchez, Milrad and Vavoula 2009) meets simulation pedagogy, which has proven to be effective in learning multi-professional teamwork and care processes involving several professionals and taking place in various phases and places (Gaba 2007; Rall, van Gessel and Staender 2011). Second, the focus is on developing a TETRAsim simulator through the application of mobile ICTs to enable decentralized simulation.

This study is a part of CRICS research that investigates ICT-supported service processes, especially the use of the TETRA phone, in various public service sectors. The project strives for sustainable pedagogical models and technological solutions that could be widely available, engage working communities in developing their communications, and would not demand large and costly ICT investments. The existing culture of using technology, especially in healthcare, dynamic culture, and socio-culturally diverse contexts, provides building blocks that promote developing more sophisticated pedagogy and ICTs for training in official communication.

2 Pedagogical Premises for Decentralized Simulations

Experience gained in several fields of expertise utilizing simulations (e.g., aviation, space sciences, and military sciences) can be used in developing both decentralized simulation pedagogy and technology (Fujimoto 2000; Gaba 2012). Applying mobile ICTs in simulation-based training through TETRAsim starts with defining what mobility means in this study. Sharples’ and his colleagues’ (2009) conceptualization of mobility in mobile learning from five aspects provides direction and design principles for our pedagogical and technological development. First, mobility of technology means utilizing resources that are can be easily carried around, such as TETRA phones and an online version of TETRAsim simulator accessible through tablet computers and smartphones. Second, mobility in physical space refers to officials being able to engage in learning activities flexibly during their everyday lives. For example, firemen could use quiet moments during a work day for simulation practice. The third aspect, mobility in social space, refers to learners performing within various social groups in various contexts. In our case, this means affording possibilities for training official communication in multi-professional teams online and through scenarios that cover both everyday routine and crisis situations. Fourth, mobility in conceptual space means that a person’s interest, curiosity, and commitment define the focus of attention, which can change dynamically. The fifth aspect is a temporal one. Learning is understood as a cumulative process involving connections and reinforcement among a variety of learning experiences across formal and informal learning contexts. For an official in training, the last two aspects imply that simulation training concerning official communication is be approached from several motivations, whether the need is to remind oneself how to use the buttons of a TETRA phone or how apply a blueprint of communicating in a multi-professional team during a trauma case.

Through these five aspects, both pedagogy and ICTs will be developed to meet the needs of authorities in different fields of expertise. Mobility promotes the blurring the boundaries between education and work, and creating a learning continuum (Pimmer, Pachler and Genewein 2013) essential for professionals aiming to maintain expertise in dynamic and complex working contexts. Widening the variety of pedagogical designs and ICTs in use also enables simulating nontechnical skills and applying game-based learning in restructuring
simulation-based training. The research and development of this study will be carried out through three DBR cycles presented in following section.

3 Research Design

The research questions of this study are: 1) What kind of pedagogical design should be applied in decentralized simulation training with mobile ICTs to promote learning official communication? and 2) What developmental implications does the pedagogical design of decentralized simulations of official communication have on simulation software? The answers are sought through three qualitative case studies following the cycles of DBR (Barab and Squire 2004). The overall research design is presented in Table 1.

Table 1. Design-based Research Cycles of Official Communication

<table>
<thead>
<tr>
<th>DESIGN</th>
<th>IMPLEMENTATION</th>
<th>ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training experiments and participants</td>
<td>Focus and methods of simulation</td>
<td>Data collection, analysis and re-design</td>
</tr>
<tr>
<td>1) Alarm blueprint exercise</td>
<td>Individual online simulation training to learn how to use a TETRA phone</td>
<td>Focus on how the design principles based on the five aspects of mobility (Sharples et al., 2007) are realized in the data:</td>
</tr>
<tr>
<td>N=12, Social services, police, fire department, and paramedics</td>
<td>Instructor-led online simulation training of official communication in teams</td>
<td>Video ethnography</td>
</tr>
<tr>
<td></td>
<td>Rehearsing an alarm blueprint and multi-professional communication in an in-situ simulation of a child welfare case</td>
<td>Observations</td>
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<tr>
<td></td>
<td></td>
<td>Group interviews</td>
</tr>
<tr>
<td>2) Trauma exercise</td>
<td>Individual online simulation training to learn how to use a TETRA phone</td>
<td>User diaries</td>
</tr>
<tr>
<td>N=15, Medical staff at a local hospital: trauma, laboratory, and surgical teams</td>
<td>Instructor-led online simulation training of official communication in teams</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rehearsing a communications blueprint and multi-professional communication during an in-situ simulation of a trauma case</td>
<td></td>
</tr>
<tr>
<td>3) Emergency-rescue exercise</td>
<td>Individual online simulation training to learn how to use a TETRA phone</td>
<td></td>
</tr>
<tr>
<td>N=15, Fire department, police, and paramedics</td>
<td>Instructor-led online simulation training of official communication in teams</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training official communication under pressure during an in-situ simulation of an emergency-rescue case in challenging conditions (wet, cold, dark, smoky)</td>
<td></td>
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</table>

During the three case studies official communications are tested in varying contexts and conditions. Participants start by individually using an online version of TETRAsim to learn how to use a TETRA phone. Next, an instructor-led group-based simulation training will be organized to practice communicating using a TETRA phone. The training session ends with an in-situ simulation also involving patient actors (Dieckmann 2009; Keskitalo 2015). During each case, several types of qualitative data will be collected and analyzed. The pedagogical design will be adjusted according to the results.

4 Discussion

This paper introduced a DBR aiming to develop official communication training through decentralized simulations. As we approach the first DRB cycle in October 2016, it needs to be acknowledged that we are operating in a quite in detail defined research context. For example, our focus is on using specific software
and devices in simulation training, which might threat the applicability of our results in the future as the life-span of mobile ICTs is very short. Hence we should aim for transferable design principles that could be applied even if technologies change. As the analysis of past crises has demonstrated, the need to develop official communication is global and requires intertwining ICTs, pedagogies, contexts, contents, and people.

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Location-Based Vocabulary Learning App

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Abstract. This paper presents a mobile app that generates vocabulary learning games based on the user’s geographical location—cinema, restaurant, museum, etc. The app sends the user a notification and offers three fun vocabulary games—Unscramble, Hangman and Matching—when the user enters the premises of the location of interest. This project used cinema halls as the primary location. The games are automatically generated from the movie words and phrases extracted from New York Times movie reviews. The user can either learn new words or review words learned previously. A preliminary study with seven language learners has shown learners’ positive attitude towards the underlying principles of location-based vocabulary learning. It has also provided constructive feedback for the future development.

Keywords: vocabulary games, contextual learning, mobile vocabulary learning, location-based learning.

1 Introduction

The use of mobile devices in language education, particularly in vocabulary learning, has attracted considerable attention due to the growing popularity of mobile devices among young learners (Diaz-Vera, 2012; Kim, et al., 2013; Stockwell, 2016). The advantages of mobile learning include allowing learners to self-study at anytime and anywhere, and providing contextual learning material based on where learners are and what they are doing, which is proven to be effective in vocabulary acquisition in terms of retention and comprehension (Kramsch, 1993; Webb, 2008; Edge et al., 2011). Mobile learning also has great potential in offering personalised learning experience because of mobile devices’ ability of tracking and storing learning progresses.

This paper presents the exploration of the use of mobile devices to provide location-based vocabulary games that are fun and engaging. We have built a proof of concept prototype that tracks the user’s movement and automatically detects the user’s geographical location, in this case cinema halls, based on mobile devices’ GPS coordinates and the location’s textual description retrieved from Google Place Service. The app suggests vocabulary games that target the words and phrases relevant to the current context (for example, watching a movie in a cinema hall). New York Times movie reviews were downloaded and parsed by a part-of-speech tagger to create a movie words bank that contains frequently used words and phrases in movie reviews. The app is shipped with three games—Unscramble, Hangman and Matching—for users to learn either new words (retrieved from the movie words bank) or words learned previously. To facilitate spaced repetition, which is a common and effective vocabulary learning strategy (Godwin-Jones, 2011; Nation, 2001), the words previously learned are stored on the device and recycled periodically. The app was evaluated with seven university students, who are also language learners, at Waikato University, New Zealand. The results have indicated the students’ positive perception of the principles that underpin the system.

2 Location-Based Vocabulary Learning App

The app comprises three components: a movie words bank, a location detection and notification facility, and three vocabulary games.
Location-Based Words Bank

In this project a movie words bank was built from New York Time movie reviews\(^4\) and embedded in the app. Summaries of reviews were downloaded and parsed by a part-of-speech tagger to extract individual nouns, adjectives, adverbs, and verbs, and phrases following the syntactic patterns like adjective + noun, adverb + adjective, and noun + noun. For example, the review of the movie *The Prestige*:

“Entertaining, spirited and shamelessly gimmicky, Christopher Nolan’s new film tells the intricate tale of two rival magicians practicing their art in late-Victorian London.”

The words in bold, along with the phrases *shamelessly gimmicky, intricate tale, rival magicians* were extracted, grouped and sorted by frequency. Two English language teachers reviewed the words and discarded those that were common and not specific to movies (e.g. *new, tell*). The final words bank contains about 400 movie words and associated phrases. To help students learn more about a word, its synonyms and definitions were also retrieved from an online dictionary, reviewed and included in the bank.

Location Detection and Notification

The app tracks the user’s movements (e.g., the speed and moving patterns) and uses the GPS coordinates to detect the user’s current location. The Google Places service is consulted for the name and description of the surrounding places. A notification, indicated by a sound, shown in Figure 1a, is triggered once the user enters the premises of a location of interest (e.g., a cinema hall). The user accepts the notification by clicking the “Yes” button, or dismisses it by clicking “No”. The app launches a screen asking the user to select one of vocabulary game described in the next session if “Yes” is clicked.

Vocabulary Games

The app offers three vocabulary games: *Unscramble, Hangman, and Matching*. *Unscramble* and *Hangman* improve students’ spelling skills, while *Matching* raises awareness of common word combinations. *Unscramble* is a permutation activity where letters of a word are scrambled. In the game, shown in Figure 1b, the player needs to reassemble the word before the countdown timer expires (three minutes by default, adjustable, and can be turned off). A hint, which is either a synonym or definition retrieved from the movie words bank, is given beneath, in this case “very complicated or detailed”. *Hangman* asks the player to guess an unknown word one letter at a time, shown in Figure 1c. A mystery word, in this case the word *scene*, is chosen for the player to guess, and is shown by a row of dashes representing the number of letters in it. When the player suggests a letter that occurs in the word, it is put in all its correct positions. If they suggest one that does not occur, one element of the stick figure is drawn. The game is over when the player completes the word, or when the diagram is finished—in which case the player has lost. *Matching* is another permutation activity where five phrases are split into left- and right-hand parts, each part containing one or two words (phrases can be three words long, e.g., *satisfyingly puzzelike structure*), shuffled and presented on

\(^4\) [http://www.nytimes.com/reviews/movies]
each side, as shown in Figure 1d. The player matches the left-hand words with their right-hand partners by dragging and dropping them in a way that creates the strongest partnership.

When selecting a game, the user chooses either to review the words learned previously or to learn new words. In the first the game pulls out the words from a database where the words previously learned are stored. The database also records when and how many times a word has been encountered for spaced repetition. The learned words currently are recycled three times in an interval of the next day, a week later and three weeks later, suggested by Nation (2001). In learning new words, the game retrieves words from the words bank described above, and uses those that have not been seen by the learner. Once the learner finishes the game, the new words are saved to the learned words database for recycling later.

3 Evaluation

A preliminary user study was conducted with seven language learners with the aim to measure the accuracy of the location detection algorithm, and gather feedback on the features of notification, spaced repetition, and vocabulary games that target words relevant to the user’s current context (e.g., cinema halls). Here we briefly report the findings. Seven undergraduates studying at University of Waikato, aged from 19 to 33, from three countries (i.e. China, Indian and Fiji), participated the evaluation over a week. They visited four cinema halls in the city in two days and tested the app around the premises of the cinema halls, including waiting for notifications and playing with vocabulary games. After that they were encouraged to continue to use the app over the following week. They were then interviewed and answered a set of questions.

Overall the participants were satisfied with the location detection notification facility that, they thought, was generally accurate and not disturbing, but some complaint about a few instances of unexpected delays (i.e. they had waited for too long to receive the notification). They liked the idea of learning movies-related words in a cinema hall where they may encounter those words on the poster or reviews, or they could use those words to talk about the movie with their friends. They appreciated the spaced repetition feature that would help them retain the word they have learned previously, and preferred more frequent repetition (e.g., the next day, two or three days later, weekly and monthly) to promote retention. The participants found the vocabulary games were interesting and enjoyable, and would like to play them while waiting for the movie to start at cinema halls. Feedback and suggestions were collected during the course of evaluation. Adding a scoring system and multiplayer mode would make the games more fun, and help maintain high motivation. More information about a word needs to be included, such as translation, pronunciation, and usages in sentences. Adding other locations such as museums, cafes, and sport venues were also suggested.

4 Conclusion

This paper describes a location-based vocabulary learning app that detects the user’s geographical location and provides contextual vocabulary games that are automatically created using the contextual words and phrases. In this project we have built a proof of concept prototype that uses cinema halls as the target location, and focuses on the movie words extracted from the movie reviews. The initial evaluation with language learners suggested their acceptance of the design principles underpinning the system. The development of a fully-fledged application is still in progress. The accuracy of the location detection algorithm will be further improved by using more sophisticated location detection algorithms. The words banks for other locations—restaurants, museums, airports, sport venues—will be established and enriched by incorporating other language resources such as sample sentences, audio pronunciations, and collocations. Literature reviews on spaced repetition will be further carried out to develop a new recycling algorithm. More vocabulary games will be developed, with multiple players and scoring features.

5 References


Learning Collocations with FLAX Apps

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Abstract. The rise of Mobile Assisted Language Learning has brought a new dimension and dynamic into language classes. Game-like apps have become a particularly effective way to promote self-learning to young learners outside classroom. This paper describes a system called FLAX that allows teachers to automatically generate a variety of collocation games from a contemporary collocation database built from Wikipedia text. These games are fun to play and mimic traditional classroom activities such as Collocation Matching, Collocation Guessing, Collocation Dominoes, and Related Words. The apps can be downloaded onto Android devices from the Google Play store, and exercises are automatically updated whenever new materials are added by teachers through a web-based interface on the FLAX server. Teachers have used these games to provide supplementary material for several Massive Open Online courses (MOOC) in Law discipline.

Keywords: Mobile language learning, collocation learning, Wikipedia, language learning games

1 Introduction

With their superior portability and wide accessibility among young learners, the use of mobile devices in education is growing in popularity. Researchers and teachers have been exploring the full potential of what Mobile Assisted Language Learning (MALL) can offer to language learners (Stockwell, 2016). One of the advantage of MALL is that it serves as a primary self-learning tool due to the fact that students are able to access language materials almost anywhere and anytime (Hamada, 2013). The use of mobile devices in the design and implementation of language activities has also added significant value to what teachers can now offer to students in terms of challenging and interactive language games (Wu et al., 2012).

This paper presents a system called FLAX⁵ that was initially developed to support collocation learning through web- and mobile-based games that mimic popular language activities in classroom. The games are created from a massive collocation database that is automatically built from Wikipedia text. The value of Wikipedia’s data has long been obvious, with its articles being continually refreshed, but nonetheless frequent (Vrandecis, 2014). Recent years have seen many efforts to use Wikipedia not just as source of information but also as extensive and contemporary corpus for language learning (Nothman, 2013). FLAX extracts Wikipedia texts and provides language teachers with options to set particular parameters when designing games. In such a way, the games are controlled by the teacher both in terms of content, form, and level of difficulty or complexity. This paper focuses on the description of the Collocation Related Words game, including its mobile interface and teacher’s design interface. It also briefly discusses three other games—Collocation Matching, Collocation Guessing, and Collocation Dominoes. We include some user cases where teachers use FLAX collocation games to create supplementary material for their students enrolled in Massive Open Online courses.

2 Collocation Learning Games

Knowing the collocations of a word is an important aspect of one’s vocabulary knowledge. The term collocation has different definitions in the literature. We take a syntax-oriented approach in this paper that emphasises the grammatical structure of collocation (Benson, et al., 1997) and identifies collocations by syntactic structures (e.g. verb + noun, adjective + noun, noun + verb). We have designed and implemented four

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⁵ The FLAX project was started in 2008 and the authors are the core designers and developers of the FLAX system.
Collocation games that incorporate the common learning strategies that facilitate raising awareness (e.g., help students notice language patterns), enhancing precision (e.g., help students express ideas more precisely) and improving motivation (e.g., help students maintain high motivation).

**Collocation Guessing** lets learners try their hand at identifying words from the company they keep and allows the teacher to choose a target word and a number of associated collocations. The target word is removed and the associated collocations are revealed one by one; players must guess the target word as quickly as possible. For example, given this list: *plain, dark, white, bitter*, milk, bar of, learners guess the word that collocates with all of them. (The answer is obvious to chocolate lovers!)

**Collocation Dominoes** mimics the traditional game of dominoes where the last word of the previous collocation becomes the first word of the next collocation.

*family* life – *life* cycle – *cycle* time – *time* period …

English word classes are incredibly flexible: many verbs can be used as nouns and many nouns can be used as adjectives. This game is designed to help learners notice these language features and collocates of particular words. In this case, the starting word “family” and the ending word “period” are given; the learner proceeds by dragging a collocate listed at the top and dropping it into an empty box to form a collocation.

**Related Words** is a popular practice in language classrooms; the aim is to help learners distinguish words with similar meanings, or words that have the same usage (e.g. *reserve* vs. *preserve*, *effective* vs. *efficient* and *identify* vs. *recognize*) by examining their common collocates. Teachers select two or three related words that they wish to target, and FLAX retrieves a list of collocates of these target words from the collocation database. The player drags a target word and drops it into the appropriate box to form valid collocations.

**Collocation Matching** is similar to Related Words; the difference is that Collocation Matching is intended for use with several words with typically just one collocation for each, whereas Related Words is intended to focus on two (or three) words, with several collocations of each. Teachers select a set of collocations with the same syntactic pattern, splits each into its left and right component, and shuffles the two sets of components. For example, *slice of toast, part of the progress, drop of water, piece of information* might be presented as: *slice of information, part of toast, drop of the progress, piece of water*. Player must rematch them.

### 3 Flax Collocation Apps

The four collocation games described above can be played in a web browser or on Android devices. We use Related Words as an example to illustrate how the game works on an Android mobile phone. Figure 1a shows the screen where exercises from two datasets (i.e., Learning Collocations and English Common Law MOOC) are listed. Figure 1b shows the exercise *Legal vs Lawful* from English Common Law MOOC that contains 15 pairs of collocations, half starting with the word *legal* and half with *lawful*. The word *Legal* and *Lawful* are displayed at the top, each associated with a number in brackets (e.g., 12), indicating the number of times that word can be dragged-dropped. The player drag-drops a word to an empty box in a way that it forms the strongest partnership (e.g., *legal battle*). Clicking the Check answer button at the bottom makes correct answers stay (indicated by the border of boxes disappearing), while incorrectly matched words (e.g., *lawful* in *lawful battle*) are removed from the boxes and the number of that word is incremented. At anytime, clicking on a completed collocation displays a screen, shown in Figure 1c, which displays ten sample sentences from Wikipedia that use the collocation.

### 4 Creating Collocation Games for FLAX Apps

Teachers use collocations retrieved from a massive collocation database to create games. The database was built from 3 million Wikipedia articles (Wu, 2012). FLAX first downloads Wikipedia text, parses it, extracts useful syntactic-based word combinations (e.g., *verb + noun, noun + noun, adjective + noun*), organizes them by syntactic pattern, sorts them by frequency, and links them to their context sentences. Teachers use an easy-to-use interface to automatically retrieve collocations based on a set of parameters and construct games by selecting and discarding collocations. All games described above are created automatically under the guidance of a designer, usually the teacher, through a web interface shown in Figure 1d. The interface varies slightly from one game to another depending on the parameters that can be manipulated. Creating a game can be simply accepting all the defaults, then clicking *Save*, or clicking *Display* to play the game if you
want to see what it’s like before making it available to students. Once a game is created, its web version is instantly available on the FLAX website; any Android mobile devices with the app installed are promoted to download the new game when the app is launched.

(a) Choosing an exercise  (b) Playing the game  (c) Displaying sample sentences  (d) Teacher’s design interface

Figure 1. Collocation Related Words Mobile Interface and Teacher’s Design Interface

When designing the Related Word game, the teacher specifies two or three target words (e.g. legal and lawful, which have similar meanings, but are used in quite different contexts), and their desired syntactic pattern (e.g., adjective + noun). After clicking the Review button, FLAX retrieves 10 collocations (10 is the default value and is configurable) from the database and displays them in descending order of occurrence frequency for the teacher to make selections, as shown in Figure 1d. The number in brackets indicates the frequency of the collocation in the database. The teacher uses the check boxes to select a few that are appropriate for the students and can also click any of the collocations to view the sentences that contain it, which will help the teacher decide on the best ones to choose. These sentences are extracted from the Wikipedia articles where the collocation is identified when building the database. The sentences are made available to students once they correctly complete a collocation, as shown in Figure 1c.

5 CONCLUSION

We have described four FLAX collocation games that can be played in a browser or on Android devices. The games are automatically generated from a collocation database built from Wikipedia text, with many options for teacher manipulation. Teachers have used FLAX to create collocation games to provide supplementary language materials for their MOOC students in law discipline, for example, the “English Common Law MOOC” from University of London and ContractsX, from Harvard University. We are currently evaluating these mobile apps with MOOC students, as well as TESL teachers and students at Waikato Institute of Technology, New Zealand. At this stage, the evaluation focuses on intuitiveness of the user interface, and collecting feature suggestions.

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4 Student levels range from Beginner to Upper-intermediate, according to http://www.icaltefl.com/learner-levels-in-tefl.


Factors in Designing an Augmented Reality M-Learning Trail with Place-based Pedagogy in Residential Education

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Abstract. Coupling the emerging technologies of augmented reality (AR) and mobile learning (m-learning) together with the rising importance of place-based pedagogy, the purpose of this paper is to investigate factors in designing an AR m-learning trail for newly recruited Hall Tutors (HTs) as part of the Induction Training Programme to achieve the expected outcome of the HTs exploring and internalizing conceptual ethical issues. The learning trail context was designed as a result of the joint effort of both students and staff of Undergraduate Halls to create a scenario-driven story-line with value-added features. Both qualitative and quantitative methodologies were adopted in this study and the results were triangulated in such a way to support the positive outcomes. The impact of exploring this student-oriented learning trail has empowered HTs to have a better understanding of place-significance in their community together with the enhancement of HTs’ ethical reasoning and judgmental skills that enable them to see their roles as role models to peer residents. This study has suggested to further conduct these AR m-learning activities regularly by involving more HTs and even residents to a wider scope of Residential Education in the near future.

Keywords: augmented reality, m-learning, place-based learning, residential education

1 Introduction

The emergence of revolutionary AR mobile technologies has made significant impact on educational technology. Being wireless is one of the main advantages of mobile technology; access to the communication network is not tied to a fixed location or to the transmission medium has favoured its expansion (Ferran-Ferrer, Domingo, Prieto-Blazquez, Corcoles, Sancho-Vinuesa & Santanach, 2014, p.176). With the possibility exists for AR to provide a more holistic approach to education, students will no longer view concepts and ideas in an isolated set of facts or procedures (Squire & Klopfner, 2007), instead they will be able to determine spatial and visual relationships via this kind of AR application. AR allows students to take a more active role in their education (Villano, 2008). AR can also be great for discovery-based learning, allowing students to be creative, take risks, and make mistakes without consequences (Thornton, Ernst & Clark, 2012, p.20). M-learning in higher education, however, is still in the early stages of development (Park, 2011), and only very few applications or even none have been adopted for residential education. Many universities provide free Apps for their students to download, but many of their contents are primarily non-instructional (e.g., news, event calendars, and maps) which do not provide any atmosphere for conducive learning. However, with the advancements of mobile technology, mobile device applications (i.e., Apps) can be used as a source (e.g., to activate a scenario-driven story-line in specific place-based information) that students can access from virtually anywhere (Young, 2011). Students are then able to have relevant place-based information about specific learning (“Undergraduate Hall” in this study) environment with online access capability. However, without a student-oriented and meaningful AR m-learning design, it would be difficult for students to realize these benefits of conducive learning via AR m-learning in this techno-generation. Despite the benefits of using AR m-learning, very little research has been conducted concerning factors in designing AR m-learning to enhance students’ understanding on conceptual issues in the context of training leadership in residential students. To this end, this study investigated factors in designing an AR m-learning trail and how these design factors could benefit students’ better understanding on ethical issues.
2 Background

Since its commission in March 2002, residential education forms an integral part of the Hong Kong Baptist University's (HKBU) holistic approach to its ethos of Whole Person Education (WPE). The University aims at cultivating a "living-learning" environment in the Undergraduate Halls where residents will enjoy a "home away from home" environment and benefit from the many learning opportunities for acquiring life skills, facilitating intellectual achievement, experiencing multi-cultural exchanges, and getting involved in the many-faceted campus life programs. There are currently four Undergraduate Halls which provide a total of 1,770 residences for full-time students of the University, with 34 HTs assisting the four Resident Masters in routine management. It is a living learning-community where residents have the opportunities to interact with residents from different cultures and social backgrounds.

Senior year students (usually 3rd or 4th year of the study) were recruited every year as Hall Tutors (HTs) and each HT would be assigned a floor to look after around 50 residents. Prior to the commencement of each academic year, newly recruited HTs have to attend an Induction Training Programme organized by the Hall Life Education Team, which consisted of Resident Masters and Resident Coordinators from the 4 Halls, a Student Affairs Officer and other administrative staff, to facilitate their roles as leaders, team builders, peer counselors, floor managers to the residents of their respective floors in order to maintain a harmonious and caring living environment.

The existing classroom-based HT training materials, initially designed by the Hall Life Education Team sometimes ago, have been regularly updated and adjusted according to the regular feedback given by ex-HTs and residents. Apparently, there was a strong demand on emphasizing the understanding of ethical and integrity in HTs when they performed their role as leaders. Most university students nowadays have their own mobile devices (Traxler, 2007) and thereby having ubiquitous access to remote resources, it has therefore been suggested that new elements should be introduced into the current HT training programme to reinforce students’ learning outside classroom. Subsequently, an AR m-learning trail focused on how to implement the Hall rules and regulations that within the remit of HTs was designed as part of their training in the summer of 2015. Newly recruited HTs were required to attend three parts of training, i.e. firstly, classroom-based training regarding house-keeping issues like Hall rules and regulations, roles and responsibilities; secondly, an outdoor camp-site training for physical team-building exercise; and thirdly exploring an AR m-learning trail in hall environment (outside classroom).

To build up and sustain a balanced hall life, a hall life programme grid with eight dimensions was employed as shown in Figure 1 as the various themes of designing hall life activities. This study supported the leadership development of HTs under one of the grids called “Community Service / Leadership Training”. All the recruited HTs were actively involved in promoting other dimensions of hall life programme among their peer residents.

3 Literature Review

Klopf and Sheldon (2010) emphasized that the potential of AR for learning was its capacity “to enable students to see the world around them in new ways and engage with realistic issues in a context with which the students were already connected” (Delello, McWhorter & Camp, 2015, p.211-212). In this situation, AR could provide users technology-mediated immersive experiences in which real and virtual worlds were blended (Klopf & Sheldon, 2010) and users’ interactions and engagement were augmented (Dunleavy, Dede, & Mitchell, 2009). This kind of interactive learning environment could turn passive students into active learners that were fully engaged (Moore, Fowler & Watson, 2007; Dufresne, Gerace, Leonard & Mestre, 1996). This study also drew on the significance of using Place-based approach, to help the hall of residence (as a community) through employing both students and university staff in solving problems encountered within the hall environment. The reason of adopting AR m-learning in this study was that the ability of AR to supplement reality augmenting one’s immediate data or information (FitzGerald et al., 2012) and digital assets such as audio and video files, textual information, and even olfactory or tactile information could be incorporated into users’ perceptions of the real world (Yuen, Yaoyuneyong & Johnson, 2011). The emergence of new technological innovations such as AR technologies not only demonstrated the weaknesses of traditional teaching methods but also the potential for improving them (Liarokapis, 2012). Together with the Place-based Approach (Sobel, 2004) which aimed at designing curriculum / training program to make school-based / classroom based learning more relevant to everyday life through a focus of local issues. With
that, we were trying to investigate factors in designing an AR m-learning trail that could help HTs to personalize their ethical understanding upon their roles and responsibilities.

To develop students with a higher order of thinking, this study encouraged students to become the designers of this AR m-learning trail. Design-based learning was founded in the constructionist pedagogical paradigm, which espoused that students understanding of their world was best developed when they actively created real objects (Papert & Harel, 1991). Learning by design has been shown to improve student learning outcomes (Doppelt, Mehalik, Schunn, Silk, & Krysinski, 2008). To begin with this study, we developed a pilot learning trail (see section 2 for details) with inputs from a former HT and a resident under the guidance of the RC based on their previous experience living in the Hall.

After the pilot trail was designed, another former HT and resident were invited to test whether the context of the pilot trail was appropriate from the student point of view. The actual AR m-learning trail was then redesigned based on the feedback given by participants conducted the pilot trail with many other value-added features (see section 2 for details) like real sound effect, context language used, input boxes etc. To better improve the conceptual understanding, design-based learning took a place to improve motivation for students to pursue careers in the domain of practice (Apedoe, Reynolds, Ellefson, & Schunn, 2008).

Adoption of both quantitative and qualitative methodologies in this study has provided a viable option to obtain complementary findings that collected from surveys, interviews etc and to decrease the potential of bias in gathering, reporting, coding, or analyzing of the data (Denzin, 1970; Mitchell, 1986) as well as to contribute to internal validity (Boyd, 2000). The benefits of triangulation could include increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem (Jick, 1979).

4 Methodologies

Pilot Run

To reinforce students’ ethical understanding on the role of HTs to their peer residents, a pilot AR m-learning trail study using the mobile App called Mobxz was designed based on the previous trail design experience sought from other departments in HKBU together with input from a former HT and a resident. This pilot trail was developed based on a scenario of “Lending Student ID Card”. Lending student ID card to
others was considered a violation of the Hall rules and which was commonly offended among residents. The screen layouts and the context (Figure 2) were first designed by using PowerPoint software and written in proper English style. Different instructions were given to guide participants to go through the trail. The whole design contexts were then converted into different mobile App interfaces by employing a Singaporean software house for technical support. To start the trail, participants had to download the mobile App (Mobxz) onto their mobile devices and then scanned the designated QR codes to trigger the scenario information. To obtain the QR codes they had to go to a designated location within the Hall environment according to the checkpoint # they selected on the App. The main purpose of this pilot trail was to allow participants an opportunity to understand the ethical issue behind the action of lending their student ID cards to others which had resulted in an unpleasant and uncontrolled situation with adverse consequences like theft, loss of properties or even unwanted intrusion into resident rooms.

A former HT and a resident were invited to try out this pilot trail (see Figure 3). They were asked to complete a survey (see Table 1) with six short questions regarding the usage experience of this pilot AR m-learning trail in order to evaluate the effectiveness of the Mobxz App design immediately after they had finished the trail, and followed by a short interview to solicit their personal response of exploring this pilot trail with a fresh experience.

They were then asked to give their personal comments on the design of this pilot trail, feedbacks collected from these two participants were summarized as below.

a) The questions prompted inside the Mobxz App were too straight-forward and didn’t require much thinking from the participants, therefore they were not challenging enough;

b) The context of this kind of informal learning should be written in the Hong Kong-style Cantonese (the local dialect) as all HTs were Cantonese-speaking Hong Kong Chinese born after 80s, the use of more Cantonese slang would be easier for them to understand the scenario better;

c) The length of the given scenario (only 4 steps) should be longer to allow participants more time to immerse themselves in the real simulated situation;

d) It would be better to incorporate sound or video to create some kind of real-life effect on each scenario appropriately;

e) Apart from using the clicking buttons to response to the pop-up questions, dialogue boxes should also be included to allow participants to express their response and feelings in their own words.

Note: Depending on option that participants selected on their mobile screen, each check-point # here refers to a location within the Hall environment where they could trigger a QR code to open a new page of information to follow. All learning context was written in English and in a static format.
Figure 2. AR m-Learning Interface Design for Pilot Trail

Figure 3. Participants Scanning QR Codes in Designated Locations in the Pilot Learning Trail

Table 1. Questionnaire Feedback on the Pilot Learning Trail

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Student 1</th>
<th>Student 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I find this App easy to use.</td>
<td>Disagree</td>
<td>Neutral</td>
</tr>
<tr>
<td>2. My interaction with this App is clear and understandable.</td>
<td>Agree</td>
<td>Neutral</td>
</tr>
<tr>
<td>3. This App makes learning academic integrity and ethics more interesting.</td>
<td>Neutral</td>
<td>Disagree</td>
</tr>
<tr>
<td>4. Working with this App is fun.</td>
<td>Disagree</td>
<td>Agree</td>
</tr>
<tr>
<td>5. The WiFi connection is stable.</td>
<td>Strongly disagree</td>
<td>Disagree</td>
</tr>
<tr>
<td>6. My overall usage experience with this learning trail is good.</td>
<td>Disagree</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

Actual Run – New Design of the AR m-learning Trail

Based on the feedback collected from the pilot trail, the Hall Life Education Team then worked together with the former HT to re-design the entire actual AR m-learning trail with different sequenced stages of scenario to lengthen the story-line. The App context was now written in the Chinese – the Hong Kong Cantonese dialect including slang words to allow the text phrasing appeared in form of conversations and close to the mindset of the participants, hence making the scenario-driven story-line more real and related to them. There were originally 34 HTs recruited in AY2015-16, however during the Induction Training in summer 2015 only 27 of them were available. Therefore the revised learning trail was introduced as part of the HT training programme to these 27 newly recruited HTs.

Following the same procedure as applied to the pilot trail, participants were first instructed to downloaded the Mobxz App and login to the Mobxz web-based database (see Figure 4a), however this time every single click made and text entered on the mobile devices were recorded and stored for future data retrieval. Once logon to the Mobxz, they simply followed the instruction displayed on the mobile screen (see Figure 4b) to start the trail journey. As shown in Figure 5 this actual AR m-learning trail was written in Cantonese slang with different sequenced stages according to the trail flow design. Use of various real sound effects together with the real hall pictures were incorporated into different scenarios to create some kind of real-life experience. Depending on the choice(s) participants selected via the Mobxz App, participants moved around to different locations within the Hall environment. This actual AR m-learning trail has a rather complex storyline with vivid scenario description based on a fictious story that a HT went home overnight for a birthday celebration, and leaving his/her floor-mates behind without notice. However, few incidents happened that evening, all these unexpected incidents had unconsciously caused the guilty feeling for HT which he/she would like to rectify the problem encountered. The whole story-line scenario was described in Step 2 as shown in Figure 5.
Figure 4. Tailor-made Mobile App (Mobxz)

Step 1:

Participants were required to list three the most difficult problems / issues (see below) to handle as a HT before conducting the m-learning trail.

Pre Trail Survey:
請列出三項作為HT最難處理的情況／問題。

Pre Trail Survey:
Please list out the THREE most difficult problems/ issues to handle as a Hall Tutor.

Step 2:

After completion of the Pre-trail survey, participants were guided to a familiar location within the Hall and started the m-learning trail through triggering of a QR code in a designated location. The learning text was written in a user friendly and easy understanding Cantonese style format with real sound effects like screaming, ambulance siren, glass breaking, phone ringing, conversations etc together with pop-up related images and text to create the real-life experience.

Cantonese Version of the story-line with Scenario Description

English Translation Version of the Story-line with Scenario Description
You are a hall tutor of a female floor. Although this is your first year serving in this role, your past hall residence experience has enabled you to handle hall affairs smoothly. Coming to October, your floormates are mingling well with one another. Many residents enjoy hanging out on this floor, including floormates and O'camp group members who like to meet at your room from time to time.

On a Thursday, you went home to celebrate your mother’s birthday and stay over for the night.

Audio: Scream
Audio: Ambulance siren
Texts appear 10 seconds after the sounds:
A female resident on your floor was admitted to the hospital yesterday night. As you returned to the hall, your floormates were asking you what happened. You are determined to find out the reasons behind the resident’s hospital admission. The name of the resident concerned is Desperate Ng.

Result
Step 3:
Participants were then asked to answer a Post Trail Survey as below.

Post Trail Survey:
Please list out the most difficult problem / matter to handle as a Hall Tutor.

Step 4:
A debriefing session with questions was conducted with all participants after the trail.

Debriefing Session after the Trail:
- Insights gained from the Trial
- Problems reflected in the trail
- Hall rules and regulations infringement and remedies
- Preventive measures to problems
- The roles of being a Hall tutor

Figure 5. Flow of a Story-line Scenario-based AR m-learning Designed by the Joint Effort of Students & Staff of Undergraduate Halls
Figure 6. Samples of Mobx App Interfaces Design Used in the Actual AR m-Learning Trail

Figure 6 above has illustrated some samples of screen design which had incorporated real hall pictures, real voice/sound and the context was written in the Hong Kong Cantonese style which allowed participants a sense of actual reality. The process of designing the AR m-learning study trail in this study was summarized and presented in the form of a flow chart as shown in Figure 7.

Figure 7. Flow Chart of Designing the Entire AR m-Learning Trail
5 Results

Questionnaire:

27 newly recruited HTs for AY 2015-16 were invited to answer the survey (as explained in Section 2) regarding the AR m-learning Usage Experience as shown in Figure 8a, and the results were shown in Figure 8b.

From the results shown in Figure 8b, it has illustrated that the design of the Mobxz App design was user-friendly, except the WiFi connection was unstable at times during the execution of the trail. The overall AR m-learning trail experience was considered positive.
Informal Interviews

Same as that in the pilot trail, immediately after the HTs completed their survey, they were also asked about their feedback on the design of this actual AR m-learning trail and the comments were summarized as below.

Pros
i. The design of the App interface was simple and clear;
ii. The App was user-friendly;
iii. The connectively of wifi was good;
iv. The scenario was very lively as if I was in the real situation;
v. Good audio, picture and text effect.

Cons
i. Downloading time between interfaces could be faster.

Data Collected from Participants’ Mobile Devices

The clicks and text selected/entered by participants via the buttons and different text boxes during the trail exercise were recorded and analyzed by using an Open Source Search Result Clustering Engine called Carrot² and the results collected was presented as Circle Visualization (see Figure 9). When participants were asked their understanding upon the role as HT, the biggest portion of the circle i.e. the ROLE MODEL has revealed that HTs see their roles as role models to peer residents in their own personal self-reflection after going through this actual AR m-learning trail.

![Image](image)

Figure 9. Circle Visualization of the Participants’ Text Inputs via the AR m-learning Trail

6 Discussion and Conclusions

Our results of adopting the AR technology to design such a m-learning trail has shown to be successful, as reflected by the users’ overall usage experience survey score of 3.96 out of 5 (see Figure 8b). With the user-friendly mobile interface design with the localized slang as well as the appropriate use of various audio effects, real images/pictures, long story-line etc, participants had greatly enjoyed this m-learning trail as reflected by their feedback with the score of 4.08 when answering the survey question “Working with this App is fun.” (see Figure 8b).
As described before, the m-learning trail was executed as part of the newly recruited HT training programme, with the latest development hardware of mobile devices (like camera, speakers etc) together with the free downloadable application software (like Apps, QR code scanner etc) which provided us the capability of organizing, manipulating and generating information for teaching and learning (Chen, Tan, Looi, Zhang, & Seow, 2008; Keskin & Metcalf, 2011). Furthermore, the key features of using mobile devices for this m-learning study were their one-to-one interaction with place and time independence, capacity of personalization, and extended reached as described by Motiwalla (2007). Not surprisingly, participants in this AR m-learning trail found that the Mobxz App design was easy to use as reflected from the score of 4.0 out of 5, and that their interaction with the use of the Mobxz App was clear and understandable as reflected from their scoring of 4.12 out of 5 (see Figure 8b).

AR used location awareness to create context-sensitive and place-dependent (Dunleavy, Dede & Mitchell, 2009; Dunleavy & Dede, 2014) approaches that leverage aspects of a physical setting (i.e. Hall environment in this study) to engage learners. Through applying AR technology to augment virtual object into real-life environment in the familiar situation allowed participants to immerse themselves and incorporate their prior knowledge and experiences to make decision upon those embedded prompts by clicking their mobile devices responsively in their own free time. In our AR m-learning trail, we had inserted “participatory simulations” into the different fictional locations that mimic respective local settings so as to facilitate participants to immerse themselves into the “real” situation. Our results had illustrated that participants considered the use of Mobxz App has made their learning upon ethics and integrity issues more interesting, as reflected from the scoring of 4.04 out of 5 (see Figure 8b), in agreement with Dede (2009) who stated that immersion could make possible the learning situated in real-world problems, issues and environments.

On the other hand, Bronack (2011) claimed that AR and other immersive media for learning such as serious games and virtual worlds offered affordances of presence, and immersion. AR could provide a mediated space that gave learners a sense of being in a place with others. Such sense of presence may enhance students’ recognition of community of learners (Squire & Jan, 2007). Furthermore, an AR system could include real-time feedback and provide verbal and nonverbal cues to foster students’ sense of immediacy (Kotranza, Lind, Pugh, & Lok, 2009). Therefore, in our design of this AR m-learning trail, participants were given opportunities to input their thoughts via dialogue boxes and their answers given were reviewed so as to facilitate their sense of immediacy. Given that immediacy was important to foster the effective side of learning, AR managed to bring together learners, virtual objects or information, and characters in a real environment which had the potential to increase immediacy, as we had achieved in this AR m-learning trail study.

To encourage reflection and internalization of concepts, addition of input boxes for entering text allowed participants the process to think for themselves before making any decision and inputs. This kind of mobile inputs had reflected the true personal views of participants under a free environment without any pressure. Our study results had illustrated that the exploring of this AR m-learning trail has fulfilled part of our study objective, that is, most HTs realized the importance of behaving themselves as “role model” to peer residents as the word “Role Model” has taken up the biggest portion of the circle as illustrated in Figure 9 according to their replies. This AR m-learning trail design has successfully created a higher order of thinking among most HTs ethically to better understand their roles and responsibilities in a rather personal manner.

This study has also demonstrated that place-based education (PBE) was a promising way to bring people, community, learning and services together in a locality. It was our intention to engage students in activities within and about communities (Undergraduate Halls in this case), to advance meaning making as advocated in PBE (Smith, 2000; Sobel, 2004) via the exploring of AR m-learning application. PBE highlighted disciplinary concepts that were embedded within local systems, histories, and interactions which were the rationales of adopting PBE according to Lim & Calabrese Barton (2005) and to transform disciplinary information from abstracted knowledge, such as respect of each other, considerate and integrity, to local knowledge that was related to communities’ cultural practices (Gruenewald, 2003). According to the study results, we believed there was a clear association between personal attitude and role model of many HTs to peer residents within their living communities. As places could influence personal attitude both positively and negatively, directly and indirectly, and that was the reason we considered and incorporated place-based approach in designing our AR m-learning trail for this study. Specifically we included the two main characteristics of Place-based approaches, namely targeting specific communities (Undergraduate Halls), and also stakeholders (HTs in this case) engaging in a collaborative process to address issues (implementing Hall rules and regulations) when they were experiencing an AR m-learning trail within a particular place (i.e. residential hall).
Last but not least, we discovered that an early involvement of stakeholders (i.e. HTs and residents) played an important part in designing the pilot AR m-learning trail and that was very effective from the learning design point of view, though it was found out that the pilot trail we designed was not challenging enough as explained in Section 2. The feedback and constructive suggestions we received from the pilot trail such as change of language style (use Cantonese slang style), longer story-line, adding real sound effects, and applied dialogue boxes for HTs to express themselves etc were crucial to the success of the actual AR m-learning trail design, as reflected in the high scores we collected for the usage experience survey as described earlier in this section.

In summary, the success of this study could be attributed to the five design factors as listed below and illustrated in Figure 10.

i. Adoption of the AR m-learning framework i.e. application of both the characteristics of mobile devices and features of m-learning application;

ii. Adoption and incorporation of the Place-based Education approach;

iii. The involvement of both students and hall staff in developing the entire AR m-learning trail design (see Figure 7 for the entire Design Flow of the AR m-learning Trail);

iv. Adoption of localized scenario-driven story-line that was written in the form of student acceptable language (i.e. Cantonese slang style) and executed informally in a familiar hall environment;

v. Technical tools provision such as mobile devices, network / wifi connectivity, tailor-made mobile app (i.e. Mobxz), mobile data collection etc.

Figure 10. Factors in Designing an AR M-learning Trail for Residential Education

Interesting enough when we reviewing the literature quoted in this study, we had found that there were strong correlations between the applications of AR m-learning and Place-based approaches, which include:

i. both were designed to study (ethically issue in this case) the unique needs of a location / community;

ii. both engaged participants in making decision to reflect their learning process;

iii. place-based approach in its application could evolve and adapt to a new learning approach (i.e. AR m-learning application in this study) for the interests of participants;

iv. both approaches encouraged learners to develop new behaviors (i.e. understanding the ethical role as HTs in this study).

Therefore Place-based approach when combined with the AR m-learning technologies could be an invaluable learning tool, and very effective when set in the right learning context design. This approach to learning was also meant to show students the importance of teamwork, their place in the hall community around them and to respect their role as student leaders to peer residents in this study. Though this study has involved relatively small number of students living in the hall of residence as an experiment, further development of this kind of learning strategy included better hardware support, such as sufficient network / stable WiFi connection, and evaluation of its longer term learning impact on students could be arranged. Given the positive
outcome of designing AR m-learning trail in this study, to regularize this approach by involving more HTs and even residents to extend its application to cover a wider scope of HKBU residential education could be considered.

7 Acknowledgement

This project is funded by a Teaching and Learning Grant titled ‘Reinforcing the Importance of Academic Integrity and Ethics in Students through Blended Learning—a Deployment of Augmented Reality Applications’ from the University Grants Committee of Hong Kong.

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Section II
Practitioners’ Presentations
Designing Physics Courses to Increase Student Engagement for Online and Mobile Environments

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¹University of New South Wales, Australia; ²mobilelearning.io

Keywords: physics, student engagement, scaffolding, mobile app, feedback

This talk will look at the rationale for course design and student learning activities in introductory online first year physics courses. The talk will also look at the introduction of a mobile application (mLearn) to extend student access to Moodle through their mobile devices. The courses are very contextualised to increase student engagement in an online environment. Students are scaffolded through investigations they complete at home to gain the skills they need to design their own investigation. They receive feedback from tutors and peers. Features in the mLearn app have been prioritized for development through consultation with teaching staff and students. We will consider the patterns of engagement of different students using (rather than 'who chose to use') the app and what we can learn from this. The effect of app usage on student learning, as measured by concept inventory tests, will also be presented.
Building a Campus-Wide Mobile Platform that Focuses on Enhancing Student Effectiveness and Learning

Matthew Burley\(^1\), Alexander Roche\(^2\) and John Reddin\(^1\)

\(^1\)mobilelearning.io, Australia; \(^2\)Androgogic Pty Ltd, Australia

**Keywords**: mobile platform, student effectiveness, ePortfolio, Moodle, analytics, campus-wide, case study, accessibility

Our presentation will focus on the development of a Mobile Strategy built around a robust Mobile Platform, an array of campus wide apps and deep integration with the Moodle Learning Platform, to achieve enhanced student effectiveness and learning. Using a number of case studies in mobile app implementations in University and Higher Education institutions, we will detail the use and effectiveness of mobile devices in extending student engagement through the opening up of mobile channels with native apps.

The mobile app platform is designed to make it easier for students to keep up with their courses using their personal mobile device. They can communicate, socialise and engage with their teachers and fellow students through in-app forums and messages. They can download student-learning materials and go offline to keep learning on the go. Designed for iPhone, iPad, iPod Touch, Android tablets and mobile devices, the app incorporates a range of links to institutional support services, information and maps that encourage student engagement throughout their university studies.

The mobile app platform uses cloud based databases and systems to dynamically modify app content, personalize app experiences & transactions and track user’s mobile usage to create reports using Learning Analytics and to visualize student workflows and behaviours, plan and implement intervention strategies, communicate to individual students or large groups using automated large scale push notification, email or SMS.

The primary objective of our research and development work is to combine the world of apps with enterprise learning systems to target better learning and teaching experiences. These include improving the:

- Ability for learners to make choices about how they learn, with personalized analytics
- Ability to harness a broad range of specialist tools available in the world of apps
- Access to rapid, ongoing innovation in the app space
- Usability derived from features only available in mobile device native operating systems and not available via mobile browser technologies such as HTML5

The presentation will be interactive and examples of individual and group behavioural profiles will be discussed with a view to informing institutional Mobile Strategies including ePortfolio platforms.
Designing for Mobile Learning

Lucila Carvalho¹ and Pippa Yeoman²

¹Institute for Interactive Media and Learning, University of Technology Sydney, Australia; ²Centre for Research on Learning and Innovation, University of Sydney, Australia

Keywords: mobile learning, design for learning, design anthropology, networked learning

How do we engage in innovative educational design in formal and informal settings where mobile learning has become the norm? How do we ensure that our design choices are coherent across scale levels and accommodate socio-cultural and socio-material approaches to learning? How do we support autonomy and collaboration, and equip learning spaces in ways that support diversity and choice, without overwhelming all?

This workshop invites participants to consider how pedagogical, digital/material resources, and people may be brought together when designing for mobile learning. We have chosen an approach from design anthropology (Gunn, Otto & Smith, 2013), as it combines the strengths of a design-oriented perspective – the creation of contextual knowledge in order to develop specific solutions – and an anthropologically-oriented perspective – where thinking about things, the context in which they are used and their role in creating meaning is essential.

Whilst we draw deeply on theoretical perspectives about learning and the nature of knowledge, this will be a decidedly hands on workshop. Participants will be led through a process of elicitation, that is easily replicable and may be used across a broad range of mobile teaching and learning contexts including schools, universities, museums, workplaces and gaming environments. Participants will be introduced to the Activity-Centred Analysis and Design Framework (Carvalho & Goodyear, 2014) while considering its application on three mobile learning scenarios – e.g. Design Studio (museum), CmyView (university), Project-Based Learning (school). Participants will experience ways of connecting theory and practice, and encouraged to begin the process of realising their own vision for mobile learning – a vision where digital/material resources, the social connections between learners, and the tasks with which they engage, are integrated into a coherent whole.

References

Lighting a FUSE Program for Student Engagement and Differentiated Learning with Mobile Technologies

Scott Diamond and Andrew Brown
Surf Coast Secondary College, Australia

**Keywords**: holistic learning approaches, individualized learning, student engagement, secondary school

FUSE is a specially designed program that integrates the core subjects of English, mathematics, humanities, and science at a level each student is capable of. At times students will study common themes that interweave all of the subject areas, while at other times learning will be focused on the development of a specific skill, such as numeracy and literacy. The program actively engages students to understand their current capacity and what is required to take their learning to the next level. In this workshop, we will share our experiences in the planning of the FUSE pedagogy, its implementation and the experiences of students and teachers in the program.
Pedagogy GO:
Enhancing Educational Experiences with Location-Based Mobile Learning Games

Roger Edmonds and Simon Smith
University of South Australia, Australia

**Keywords:** location-based mobile learning, action research, gamification, real world teaching and learning

This 60 min practitioner’s presentation is in the form of an interactive workshop that has both an indoor and an outdoor component. We begin inside the conference venue where we will briefly describe the results of implementing location-based mobile learning games in our University. Location-based mobile learning games embrace the characteristics of mobile learning, location-based learning and game-based learning. Delivered as a mobile app they integrate storytelling, augmented reality and rich media with GPS, maps and gamification methodologies.

Next it’s outdoors for 30 minutes in small groups to play a prototype location-based mobile learning game on your mobile phone (iOS or Android only) around UTS and nearby streets. We then return inside to briefly deconstruct how it was designed and for you to collect a free director account and access to materials that will allow you to design and publish one of your own.

**IMPORTANT: Pre-Workshop Task (10 minutes)**

Before the workshop please download and install the free Mobile Learning Academy app on your iOS or Android phone from either the Apple App Store or Google Play. Please refer to the companion website at http://bit.ly/1TL1tHm for instructions on getting prepared to play.
Mobile Learning: An Innovative Approach that Puts the Control of the Internet of Things into the Hands of Primary School Students

Deborah Evans and Alix Spillane

Wahroonga Public School, NSW, Australia

Keywords: Internet of Things, student-directed, prototyping

According to research (Forbes, 2013) by 2020, the Internet of Things (IoT) will generate 30 billion autonomously connected end points and $USD8.9 trillion in revenue; for example the average home in China in 2030 will have 40–50 intelligent devices/sensors that are generating 200TB of data annually. The IoT means that it’s not so much that the device is mobile, it is the user and the data that it generates.

For students in Australian primary schools in 2016 aged 6 this forecast means that when they finish school in 2028 they will need to know not just how to use the Internet but understand, control and support how the IoT grows.

This workshop reports on how Year 4 students at Wahroonga Public School (WPS) are using html to create webpages that enables them to control a range of interconnected devices located at school from the Internet. The program at WPS is a prototype. At the moment the focus is on fun and building confidence. Students are able to connect and control a range of devices connected to a Raspberry Pi located in the Deputy Principal’s office from their own webpage at any time, and from any location. A webcam captures these events in real time.

Prototyping is a key aspect of the WPS focus on Science Technology Engineering and Mathematics (STEM) education where it is being demonstrated that tackling these disciplines early means students are more likely to create and modify what they produce using digital solutions. In the workshop resources and teaching strategies that enable primary school teachers to provide a student-directed approach to mobile learning using various technologies will be reviewed. Participants will have opportunities to test drive ‘hands on’ examples and experience the elements of ‘fun and play’ that inspires students to learn and teach each other.
Teaching Arabic Alphabet using EBook Widgets

Hany Fazza
Georgetown University, Qatar

**Keywords:** book Widgets, Arabic, PPP

Ketsman (2012) in her study “Technology-enhanced Multimedia Instruction in Foreign Language Classrooms: A Mixed Methods Study” had found that, “Technology-enhanced multimedia instruction provided opportunities for successful and effective language learning instruction and allowed foreign language teachers to meet the needs of twenty-first century learners.”

The main goal of this presentation is to demonstrate the application of new techniques for teaching the Arabic alphabet for beginner non-native speakers, by creating interactive drills using e-book widgets.

The subjects of this study are non-native speakers studying Arabic at Georgetown-Q in Qatar. The beginners’ class is a six-credit intensive course that covers all language skills at beginners level. Teaching material, for this class is the renowned textbook in the field called Alif Baa (Brustad, 2010), which is a collection of texts covering topics from different disciplines.

The students will follow the textbook in addition to a mobile e-book that includes ten interactive widgets after each unit. The e-book was developed in light of the Book Author software. In addition, interactive widgets were designed by web applications called BookWidgets and Bookery.

The design of the e-book is following a three-step teaching structure called the “PPP”: Present, Practice, Produce. In the presentation step, widgets were designed to help students recognize and learn the alphabet. This is followed by a set of widgets as a controlled practice of the alphabet. The production stage requires students to use these alphabets to produce words and take a quiz after each unit.

The E-book widgets include flash cards, split worksheets, quiz, hangman game, jigsaw puzzle, randomness, and word search, crossword and memory game. Additionally, videos explain the writing system for each single letter in Arabic.

**References**


Integrating iPads into Science Teaching and Learning

Heidi Hammond and Linda Clutterbuck

East Hills Girls Technology High School, Sydney, Australia

**Keywords**: tablets, Science, STEM disciplines, secondary school, inquiry-based learning

We are an Apple Distinguished Program School with iPads for students in 7-11. In this presentation, we will share our experiences on how we integrate the use of the iPad in Science teaching and learning at our school. A range of examples will be presented and the benefits, issues and impact on students will be discussed. We will walk you through the use of applications like, iTunes U for the delivery of work to students, the integrated use of Showbie to differentiate work and provide quality feedback, the use of Kahoots and Quizlet as tools to check learning. The integration of platforms like Pearson eBooks and IntoScience to deliver content and provide feedback on inquiry learning plus its effects on standardised testing.
Google Classroom in My Classroom

Nicole Holgersson
Pittwater House, Sydney, Australia

Keywords: BYOD, Bring-Your-Own-Device, Google, Google Classroom, Primary School

Disseminating information to students, and then collecting work back from them, is one of the many challenges of a Bring-Your-Own-Device classroom, especially in the primary school environment. Added to this, students are often working from a variety of devices in a number of different settings. This can create real challenges for teachers. In my classroom, we adopted Google Classroom, a learning management system that not only has the benefit of being web-based, and so accessible anywhere, but it is also a free system that works very well with the rest of the Google suite on offer.

Google Classroom allows the teacher to distribute learning tasks, with the required resources also attached, and submissions of work by students are collected in real-time. Work can be viewed, graded and returned all in one easy step, and individual or group comments can be sent out to all of the students. With everything being saved in Google Drive, it doesn’t matter if a student is working from home or school, and should a student forget to bring their computer or a computer gets broken, any device can be used, with no work lost.

For us, Google Classroom has been an integral part of the success of our BYOD program. I am able to provide my students with many resources and with great ease. In this presentation I will discuss how I use Google Classroom with my primary school students and how this, along with the rest of the Google suite, underpin much of what we do in our Bring-Your-Own-Device environment.
Sustaining Mobile Learning Pedagogies with High Possibility Classrooms: A Vision for Teacher Education in Australian Universities

Jane Hunter and Ariane Skapetis
Faculty of Arts and Social Sciences, University of Technology Sydney, Australia

Keywords: pedagogy, teacher education, theoretical frameworks

Teacher education in Australian universities is increasingly going online or combining face-to-face pedagogies with more blended learning approaches involving mobile devices (McLean Davies et al, 2013). For many teacher educators technology is disrupting the linear process of curriculum delivery to their adult learners, in this case, pre-service teachers. Understanding the challenges and adopting suitable pedagogical frameworks to support this process of transition is necessary if schools/and faculties of education in universities are to successfully model what pre-service teachers need to experience prior to commencing classroom teaching. Expectations in primary and secondary schools are that graduate teachers be better equipped to enhance learning with technology in classrooms (Action Now: Classroom Ready Teachers, 2015). At the University of Technology Sydney (UTS) learning technologists in the Institute for Interactive Media and Learning (IML) support teacher educators in the School of Education to blend, create and experiment with resources/applications that are suitable for pre-service teachers to use on their mobile devices with a view to implementing and growing confidence in technology enhanced learning (TEL) when they teach in schools. Research conducted in exemplary teachers’ knowledge of technology integration in NSW schools led to the development of the High Possibility Classrooms (HPC) framework (Hunter, 2013; 2014; 2015; 2016) which is now being used by teachers in NSW, ACT and Victorian schools; the framework has five conceptions: theory, creativity, public learning, life preparation and contextual accommodations that are relevant to teacher education. This workshop examines suitable applications, resources and teaching strategies that align with conceptions in the HPC framework. The ‘hands on examples’ draw on ideas from the perspectives of a teacher educator and a learning technologist at UTS on how a pedagogical scaffold developed from research in school education contexts can re-imagine how mobile learning in teacher education in Australian universities might be conducted.
Why Gamified Learning and Using Games to Teach are not the Same Thing

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Keywords: mobile games, augmented reality, group learning, learning metrics, intrinsic rewards

The world around our students has changed dramatically, yet the university classroom has barely changed at all. Each student carries with them a mobile computer that provides them with any piece of information and promises unlimited connectivity, yet universities ignore the way students interact with the world. It’s time to use mobile resources to engage students in the way they are accustomed. Although educational games are touted as the saviour of our crumbling education system, most ‘educational’ games focus on external rewards (e.g., points, badges) to teach a concept, rather than harnessing the fun inherent in learning and exploring a new topic. A secondary problem is that most educational game developers are creating ecosystems that attempt to immerse students in a learning environment. This approach has two fundamental flaws: (1) it removes two of the most important aspects in learning – social interactions and physical gesturing, and (2) suggests that a single method of learning suits all topics. In this workshop, I will use examples from my own teaching with games I have developed to demonstrate what a future in mobile education can look like. We will play different games that teach STEM concepts using different mechanics such as augmented reality, multiplayer real-time gaming, and ‘flipped’ single-player teaching. We will discuss the benefits/shortcomings of the different approaches and how there is no magic bullet in game design and student learning. I will then present student responses and feedback, and will discuss how the different games have influenced my teaching. I hope to convince attendants that games can be powerful tools to engage students and explore how they are learning only if they are considered learning tools rather than ecosystems.
Using Mobile Serious Games Technology to Enhance Student Engagement and Learning in a Postgraduate Ethics Classroom: A Case Study

Gillian McGregor and Emma Bartle

University of Queensland, Australia

**Keywords:** serious games technology, student engagement, deep learning, technology in teaching and learning

Student engagement contributes positively to quality of education and the experience of authentic and productive learning (Coates, 2005). Students can be encouraged to adopt a deep learning approach through carefully structured learning activities, which then fosters higher quality learning outcomes. Tasks where students are actively constructing their own knowledge and which inspire discussions are examples of these (Arnab, Brown, Clarke, Dunwell, Lim, Suttie, et al., 2013). Authentic active learning strategies are particularly effective for improving engagement in content that students see as mundane. Although Ethics is a core competency for postgraduate psychology students, anecdotal evidence suggests that students can perceive the subject as tedious. Consequently, ethics courses present a challenge to facilitators to keep students engaged in order to enhance learning outcomes.

Interestingly, recent research at the Open University has found a correlation between positive attitudes to using technology for studying and a deep approach to learning (Haigh, 2011). The first author has worked with software engineers to develop a digital game to enhance ethical knowledge and practice competence by providing improved teaching, learning, assessment and feedback mechanisms. The software uses serious games technology to deliver a stimulating and engaging educational experience. Students are entertained while learning in a manner that fosters discussion and the transfer of knowledge and skills to real world scenarios.

Delegates will have the opportunity to experience playing the game first hand during the presentation. The presentation will describe the implementation of the digital game in a post-graduate Ethics course. Data will be presented on user and stakeholder experience, comparing the experiences of students engaging with the software, to those of traditional teaching methods. Implications of the use of games technology in providing a feasible solution to enhancing student engagement and deep learning will be explored. Limitations and challenges to such an approach will be described.

**Pre-Work**

Delegates attending this practitioner’s presentation are invited to download the game to their mobile android devices (smart phone and tablet) prior to attending. Please follow the link below. It is recommended that you download the game using wifi:

http://laurus.tech/play/mlearn2016/
Our ‘Have a go, Share and eValuate’ iPad Learning Journey: From Implementation to Acceptance

Damien McGuire
St Agnes Catholic High School, Australia

Keywords: tablets, secondary school education, SAMR model, ICT integration

In 2012, St Agnes Catholic High School Rooty Hill, launched its, “Have a go, Share and eValuate” (HSV) iPad program. The objective of the HSV iPad program is to prepare, educate and guide staff, students and parents to confidently implement the iPad as an educational tool.

Join the St Agnes Community while we explore Our Have a go, Share and eValuate iPad Learning Journey: From implementation to acceptance. We were started on our iPad Learning Journey by one of our past year 8 students who registered for an iPad 1 pilot program facilitated by Catholic Education Diocese of Parramatta. This student, along with her friends, constantly demonstrated the educational benefit of this mobile device. This tradition of student leadership has continued throughout the HSV program.

At the core of the HSV program is the belief that we should always ‘Have a go’ at using our mobile devices to facilitate creative reciprocal teaching and learning environments. If we see the challenges of teaching and learning as a constantly changing stream then our mobile devices can provide an easily accessible bridge for teachers and students to cross over to become independent learners. Our laptops, iPads and our App Lists, guided by the SAMR model of ICT integration and a respect for Digital Citizenship, form this bridge. This bridge has helped to transform our staff and also remarkably our students, from learning dictators to learning facilitators.

ICT educators always need to remember that some students and staff are reluctant to use ICT within their teaching and learning environment because of past negative experiences or a general feeling of being overwhelmed. Therefore, constant support is needed to foster an environment where everyone can ‘Share’ what was taught and learnt with our mobile devices. Our mobile devices have aided our teachers and students to teach and learn from each other.

We regularly implement formal and informal methods to honestly and openly ‘eValuate’ our HSV program. To ensure our HSV Learning Journey and its products remain student centred our students are encouraged to evaluate our App list and participate in the training of the younger year groups.

We are looking forward to discussing our Our Have a go, Share and eValuate iPad Learning Journey: From implementation to acceptance with you.
Mobile Phone Potential in Secondary School Classrooms

Gus McLean
Greensborough Secondary College, Australia

**Keywords**: BYOD, Science teaching, literacy, ethical issues, disruption, distraction

Mobile phones are always present in the secondary school classroom. But they are often hidden away in pockets or in pencil cases, which means that their educational potential can remain unexploited. The powerful processors and rich sets of features in these devices have much to offer as tools for teaching and learning.

I started to wonder about the potential of these powerful mobile devices for teaching and learning and whether my teaching needed to be dramatically different if I encouraged the students to bring their own mobile phones. My teaching-based research took place over two years in two different year levels and across a number of curriculum areas, I explored the use of mobile phones in established classes for 6 months in three Year 8 science classes and for 6 months in a Year 8 science class, a Year 8 maths class and a Year 7 literacy class.

What I found was that mobile phones are not as different from established good pedagogy as is sometimes suggested. Nevertheless, using mobile phones for teaching and learning is not the same as introducing a new textbook. Mobile devices offer the potential to magnify the opportunities for teaching and learning, as well as magnifying the potential for disruption and distraction. This workshop presents some suggestions and strategies, ways of working effectively with mobile devices and what they offer to students and teachers based on my experiences and analysis of using mobile devices in everyday secondary school classrooms.
A Global Classroom: The ACO Music & Art Program

Vicki Norton and Zoe Arthur
Australian Chamber Orchestra (ACO)

**Keywords:** video conference, regional communities, connectivity in the classroom

The Australian Chamber Orchestra (ACO) presents the ACO Music & Art Program to primary students in regional Australia and Western Sydney. This innovative Program offers students an accessible and engaging way to respond to music through the creation of artworks all via a virtual classroom. ACO Musicians call into classrooms once a month over the course of the year to deliver interactive units of work which are then continued by the classroom teacher via the Program website.

The essence of the Program is to provide students with a way to make connections between music and art and their own feelings and experiences, thus students and teachers create connections to their own knowledge and experience to achieve learning outcomes. Teachers that are new to teaching the arts are encouraged to discover and explore alongside their students. The added dimension of lessons delivery via video conferencing and videos sent from international concert halls, enhances the program by exposing students first-hand to life as a touring musician.

This practitioner presentation aims to share the best practices involved in this Program by exploring the social, technical and pedagogical considerations associated with its delivery. We will identify the issues we have encountered in delivering a Program over the internet to schools in regional areas and celebrate the successes we have had in reaching students who would otherwise not have the opportunity to engage with the arts in this manner. We will offer an introduction to how teachers can utilize the Program itself, or learn from it to develop their own programs. We will then look forward to how the Program will develop in the future based on the evaluation and development of a second year, to scale activities and create ways for students to share their work via different technologies.

**Social:**
- Engaging with regional communities
- Creating links between schools and their local arts venues

**Technical:**
- Connectivity
- Access

**Pedagogical:**
- Offering arts learning where it might not otherwise be available
- Upskilling classroom teachers in how to teach the arts
- Upskilling classroom teachers in how to make the most of technology
- Creating accessibility links for students with music and art in the future

**Identifying Issues:**
- Connectivity
- Virtual classroom
- Teacher knowledge
• Classroom management

**Celebrating Successes:**
  • Reaching new audiences
  • Providing regional students with access to the ACO
  • Engaging schools with their local venues

**Program Development:**
  • Evaluation procedure
  • Looking forward
Accepting the Challenge of Adapting Traditional Faculty Development to Online and Mobile Environments

Lisa O’Neill
Teaching Commons, York University, Toronto, Canada

**Keywords:** adaptation, delivery models, faculty development, instructional skills workshop

Since the 1978 pilot Instructional Skills Workshop’s (ISW’s) have been Canada’s longest running professional development activity for post-secondary educators. ISW is currently offered in 60 different countries. Because the ISW has traditionally been taught face-to-face, it could better support the technology enhanced, online and mobile environments faculty currently teach in. Although a few institutions have offered technology enhanced ISW’s, online and mobile ISW delivery models do not yet exist because of the challenge in proving that the learner experience remains true to the face-to-face learner experience. Those not emulating this experience are not able to provide participants with an ISW certificate/credential.

York University’s Teaching Commons (TC) is currently adapting the ISW for online and mobile delivery in ways that maintain the best of the ISW learner experience with the aim to be certified to issue the ISW certificate for multiple delivery models. The principal investigator (PI) has been an integral part of the ISW Network and Facilitator Development Workshop (FDW), which certifies faculty to teach ISW’s, and is currently working in committee to revise the certified ISW Participant Handbook. The PI will utilize curated open educational resources as replacements for currently copyrighted learning materials, and develop a mobile participant handbook to accompany the facilitator handbook. The initial redevelopment of ISW resources will create the requisite flexibility required to redesign the learning cycles for flexible (online and mobile) delivery.

The PI will present initial research findings and practices involved in adapting the ISW for flexible delivery, highlighting the processes that have protected the most valuable aspects of this significant faculty development opportunity: social and experiential learning. This presentation will also highlight the affordances that this adaptation will have on the provisioning of ISW’s in general for Institutions who currently offer them, and those who are not yet certified.
How Does a Mobile App Incorporate Facebook-Style Social Connectivity within a Learning Platform?

Alexander Roche\textsuperscript{1}, Josephine Chan\textsuperscript{1}, Anthony Chung\textsuperscript{2} and Matthew Burley\textsuperscript{2}

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\textit{Keywords:} mobile app, case study, peer interaction, social networking, social media

Surveys regularly show that students expect to access learning material with mobile devices. Although a core of early adopters will independently use an app that gives them another channel to access their digital learning materials, a network effect is required to encourage wider usage.

Traditional forums on learning management systems do not provide the flexibility for students to initiate forum topics, interact through voting up comments and follow content they are interested in. Students are used to the flexibility that newer technology platforms like Facebook provide. However, due to privacy concerns institutions are restricted from using Facebook to support social learning engagements of their students. The challenge therefore is to provide the flexibility of modern social platforms while at the same time providing the privacy and controls that enterprises and institutions require.

The presentation will be interactive, with examples generated by the system, showing how students have complete freedom to interact with their peers across courses, faculties and teachers and employers using their own privacy and in-app notification settings. Sharing timetable information, ideas, questions, to-do-lists and project work extends their engagement with the app and helps them be more connected with their learning ‘Community of Practice’.

Social platforms can also host digital course artefacts, which they can manage and share as interns and Alumni to extend their career network.
How Does a Mobile Platform Address TEQSA and Other Regulatory Compliance for Online Courses?

Alexander Roche\textsuperscript{1}, Josephine Chan\textsuperscript{1}, Anthony Chung\textsuperscript{2} and Matthew Burley\textsuperscript{2}

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\textbf{Keywords:} regulatory frameworks, compliance, mobile phones, accessibility, learning analytics

Mobile phones can offer transitional support and analytics to detect students at risk (see Section 1.3). For example, analytics can track a drop or increase in student engagement and be used both for auditing, monitoring, continual improvement, engagement and intervention strategies. Learning Analytics solutions exist on current systems. However, as mobile systems are introduced into the student’s digital life it is important to have an offline and online analytics strategy that is able to measure individual and group activity on these mobile devices to fill the gaps in reporting. Recording data prepares for future machine learning systems that can automate interventions.

Mobile devices also offer opportunities for successful transition into and progression through their course of study, irrespective of their educational (section 1.3.6) background, entry pathway, or mode or place of study. One example is Mobile Support for Accessibility for hearing and visually impaired users to use their primary personal mobile device to read, translate and use text to speech capabilities that can be leveraged from mobile devices.

They can also be used for specifying and validating learning outcomes (Section 1.4) that might normally be assessed on-site. For example, signing forms using an app PDF engine or mobile surveys.

They also address specific requirements in the Standards: providing flexible anywhere, anytime access to electronic information (Standard 2.1.2); and supporting interactions among students outside of formal teaching (Standard 2.1.3) such as group work.

Probably the best example of this is through native mobile integration with Enterprise Social Learning Platforms that allow for the flexibility and privacy of Social Learning interactions within an institutional context, with the flexibility of student driven interactions where students create forums, “like” and follow other student-generated content that they are interested in.

We also cover support for safety and support services (Section 2.3), and the provision of access to learning resources and educational support, and maintaining college contact with off-campus students (Section 3.3).

Bring your mobile devices and we will help you experience how this works through mobile technology first hand. This will be an interactive presentation, with examples generated by the system showing how to address compliance challenges such as how to validate learning outcomes that might normally be assessed on-site; support group interactions, and maintain college contact with off-campus students.
Online Tutorials and GeoGebra as Mobile Learning Tools

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University Of New South Wales, Australia

Keywords: STEM disciplines, mathematics, statistics, MOOCs

We discuss various initiatives in the online space that we have been pursuing recently in the School of Mathematics and Statistics at UNSW, including use of Maple TA to allow students to engage with exercises in Online Tutorials, live streaming for test and exam review, development of open learning courses and MOOCs to engage high school teachers, and GeoGebra to replace our static images with interactive ones, allowing students to push and pull on what used to be just flat mathematical ideas.
Section III
Abstracts
Teachers as Digital Citizens: Investigation of Variables Influencing Teachers’ Perceptions of Digital Citizenship

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Ohio State University, USA

**Keywords:** Digital citizenship, citizenship education, teacher education, ANOVA, multiple regression

Demonstrating how to be digitally engaged in the Internet era has been promoted by the global educational community as an essential teaching practice to accelerate P-12 students’ academic success. Teacher variables that may predict teachers' perception of digital citizenship is an under-researched area of the existing scholarship. Using survey methodology, this study investigated the influence of select personal, school, and Internet usage related variables on teachers’ perception of digital citizenship. Participants (n=348) from a multi-state U.S. consortium of school districts completed an online survey. Statistically significant differences were found in respondents’ perception of digital citizenship. Prior years of work experience (other than in teaching), grade level, purpose of internet usage, and type of digital media source used to obtain information also emerged as significant predictors. Implications for future research are discussed.
Using Mobile Technology to Increase Engagement and Learning in Lectures

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Keywords: biomedical, eLearning, image annotation, collaborative

1 Significance

Biomedical images play a large role in supporting student understanding in the fields of histology, histopathology, anatomy and pathology, where they can supplement, or provide an alternative to access to the physical specimens. The BEST Network image bank, Slice, is a collection of over 19,700 images across a range of biomedical and biological disciplines. Accessible online, including by mobile devices, Slice includes an annotation tool that enables both students and their teachers to make notes and mark features on images. In order to increase interaction and engagement with images in both lectures and practical classes, we implemented the capacity to collaboratively annotate images. Here we demonstrate our findings of improved engagement in large group teaching with biomedical images, using a ‘bring your own device’ approach.

2 Methodology

Annotation activities were created for a series of lectures given in histology, anatomy and pathology classes across Medical Science and Medicine courses. Students accessed Slice via links on their learning management system for single-sign on access. Activities were designed so that students worked individually or in small groups to anonymously mark features on pre-selected images. Students had no access to annotations made by their peers while they completed the activity. All annotations were revealed to students both on their devices and by projection onto a screen upon completion of the activity. Answers were overlayed and student misconceptions were addressed in real-time.

3 Results

The activities were well received by students, who reported that they enjoyed the interactivity and seeing the responses of other students. The value of targeted and in-depth feedback was a recurring theme in student evaluations. Questionnaire results revealed that students perceived that they received useful feedback and that the activity enhanced their motivation.

4 Conclusions

Use of Slice on mobile devices enables implementation of interactive learning activities around biomedical images without requiring access to a computer laboratory. In addition to enhancing the student experience, collaborative annotation during large group teaching provides academics with feedback about students’ understanding and misconceptions. This in turn enables teaching to be targeted appropriately.
Choosing between a Student-Generated Animation or Written Assignment: Students Know What They Want and Why

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Keywords: animation, assessment, choice, Health Sciences, learning strategies, learner autonomy

Student-generated multimedia assessment has been adopted in a variety of disciplines by teachers seeking innovative ways to engage students and improve learning outcomes. It represents the application to the educational setting of user-generated content, which has seen an enormous growth since the widespread availability of free file-hosting websites and the almost universal adoption of multifunction mobile phones. The latter allow students to easily take photos, videos or sound recordings which can then be edited with the addition of written text or spoken narration to create a truly multimedia artefact to demonstrate the achievement of the designated learning objectives. These multimedia products can be made available as learning resources to fellow students to view on their desktop or mobile devices. Student-generated multimedia assessment may thus introduce the benefits of both visual literacy and peer-mediated learning into courses.

Working in a university setting, we offered a student-generated animation assignment to first-year health science students but, contrary to expectations, it led to poorer learning outcomes. Upon analysis of an end-of-semester student survey, the assignment was redesigned to offer students a choice of either a group-based animation task or an individual written task. Results showed improved learning outcomes in terms of depth of learning on their chosen topic in the assignments submitted and better performance at final examinations. Student feedback from a focus group indicated that students adopt deliberate individual learning strategies when offered choices in assessment.

The origins of such deployed individual learning strategies seem varied and are the subject of this presentation based on a subsequent study involving second-year health science students. Analysis of a student survey showed preferences in regard to collaborative learning and group work, willingness to attempt and enjoyment of a new mode of assessment, time constraints based around work and family that limit a student’s ability to contribute to a meaningful group effort, and prior visual literacy skills. The study revealed that most students demonstrated detailed insights into their own abilities and situation. This presentation will argue that students’ understanding of their abilities, individual situations, agencies and preferences allow them to adopt deliberate individual learning strategies when offered choices in assessment, leading to deep learning, and improved learning outcomes.
Using OffLine Personal Devices to Enable Access to Higher Education in Prisons

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Digital Life Lab, University of Southern Queensland

Keywords: mobile learning, m-learning, eLearning, digital divide, notebook computer, prisoner education.

Making the Connection is a $4.4 million Australian government-funded project, led by the University of Southern Queensland, which aims to introduce digital technologies into prisons to enable prisoner access to higher education. The first part of the project saw the introduction of servers (Enterprise Platforms), preloaded with an offline version of USQ’s learning management system, USQ OffLine StudyDesk (a version of Moodle), and a suite of programs, into the prisoner computer labs of prisons. The second part of the project will see the introduction of USQ OffLine Personal Devices (OPDs): notebook computers loaded with the USQ OffLine StudyDesk and the same suite of courses, which prisoners will be able to take back to their cells.

The introduction of digital technologies into prisons is complicated by the prohibition of prisoner access to the internet in most Australian correctional jurisdictions. The technologies developed as part of the Making the Connection project do not require internet access. In tandem with the development of the technologies, a suite of programs has been modified to operate without the internet. First among these are the Tertiary Preparation Program and the Indigenous Higher Education Pathways Program, both Commonwealth-funded enabling programs. Successful completion of either of these programs enables entry into an offline Diploma of Arts (in Community Welfare and Development), a Diploma of Science (in the Environment and Sustainability), and a Diploma of Business Administration.

The USQ OffLine Personal Device is an 11 inch Dell notebook which allows for two types of log on: 1) an education officer log on and 2) a prisoner log on. When the prisoner logs on, the camera, microphone, Wi-Fi, Bluetooth and USB ports (for mass storage devices) are disabled. The prisoner can only access the USQ OffLine StudyDesk and a version of LibreOffice. The education officer log on allows access to the Device Management Software developed by the Making the Connection project team. This software allows the education to see at a glance whether the security features of the device are still enabled. It also affords a view of all prisoner activity on the device including any attempts to bypass the security features. The education officer log on also enables the USB ports for mass storage devices to allow prisoner assessment to be removed from the computer for submission to the university.

To date, the OffLine Personal Devices have been certified as secure by third party security experts in both Queensland and the Northern Territory. The certification process is also underway in Western Australia and Tasmania. A soft trial evaluation has just been completed in three prisons in Queensland: Borallon Training and Correctional Centre, Wolston Correctional Centre and Brisbane Women’s Correctional Centre. This paper reports on the development of the OffLine Personal Device and the results of the soft trial evaluation. It discusses the potential to use the OffLine Personal Devices to facilitate mobile learning, without access to the internet, in a secure correctional environment.
WhatsApp in mLearning:
The (Learning) Medium is the Message(r)

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**Keywords**: WhatsApp, mlearning, mobile learning, Web 3.0, WhatsApp in higher education, heutagogy, self-determined learning

McLuhan first coined ‘the message is the medium’ as a discourse of how technology shaped an audience’s mass-media mediated experience. The popular phrase takes on new significance as web-based technologies are reshaping the educational experience. Cochrane and Narayan (2014) stated that learning is evolving to Web 3.0. The future of learning is mobile, collaborative, connectivistic, student-generated, contextual and heutagogical (self-determined learning). While these characteristics are well-identified, there is a growing recognition that the physical and opportunity cost of implementing interactive online learning communities can be prohibitive (Hülsmann, 2016). Cochrane and Narayan (2014) further state that the implementation conundrum can be overcome by cultivating creative pedagogies that facilitate the process of helping learners to become active members of learning communities through the innovative use of technology. One such creative pedagogical use leverages WhatsApp, a cross-platform, instant messaging mobile application. WhatsApp is ideal as it is easy-to-use and easy-to-implement at nearly no additional cost, in any curriculum. There is value in understanding if the rationale for adopting mlearning stems from the use of mobile technology itself. Several researchers have looked at the use of WhatsApp in educational settings in mostly descriptive studies of learning experiences and performance change (Church and Oliveira, 2013; O’Hara et al., 2014). Research has largely been focused on mobile learning’s impact in generating greater interactivity to address the passive knowledge transfer modes of recorded lectures and elearning to make the case for adopting mlearning (Wang et al., 2009; Kinash et al., 2012).

There is value in determining if the learning medium has indeed become the messenger or harbinger that directs the form that mlearning should take. An investigation of such nature must, therefore, include the hugely popular WhatsApp. This study looks at whether WhatsApp engenders learners to exercise the attributes of Web 3.0 leading to higher learner-perceived and actualised levels of collaboration and self-determined learning. Specifically, the study illuminates the types of distinct learning behaviours exhibited through the use of WhatsApp by both learners and tutors. There is benefit in understanding how mlearning optimises learning as a consequence of the habitual use of preferred technologies. The study presents insights from research conducted in an institute of higher education in Singapore – a self-directed readiness survey examining usage patterns and Web 3.0 characteristics and a comparative study between two groups with and without WhatsApp-enhanced learning. Findings show that there is a significant difference between learners’ years of usage, receptivity of WhatsApp and the range of Web 3.0 learning behaviours exhibited. Classes where tutors used WhatsApp extensively also showed greater academic performance change compared to those where WhatsApp was used for communicative purposes only. Learners also report higher self-perceived levels of control, propensity to propose topics and negotiate learning tasks with tutors. The findings suggest that the use of mobile applications like WhatsApp pre-disposes and even pre-equip learners to incorporate effective mobile-enhanced learning strategies through the cost-effective and creative pedagogical use of readily available mobile applications.

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On the Path to Situated Learning: 
Embedding Academic Integrity via Mobile Augmented Reality Learning Trails

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Keywords: academic integrity, augmented reality, ethics, mobile learning trails, situated learning

In developed world settings where mobile smart devices are proliferating rapidly, supported by an extensive telecommunications infrastructure, their greatest educational benefits would seem to lie in their facilitation of contextual learning. Instead of engaging in formal learning in classroom contexts detached from the wider world, students can be encouraged to develop some aspects of their knowledge in the real-world settings where it applies. Situated learning experiences, it has been suggested, may lead to deeper understanding, better retention of new knowledge over time, and greater ability to apply learning in relevant settings. Such learning can be structured, informed and scaffolded by augmented reality (AR) applications which present students with carefully designed, contextually relevant tasks, prompts and information. These can be triggered on their smart devices in a variety of ways – including through GPS and image recognition – once they arrive at the appropriate locations on AR learning trails.

Throughout the developed world, institutions of higher education are currently placing increasing emphasis on developing students’ sense of academic integrity and ethics, often through introductory face-to-face, blended or online modules which all new students are required to take. It is however not clear that students perceive such modules as a valuable component of their studies, nor that they are able to apply the general formal knowledge acquired to specific everyday ethical dilemmas of the kind they may face during their studies.

This paper reports on the initial stages of a large-scale, government-funded study of the value of inducting students into considerations of academic integrity and ethics through mobile AR learning trails accessed on smart devices by university students in Hong Kong. The trails immerse students in collaborative problem-solving tasks centred on ethical dilemmas, addressed in real-world locations where such dilemmas might arise, with contextually appropriate digital advice and information available on hand. By allowing students to play out the consequences of their decisions, this approach is designed to complement classroom engagement and, in particular, to reinforce the links between theoretical learning and the practical application of such learning in everyday contexts.

To date, at the midway point of this 3-year project, over 600 students have experienced pilot versions of these Trails of Integrity and Ethics (TIEs), including a general introductory trail (covering topics such as data falsification and plagiarism) as well as three subject-specific trails (where students are inducted into professional norms and standards). Data have been collected on students’ responses, with pre- and post-trail tasks being analysed to ascertain the effectiveness of such mobile-enabled, AR-based, situated learning designs.

The results so far have been very positive. Clear indications have emerged of the value of situated learning in helping students to integrate ethical understandings into their everyday study practices. At the same time, numerous challenges have arisen, leading to an ongoing reshaping of the trail designs as we seek to capitalise on the potential of mobile learning to turn academic integrity and ethics from formal requirements into considerations that inform students’ daily lives.
Understanding the Relationship between Augmented Reality Games and Educational Pedagogies

Christine Redman and Joanne Blannin
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**Keywords**: augmented reality online game, educational pedagogies, motivational and challenge

This study focuses on an augmented reality massive multiplayer online role-playing location based game, called Ingress. It will explain the attributes of one mobile device game, the features that seem to be significant to players and maintain their diligent participation. Unique to Ingress, is the necessity of moving into the physical world. The game occurs in a virtual world, but a player must be in a physical location in the real world to succeed in the game. This virtual overlay on the real world sees player groups interact both on and offline in order to achieve what game-makers call ‘experience points’ and gain higher status within the game. This game has social and affective implications for players. Players have joined social events in their local neighbourhoods and travelled to other cities. The experience and perceptions of participants has not been previously comprehensively researched.

We are researching the design of the game to better understand the relationships of the game players to the game. The game has an estimated seven million players globally and this success warrants an understanding of the numerous drivers embedded in the game. This game has been skilfully designed to attract and retain players from a diverse range of players, ages spanning 8 – 80, all SES groups, and genders. People play individually or in teams.

Game players can steadily progress if they employ strategic thinking skills. Significant are the exponentially increasing expectations of the game, as the design provides increasingly demanding challenges. The study has sought to identify and report on key factors that motivated and engaged participants to persist in playing the game, despite the large, and exponentially increasing, increments between game levels. We are interested to understand how the game’s challenges to players are accepted, and subsequently the pedagogical implications. The increasing complexity and demands on participants of the challenges seem to contribute both to relationships within the game, and has notable import to players’ continued engagement with the game.

Our study combines interviews and survey with both teams, that play in opposition, and who realise faux hostility in the game. We are interviewing people who play voluntarily and have maintained extended participation and persisted through the complex demands of the game. We are interested in what sustains players and what attributes of the game motivate players.

Understanding the exponentially increasing challenges in the game that could have detached players and created apathy, but seem to have supported players to persevere, warranted understanding. Hattie explains that if challenges for learning are set too low or high, or are unclear or meaningless, learners disengage. Participants within this game have voluntarily coached others, strangers have become friends, and communities have arisen to support players. Making sense of participants’ experiences of striving for success in the game, and how this could relate to school learners striving for educational success will be reported. This paper seeks to contribute to a better pedagogical understanding of motivation, and the use of mobile platforms, like Ingress and, more recently, Pokémon Go, create empowered learning communities.
The Use of Facebook to Enhance the Teaching of Writing among Secondary School Students in Malaysia

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**Keywords**: mobile-learning, Design Based Research, English as a Second Language, Facebook, smartphones, smart mobile devices

We report on the provisional findings of an ongoing research project investigating the use of Facebook tools to enhance the teaching of essay writing among Secondary School students in Malaysia. Using Design Based Research (DBR) as an approach to conduct this study, this paper presents the findings from an iteration that has completed so far. The initial design framework for the study was developed from the literature. It was tested and developed through a series of iterations and the impact of each iteration was evaluated using interviews and qualitative data analysis.

One of the most important finding reported in this paper is the imbalance perception on the possibilities of enhancing essay writing teaching by using Facebook tools among the teachers and the students involved in this study. The students found that the use of Facebook Group was motivating besides encouraging them to participate and to write their essays. Nevertheless, the students’ motivation to learn using Facebook tools was not supported by some of the teachers due to various reasons. They did not expect that their students would be motivated to participate in learning using the social media and they were skeptical on the use of social media to enhance students learning. To use new technology was also seen very troublesome to some of them, who resorted to use the traditional way of teaching. Other that that, it was also highlighted in this research that part of the reasons why the teachers did not want to use the new technologies was due to the unreliable internet connection. The high cost and the safety of smart mobile device were another factors why the teachers did not support the use of smart mobile device to be used in schools.

Future iteration will explore the teachers and the students’ perceptions on how the cost and safety problems should be addressed. It will also investigate aspects of essay writing that might be suitable to be taught using Facebook and aspects that require other modes of teaching. This study is significant because despite the popularity of Facebook and smart mobile devices to enhance learning, the participants in this study revealed that not all aspects of learning can be enhanced by using the technologies. Future research will also focus on exploring ways in which pedagogical designs for social networking in combination with mobile learning can take the view of both the teachers and the students into account in order to make best use of the positive consequences of Facebook Group to enhance students’ learning.
Using an iPad in the Classroom to Make Students’ Worked Exercises the Centre of Learning

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Keywords: tablets, student-centred learning, accounting education

Introductory Accounting is typical of many core subjects in degree programs with large enrolments in having historically substantial student disengagement and high failure rates. At the authors’ university, for example, it was previously taught using a didactic, teacher-centred paradigm, with large two-hour lectures for content delivery. Even in the tutorials it was observed that most of the time was dominated by the tutor explaining the solution to accounting problems, with minimal time allocated for student questions, answers or discussion.

In order to engage students more and make learning more student-centred, three technology-based innovations were gradually introduced into the subject from 2008 onwards involving a collaboration between the Accounting academics and mobile learning researchers from the discipline of Information Technology. These comprised firstly the development of a web-based interactive tool which allows students to answer questions in lectures from their 3-G phones, laptops or tablets and gain immediate feedback from the lecturer; secondly, the offering of a new multimedia assignment, in which students create screencasts using their desktop and/or mobile device; and, most recently, the use of a tablet to shift the focus of tutorials from the tutor’s solution to the students’ completed homework exercises. It is this third innovation which will be the subject of this presentation.

In tutorials, now, the tutor uses an iPad to photograph handwritten exercises completed by the students for homework. The image is wirelessly transmitted to a desktop or laptop computer connected to the classroom projector, thus enabling instantaneous sharing of the homework as well as sharing of the annotations and corrections which the tutor makes on the iPad screen using input volunteered by students. Thus, instead of tutors giving the answer, images of individual student exercises become the centre of discussion. This procedure has the advantage that the student’s hard copy is not altered and it is sustainable in that only one iPad is required per class and the annotation and sharing software is free. The importance of this in a subject with very large enrolments (approximately 1,500 in the Semester I intake alone) cannot be overstated.

This innovation has been evaluated through student focus groups, student surveys and class observations which show that there has been a high level of student acceptance of the new pedagogy. However, an analysis of the effect on students’ final examination results indicates positive benefits with procedural questions, but not with theoretical questions. This outcome will be discussed at the mLearn 2016 presentation and, in addition, we plan to demonstrate the procedure with the technology and invite conference delegates to attempt a simple exercise and offer their handwritten solution for annotation.
Debating the Future for Mobile Learning in Schools

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Keywords: debate, mobile phones, schools, disruptive

UNESCO policy guidelines (West and Vosloo, 2013) suggest mobile technology is a powerful and often overlooked tool that can support education in ways not possible before. However, in the light of Beland and Murphy (2015)’s report that banning mobile phones in UK schools was linked with small but significant improvements in national test scores among students, we need to look again at the future for mobile learning in schools. Indeed the same ‘smart’ mobile phones that enthusiasts see as enabling any time / anywhere/on the spot relevant and authentic learning opportunities are often banned in schools as they are associated by teachers and/or their line management with opportunities for cheating, cyberbullying and disruption. Thus the future for mobile learning in K-12 education looks very different depending on the perspective taken by the school or even in the country. For example, in the Net Children Go Mobile Project, a large scale survey funded by the Safer Internet Programme of the European Commission (Mascheroni and Cuman, 2014), the proportion of children surveyed who reported being encouraged to use Smartphones daily at school varied from one percent in Ireland through four percent in the UK, Belgium and Portugal, six percent in Italy, nine percent in Romania to thirteen percent in Denmark. In some countries, such as Sri Lanka, Malaysia, India or individual states in the US, mobile phones are banned from schools in their entirety; in others, for example, New York State, such bans have recently been reversed.

Therefore, taking as its context the current stance seen in the documentation of an opportunity sample of secondary level schools (students aged 11-18 years) in different English-speaking countries, this paper will review the benefits and challenges seen by educators in using mobile and Smartphones to support learning. Examples include:

From South Africa:
• Theft of cell phones at school from bags and blazers is a persistent problem.
• Cell phones may carry private and personal material, including photographs, video clips, voice messages and personal details which may become accessible by undesirable individuals and groups when cell phones are lost, borrowed or stolen.
• Cell phones can be used for cheating in examinations.

From the UK:
• The school recognises the benefits to learning from offering students the opportunity to use personal ICT devices including Smartphones and tablets in school to support learners and their learning. It is the intention of this policy to facilitate and support the use of personal ICT devices in school in furtherance of individualised student learning.
• Devices will only be used for educational purposes to support learning whilst in school. It will be at the teacher’s discretion as to when these devices may be used by a student within school. Students will respect a teacher’s decision and turn off their device when requested to do so.
• The school reserves the right, without further notice or permission, to inspect your device and access data and applications on it, and remotely review, copy, disclose or wipe to ensure compliance with our standards of conduct.
From New Zealand:
- With a signed agreement a student has the right to bring one fully charged mobile, Internet capable device to school every day (not a mobile phone).
- Responsibilities of the parent/caregiver include
  - Endeavouring to provide their child with a functioning device
  - Remaining aware of what the student is doing with their device
  - Insuring the device.

The differences found in these positions, together with the underpinning rationale, will be highlighted to inform the audience of the range of views currently present internationally. The audience will then be invited to discuss how and why they vary from institution to institution and country to country. The presentation will conclude with a debate on the impact of these findings on possible futures for mobile learning in schools and the audience invited to propose ways forward for the International Association of Mobile Learning to secure a sustainable future for mobile learning.

References


Using the *myStudyMate* App to Understand how Medical Students Learn during Work Integrated Learning

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**Keywords**: learning analytics, big data, app, work integrated learning, work based learning, clinical placement, higher education, medical education

1 Introduction

During Work Integrated Learning, medical students participate in a range of learning activities in clinical settings. These range from history taking and physical examinations, to structured learning through medical bedside and problem based learning tutorials and lectures, as well as self-directed learning with online materials and textbooks. Each requires different forms of learning behaviour and knowledge application. With this constant change, students can find it difficult to gain an overview of the most effective way to structure their learning throughout each day. There is also a concern about an imbalance of learning activities, with online self-directed learning material potentially reducing the time students need to spend developing practical and communication skills with patients. Given the mobility of students in healthcare settings, their high ownership of mobile devices and the tendency to keep them at hand, we developed the *myStudyMate* app with an activity log and wellbeing diary to help students track their learning activities and monitor learning effectiveness and wellbeing. We also aimed to explore contemporary medical students’ learning habits during Sydney Medical Program’s Child and Adolescent Health block.

2 Methods

The study was conducted in three Child and Adolescent Health blocks in June, August and November 2015. During the eight week block, students were invited to use *myStudyMate* for one week, Monday to Friday, in either the Week 3 or 4 clinical placement, or the Week 5 lecture week. Participants logged their learning activities and daily activities every half hour and completed questions at the end of every day to rate learning effectiveness and physical and emotional wellbeing. Visual representations of data were provided to participants. Participants were invited to attend a focus group in Week 6 to discuss their experience using *myStudyMate*. At the end of the study, data from *myStudyMate* were analysed using descriptive statistics; focus group data were analysed through thematic analysis.

3 Results

Students found *myStudyMate* useful for visualising their learning activities and work-life balance. Analysis of data from *myStudyMate* shows students spent much time on online resources, textbooks, lectures and tutorials, with most students spending their afternoons on self-directed online study. Comparatively less time was spent with medical teams and in direct patient contact, which generally occurred in the mornings before lunch. However, students’ ratings of learning showed the most effective knowledge acquisition and motivation-boosting events occurred through personal interaction with an engaged physician who gave them feedback and provided clinical insight and context. Student well-being, measured by sleep, exercise, socialisation and diet, was generally good.
4 Conclusion

Students’ focus on study over patient interaction reflects assessment-driven study tactics and assessment driving learning. Curriculum adjustment may be needed to achieve a balance between self-directed and clinical learning. The Child and Adolescent block has written and clinical assessments, but clinical engagement and relevant deep content knowledge are difficult to assess in standardised assessment formats. Students value interactions with medical teachers, especially when they receive feedback, but may get less of this in future if traditional training methods with patients and clinical supervisors are under-valued and student numbers increase.
Section IV
Posters
Designing a Mobile Learning Toolkit for Teacher Educators

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**Keywords:** mobile, toolkit, Erasmus+, teacher educators

The ubiquity and multiple capabilities of mobile technologies have generated considerable interest and excitement amongst educators (Kearney, et al, 2012; Foley & Reveles 2014; Johnson, Adams Becker, Estrada & Martin 2013) and yet recent empirical research (e.g. Kearney, Burden and Rai, 2015) suggests that teachers who use mobile devices tend to default to traditional teaching practices in formal classroom spaces, focusing on teacher-directed approaches and content delivery (Rushby, 2012). Therefore if the promise and potential of m-learning is to be realised educators need to better understand how to design learning experiences which genuinely exploit the unique affordances of mobile technologies such as their ability to foster self-directed learning which transcends traditional binaries such as formal and informal learning or face-to-face and virtual learning.

The authors of this poster are currently leading a transnational European Erasmus+ project (www.mttep.eu) which includes European and Australian partners. This seeks to develop a mobile learning network for teacher educators and a mobile learning toolkit to operationalise the network. This poster will describe and explain the theoretical basis for the toolkit (the Mobile Learning Framework) along with the various instruments and resources that are currently under development and user testing. The toolkit produced in this project will support teacher educators in broadening both their own repertoire of m-learning strategies and those of the pre-service teachers (PST) they work with.

**References**


Improving IT Career Awareness through Student-Generated Vodcasts

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Keywords: careers knowledge, IT careers, video, multimedia skills, communication skills

Information Technology students are often poorly informed about what careers are available to them. This is the result of the wide range of career options in the field, the constant evolution of IT, and the inadequate advice many students receive from careers counselors at high school.

To address the situation, an IT Careers Research Project was introduced into a core communications subject taken by all first year IT and Business/IT students at our university (enrolments currently in excess of 500 per annum). The project was a collaboration between the faculty and the university’s careers counseling service. However, as first offered, it was not totally successful, the sharing of students’ findings across the cohort using traditional class presentations being unwieldy to organize.

To streamline the peer share process, the researchers introduced vodcasts (video podcasts) into the subject: students now work in teams to interview an IT professional in his or her workplace, video record their interview and use the recording in a tutorial presentation. From their recording they then produce a vodcast which can be shared via the learning management system across all students undertaking the subject. Students use their own mobile phones or camcorders to make the video recordings, or borrow video equipment provided.

Evaluation of the project through focus groups, questionnaires and analysis of team diaries has revealed high motivation amongst most students for visiting the workplace, undertaking the interview and making the vodcast. The questionnaire, in which students rated statements using 5-point Likert scales at the beginning and then at the end of semester, revealed statistically significant increases in their perceptions of their careers knowledge. In addition, the project increased their self-perceived skills in multimedia and widened the concept of communication skills as covered in the subject to include multimedia communication.
Mobile-Supported Fieldwork for First-Year Information Systems Students: A Way of Engaging Students in the Real World Context

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\textit{Keywords:} fieldwork, information systems, information technology students, recording, photographs

Fieldwork has long been identified as providing students undertaking professional studies with a means of implementing theory into a real world context. Over the last decade a number of educators have introduced mobile devices to support students’ fieldwork learning. In many ways there is a natural link between fieldwork and mobile technology: the portability of mobile devices lends itself to learning activities outside the classroom, and the affordance of the technology for photography and recording allows images, videos and sound recordings taken in the field to be brought back into the classroom where they can be shared with other students enrolled in the course.

This poster reports on a trial to introduce mobile support into the study of Information Systems in the field, a discipline which has not been well noted for its adoption of mobile learning to date. The lecturer was new to mobile learning and sought to experiment with this pedagogical approach while seeking a method of creating greater student engagement. Mobile devices were incorporated into a 2-stage fieldwork exercise by getting teams of first-year university students to use mobile devices to take photographs of technology in its context of use, interview users about their experience with a technology, or record the students’ own experiences with it: the images and recordings were then used in class presentations about the technology. Initially PDAs were provided by the lecturer, with some students additionally using their own mobile phones, cameras or video recorders. As a control, some students undertook the fieldwork without mobile devices and instead made notes in the field. To evaluate the effectiveness of using mobile technology for data capture, the lecturer evaluated on a scale of 1 to 10 the degree to which students had met the learning objectives (knowledge of Information Systems and research skills) as demonstrated in the class presentations. The lecturer also reflected on the practicality and sustainability of using PDAs versus student-owned devices in a subject with large enrolments (340 students); and the students who had used PDAs were asked to state the two best and worst things about using this technology.

The findings showed that mobile devices can assist students to collect data in richer, multimedia formats and make subsequent classroom presentations of their field study much more interesting and lively. Motivation levels were mostly extremely high. However, there was no evidence that teams who were supported by mobile technology did any better in coming to an understanding of the technologies under study and Information Systems concepts than teams without devices, even if the former displayed greater evidence of research skills. In terms of the practicality of using PDAs versus students’ own devices, the lecturer saw the issue of PDAs as unsustainable for security and cost reasons, and more than two-thirds of the students found the PDAs hard to use, even if they appreciated their multimedia capabilities. Therefore, a bring-your-own device model was adopted in subsequent semesters.
Location-Based Mobile Learning Games: Motivation for and Engagement with the Learning Process

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**Keywords:** location-based mobile learning, action research, gamification, real world teaching and learning

1 Rationale

Location-based mobile learning games (LBMLG) embrace the characteristics of mobile learning, location-based learning and game-based learning. Delivered as a mobile app they integrate storytelling, augmented reality and rich media with GPS, maps and gamification methodologies. But can playing location-based mobile learning games provide an authentic and meaningful pathway to teach and learn with mobile technology and make learning pleasant and engaging and extend the way students interact with locations, mobile content and communicate with each other Wijers, Jonker & Drijvers (2010).

2 Objectives

- To identify the impact that LBMLG design has on student engagement
- To identify issues of integrating LBMLG’s in different courses across different disciplines

3 Methods

The same action research methodology undertaken by Cochrane (2014) was used to create, play, manage and share location-based mobile games across four disciplines (Business, Education, Arts, Science). The focus was to deliver active learning to enrich the student experience in a meaningful and authentic context. All games used varying narratives and physical locations, rich media and gamification methodologies. Games were introduced in a lecture, then played outdoors soon after as part of a tutorial or excursion. Data was collected by means of player observations, online surveys and focus group discussions. The survey had questions on demographics, support, mobile app functionality and contribution to teaching and learning. Analysis of the data collected was used to identify user experiences related to satisfaction rates, engagement and learning outcomes.

4 Results

538 students played the four games and 112 completed the online survey. Over 75% highly rated the games in terms of suitability, easiness and quality. Over 80% agreed that their experience of playing was engaging, team building, authentic learning and a fun way to learn. Only 49% said the games helped them to learn more. This result however did vary significantly across games and indicates that design factors and implementation strategies may both influence the impact of LBMLG’s on learning. Students highlighted technology problems as issues and suggested that games would be more engaging if they were more competitive by strengthening questions or if they were being assessed.
5 Conclusions

Playing location-based mobile learning games provides an authentic and meaningful pathway to teach and learn with mobile technology and can make learning pleasant and an active, engaging educational experience. There are no significant integration issues while maintaining these benefits across disciplines. The narratives create an emotional connection that provides meaning to each game. This supports Avouris & Yiannoutsou (2012) findings that learning potential is related to the strong interconnection between the narrative supported by the virtual world and physical action in the real world. Including high quality and appropriate location-interaction tasks and simple gamification elements promotes retention and recall of knowledge and keep student’s active as they play. Further research however, is required to investigate the factors that may moderate / mediate the impact of the LBMLG’s on learning.

6 References


Achieving Sustainability through Student-Generated Screencasts

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Keywords: student-generated multimedia, accounting students, student engagement, graduate attributes

Increasingly academics are being expected to produce multimedia learning resources either in distance learning programs or as supplements to face-to-face learning. There is an expectation that students demand multimedia rather than written materials and that they will want to access these anywhere and anytime from their mobile devices or desktop computers, as they choose. Academics usually have little funding to pay for content development or the time or skills necessary to create the professional multimedia and mobile learning resources that the current generation of students increasingly expects.

This poster reports on an optional assignment in which first-year Introductory Accounting students in the Business School create multimedia content themselves as a more sustainable alternative to time-poor academics producing such resources. The assignment involves students in teams of 2 or 3, or individually, making a 3-minute screencast explaining a key accounting concept to their peers. The assignment has several aims: to build a library of learning resources for students to use wherever they wish, improve student engagement, provide an opportunity for students to learn more accounting, and also build graduate attributes. The results of student surveys (n = 119) showed that students perceived that undertaking the assignment had improved their accounting knowledge, provided them with a fun and different way of learning accounting, and contributed to the development and expression of a number of graduate attributes, including the ability to communicate accounting ideas to others, teamwork skills, and skills in multimedia and creativity. The assignment has been found to be sustainable in that the students use free software (mostly Jing: www.techsmith.com/jing), usually employ their own equipment for making the screencasts, and require little help beyond some written resources and example screencasts, preferring to work the technology out for themselves.

Problems encountered with the assignment initially included the limited technological approaches adopted (all students in the first semester chose to use the screencasting software to capture and narrate a PowerPoint slideshow) and the accounting lecturers found that, though the majority of screencasts demonstrated a reasonably good grasp of the accounting concept being explained, most contained minor accounting errors. In order to stimulate students to expand beyond the slideshow approach, new exemplar screencasts featuring different technological approaches were provided and, in addition to Jing, students were encouraged to use Screenchomp, a free-to-use mobile screencasting tool that supports freestyle drawing and annotation on tablet devices. This was successful in stimulating students to be creative in their technological choices. Regarding accuracy, the authors note that it is unrealistic to expect all students to produce perfect assignments, whether they are writing a traditional essay or report, or producing multimedia. Thus, it should be expected that the library of screencast resources will take a number of semesters to grow.
Teaching Jobseekers to Reduce the Mismatch between Their Online Social Footprint and Employers’ Perception

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Keywords: mobile lifelong learning, social footprint, online identity

At least 75% of employers check jobseekers’ online profiles before calling them for an interview (https://hbr.org/2012/04/your-future-employer-is-watchi). Jobseekers often broadcast information about themselves and social activities from their mobile devices impulsively, not realizing it may influence prospective employers’ perception of them. We introduce a tool to support jobseeker match their online social identity to the employers’ expectations by reducing the mismatch between the attributes (qualities) displayed by the jobseeker and those expected by employers.

We assume jobseekers’ online self-presentation behaviors depend on a) the company or job targeted; b) their existing footprint; c) their willingness to change; and d) perceived agency over their online footprint (El Ouirdi et al., 2015; Van Dijck, 2013; Rosenberg and Egbert, 2011). Therefore, our tool aims to help jobseekers understand employers’ expectations, their current footprint and ways in which they can manage it following a six step process through which users:

1. Identify their own attributes and ‘requirements’ for the targeted job description;
2. Rate their attributes according to the importance they perceive these have for the targeted job;
3. Conduct an online search on themselves to become aware of their online image;
4. Identify the personality traits they display online and rate them against the attributes perceived important for the targeted job;
5. Examine visualizations of the match and mismatch between the attributes they ‘display’ on their online profile and the ones required for the targeted job;
6. Access tips on how to reshape their online image. Jobseekers can clean their current footprint, but also adopt new mobile practices that allow them to communicate elements relevant prospective employer’s expectations (connections, events visited, locations, topics of interest), thereby increasing the perceived match.

These two aspects of reshaping one’s image will be investigated through empirical studies. A pilot implementation of the tool in the careers’ advisory service of a university will be conducted. This will involve a series of workshops to introduce the tool and support its usage. Qualitative data will be collected via pre and post intervention interviews with participants to see how they make use of their mobility and devices to shape their image, and other relevant stake holders such as career advisors to assess the efficiency of the changes undertaken by users. Quantitative data will be collected automatically through data logging to capture real behavior and changes.

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The Use of Mobile Instant Messenger Application for English Interaction in the Korean EFL Context

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Keywords: English interaction, use of mobile instant messenger application, EFL learning, case study

With the rapid development of mobile technology, in Korea, there is an expectation that smartphones (Internet accessible) can provide Korean students with more opportunities to interact in English with others for assisting in their learning of English as foreign language (EFL). However, there has been little empirical research on the use of mobile instant messenger (MIM) for English interaction in the Korean EFL context and limited studies on the patterns of negotiation of meaning emerged during communication through this platform.

This study aims to investigate how students across different faculties at a Korean university, use MIM application to communicate in English. The study investigates more specifically on how Korean undergraduate students make use of this medium to communicate in English when paired up with (i) other Korean students (ii) English dominant and (iii) non-English dominant speakers. The study compares the patterns of negotiation of meanings using the MIM, KakaoTalk, between the three combinations of groupings.

The study adapts a qualitative case study based approach on interaction hypothesis and the concept of negotiation of meaning in text-based interaction (Patterson & Trabaldo, 2006; Akayoglu & Altun, 2009). Data were collected via a multiple method approach that includes survey questionnaire, message observations and semi-structured interviews.

The findings revealed that the Korean students utilised the features of mobile supported environments such as using mobile dictionary, exchanging photos and links to the video clips to help their communications. Furthermore, they adopted different kinds of negotiation of meaning functions during interaction and dyads of NNS-NNS outperformed NNS-NS dyads in terms of the amount of negotiation for meaning on account of the factor of their proficiency.

These findings provide a new understanding of how Korean university students use MIM application for interaction in English and bear pedagogical implications for teaching English in the Korean context.
Responding to Increased Mobile Device Usage by Students at the National Distance University of Costa Rica

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**Keywords:** distance education, responsive design, mobile learning

Since it began operating, the Universidad Estatal a Distancia de Costa Rica (UNED), founded in 1977, has had as one of its pillars the production of teaching materials, which have allowed it not only to operate effectively in its specific field of expertise (distance education) but also to meet the demands of new student generations through the years. Since 2010, research has shown that more than 90% of students at the university now own mobile devices. Based on this feedback, the university changed its production of learning materials to multimedia materials based on the use of Responsive Design, that is, materials that adapt to different technological devices (desktop computers, laptops, tablets and smartphones). The Multimedia Electronic Production Program began in 2012 to produce different products, starting with enriched multimedia books, content modules, learning objects and virtual labs, all incorporating Responsive Design and the principle of Mobile First, in which web sites designed for firstly the most basic mobile devices are progressively enhanced for more sophisticated, large-screen devices and are thus accessible both from mobile devices but also from computers, both desktops and laptops.

The process of planning the design of a digital resource aid involves checking the different needs of the user and viewing the contents from a variety of devices. Questions during the production process include, for example: are the users interested in checking the same information from different devices? Is it correct to make changes only in the content design? Do the users invest the same amount of time browsing through web contents from their mobile device compared to their desktop computer?

Findings from the project include the necessity for a real institutional commitment and the need for issues surrounding copyright to be addressed from a clearly defined institutional policy.
How can Mobile Devices Improve Learning by Enabling Instant and Scaled Feedback, and Adaptive Teaching?

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Keywords: Instant feedback, adaptive teaching, active learning

Feedback is essential to the learning process. However, many educators face various challenges in providing timely feedback in a scaled environment. M-learning has the power to meet these challenges. It provides students with opportunities for active learning; scaled and timely feedback, and educators to execute adaptive teaching.

In this thesis, we present a case study on how mobile devices and online quizzes have been incorporated into the classroom. This was done through conducting quizzes via Googleforms, and providing instant feedback based on the students’ overall performance thereafter.

At the end of the course, a feedback survey was conducted. Overall, results from the student feedback survey for MATH1011 and MATH1131 totalled to an average of 5.3 and 5.03, respectively, on the Likert scale of 1 to 6. This meant that students enjoyed the quizzes as it enhanced their learning process, and addressed their misconceptions through immediate feedback and discussion. Furthermore, 1-to-1 interviews were conducted with 5 UNSW lecturers to gain an educator’s perspective. They appreciated the efficiency brought about by mobile devices and web-based applications while conducting the quizzes. Thus, it is essential for educators to be well-versed and informed of available learning tools and mobile devices to enhance their teaching methods.
A Web-Based Interactive Classroom System as a Sustainable Alternative to Clickers in Large Classes

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**Keywords:** BYOD, accounting students, personal response systems, electronic voting systems, student interactivity

Engaging students and making them active participants rather than passive listeners is a challenge in courses with large enrolments. One solution has been interactive classroom systems – known variously as personal response systems, electronic voting systems or simply “clickers”. Despite their many pedagogical benefits, their use is still comparatively low. Issues with clicker-based technology include cost, management software complexity, and distribution logistics: these act as major disincentives to academics. With very large classes clickers are unsustainable.

This poster reports on an alternative approach implemented in a first-year Introductory Accounting course in which students use their own Internet-enabled devices (mobile phones, tablets or laptops) to answer questions electronically in class. Prior to class, the lecturer accesses the web interface of the system to set up questions, usually three per lecture. The system allows a wide variety of question types, including multiple-choice, yes/no or true/false questions, and those requiring a numeric or text-based answer. During the class the question is displayed simultaneously on the lecturer’s PowerPoint slide and on the screen of the students’ device once they enter the website. After answering anonymously, the combined class response is displayed on the large screen in the lecture hall, usually in the form of a histogram. This is followed by immediate feedback from the lecturer and if necessary questions from the students and a discussion. One typical clicker feature not available on the system is a student login since we have never been interested in tracking individual performance and in fact encourage students to discuss and enter answers collaboratively.

Surveys of students and feedback from lecturers have shown high levels of acceptance. For example, in the second semester of operation only 15.8% of students had never used the system or only answered once or twice. Some of these found the system useful, despite not using it: only 12% of students neither used it nor found it useful. Responses to survey questions that scored more than 4 on a 5-point Likert scale included that the use of the system made lectures more fun, engaging and interactive; students enjoyed seeing the whole class response on the graph; they liked knowing what the correct answer was and getting immediate feedback from the lecturer, and appreciated the fact that the lecturer could see where they were going wrong and explain things they hadn’t understood; and they were happy to use their own mobile device.

The bring your own device (BYOD) strategy, allowing students to access the system from their own devices, has proved sustainable in this large class where enrolments are typically between 600 and 1,500 depending on the semester. This has occurred through careful design of both the technology and the pedagogy. Technically, a minimal student interface incurs an almost negligible cost to students when answering questions, and, pedagogically, students are allowed to answer each question individually or as a group, thus not discriminating against students who have no device or choose not to use it. From an in-house development, the system is now freely available on the Web (www.mqlicker.com).
Shifting the Focus of Learning in Tutorials to Students using Tablet PCs: Possibilities and Challenges

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Keywords: iPads, accounting students, student-centred learning, teachers’ epistemologies of teaching and learning

This study reports on the introduction of tablet PCs into tutorials in an introductory Accounting course, a core subject for all students enrolled in a Business studies degree or combined Business and Information Technology degree at the University of Technology, Sydney. In the past tutorials were often more teacher-centred, with students focusing on solutions provided by the tutor. It was believed that a shift to a more student-centred learning experience would improve levels of student engagement, which might in turn lead to the achievement of better learning outcomes. Now, accounting exercises that students have completed prior to the tutorial are photographed using a tablet, projected to the class, and annotated by the tutor with input volunteered or requested from students. It has the advantage that only the softcopy of the student’s homework is amended, leaving intact their personal hard copy and the student’s control over it. The approach is sustainable in that only one tablet is required per class and is used in conjunction with free software. This is important given the large enrolments.

A survey of students and observations in class showed that the use of the technology had high levels of student acceptance. However, the tutor’s pedagogy determined whether the tutorials became more interactive as a result of the deployment of the tablets: for example, one tutor already promoted interactivity in his tutorials using the traditional method of small-group discussions, even if this resulted in much off-task behaviour during these discussions. We also examined the effect of the introduction of the new learning approach on students’ achievement of the learning objectives: an analysis of the effect on students’ final examination results indicated positive benefits with procedural questions, but not with theoretical questions. These results indicate that further investigations will be necessary.
A Mobile Learning Activity Exploring the Integration of Theory and Clinical Practice of the Health Assessment in an Undergraduate Nursing Program

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**Keywords:** mobile learning, authentic learning environment, affordances, integration, theory and clinical practice, health assessment, undergraduate, nursing

The global increase, availability and affordability of mobile devices have made them important for students who make daily use of social media platforms giving them a sense of ownership while engaging with the devices (Pachler, Bachmair & Cook, 2010:2). Mobile devices can afford students access to real-time information and communication whenever and wherever needed (Lai, Yang, Chen, Ho & Chant, 2007:326).

The aim of this study was to create an authentic learning environment for students focusing on the affordances that WhatsApp Messenger, a social media application and discussion forum, could offer as a tool of communication. This mobile learning activity explored the integration of theory and clinical practice of the health assessment in an undergraduate nursing program. The assumption of this study was that mobile devices have the ability to provide a support network to learning “any time” or “anywhere” by ensuring the exchange of real-time information and communication between students and their educators irrespective of their various clinical settings.

The categories of the affordances model of Bower (2008:3) provided a framework for the data analysis by matching the affordance requirements of tasks with the affordances offered by the available mobile technology used. The categories of the affordances framework includes media, spatial, temporal, navigation, emphasis, synthesis and access-control affordances.

Descriptive qualitative data was collected through electronic reflections from students who participated in the mobile learning intervention. A systematic data analysis was done using an excel spreadsheet, guided by Tech’s (1990) data analysis method. Transcriptions of the data collected from participants were thematically analyzed to develop themes and categories in an inductive way as directed by the content of the data (Braun & Clarke 2006:77). The results of every theme and category identified will be presented in the form of discussions supported by extractions of phrases from student participants.

The following themes emerged: the accessibility and moveability of mobile devices afforded a great learning platform; WhatsApp Messenger was identified as a great tool for learning due to affordances including accessibility, moveability, readability, writability, viewability, video-production-ability and integratability; effective study was fostered but it was time consuming because of difficulties with readability, writability, viewability, and video-production-ability, and less accessibility was experienced due to internet access challenges.

This poster will describe guidelines for educators on how to integrate theory and clinical practice of the health assessment through mobile learning in an undergraduate nursing program based on the research findings.
Section V

Doctoral Consortium
Science Learning and Engagement in the Digital Age: Understanding the Effect of Mobile Technology on Adult Engagement Experiences at a Natural History Museum

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Abstract. This study investigated how the use of mobile technologies in a natural history museum might affect the science engagement experiences of adults. A mixed methods approach was adopted over two phases. Phase 1 consisted of a questionnaire to adult visitors (n=60), seeking to explore attitudes towards mobile technology use in museums, and understand usage habits. The second phase consisted of an intervention. Adult visitors (n=20) were assigned to either a control group or ‘mobile’ group, where they were asked to engage with exhibits using their personal mobile devices. Using multiple analytical methods including a modified Science Engagement Framework, preliminary findings suggest that contrary to findings in other studies, mobile devices may not be facilitating higher levels of science engagement in this context, and may instead be shaping visitor engagement experiences in other unforeseen ways. Given the current push in informal science learning to embrace ‘digital’, this research highlights a potential need to re-evaluate claims of ‘mobile learning’, and to question the unproblematized adoption of ‘digital’ as a facilitator of science learning and engagement.

**Keywords:** mobile technologies, science engagement, adults, museum learning

1 Introduction

It has been argued that informal science learning settings such as museums have the potential to afford unique opportunities for adults to engage with and learn science (Bell et al. 2009; Stocklmayer et al. 2010; Schwan et al. 2014). As personal mobile devices such as smartphones and tablets have become increasingly ubiquitous in these informal learning settings, it has become all the more significant for us to understand the ways in which these devices are interacting with the visitor learning experience. Although mobile learning research has been conducted in a wide array of settings, experts in the field of mobile learning have increasingly turned their attention towards places of informal science learning (e.g. museums, science centres, zoos, aquariums). Yet when set within these contexts, mobile learning research has primarily focused on children and students (Chen et al. 2003; Evans, 2008; Hedberg, 2014), and rarely on the ‘average’ adult visitor. Additionally, many of the mobile learning and informal science learning studies have brought up the term engagement in conjunction with science learning, yet seldom investigated the concept of engagement itself, with few exceptions (Rennie et al. 2003; Barriault and Pearson 2010).

Thus this research focused on investigating how the use of personal mobile technologies in a natural history museum context might affect the science engagement experiences of adults. From this the following three research questions were developed.

- **RQ1.** What are adults’ attitudes towards and perceptions of mobile technology use in museums?
- **RQ2.** How do adults naturalistically use mobile technologies in a museum context, and how does it compare to how they use them in their daily lives?
- **RQ3.** Does the prompted use of mobile technologies by adults in this context facilitate an increase in science engagement?

Two phases of research were conducted using a mixed-methods approach, as part of a collaborative research project between King’s College London and the Natural History Museum in London. Provisional analysis of responses has shown that visitor dependence on and desire to use mobile devices decreases when at a museum. Perhaps more significantly, however, preliminary findings have suggested that, contrary to
findings in other studies, mobile devices may not be facilitating higher levels of science engagement, and instead may be shaping the overall visitor engagement experiences in other unforeseen ways.

2 Literature Review

What is Mobile Learning?

Mobile learning has been defined in a plethora of different ways since its inception. For example, some studies have defined mobile learning in more techno-centric terms (Stevens and Kitchenham 2011), while others have stressed the underlying learner experience (Sharples et al. 2007). Rather than defining mobile learning, it is perhaps more useful to identify some shared characteristics of mobile learning from the literature, which impact on this study—that it is mobile, personalised, and collaborative. Mobility refers to the devices’ ability to be brought from one context to another, while the learning can be accomplished across multiple contexts and on-the-go (Vavoula et al. 2009). Mobile learning is also personalised; learners are able to use mobile technologies in ways that cater to their own individual experiences and history and that are specific to the temporal and physical context of the learning moment (Kearney et al. 2012). Finally, mobile learning has the ability to be collaborative (Clough et al. 2008). Regardless of which conception of mobile learning they have used, however, studies have overwhelmingly championed the use of mobile devices in enabling learning. For example, Hwang and Wu (2014) reported that 83% of student-focused mobile learning research showed positive results when measuring students’ learning achievements.

Engagement with Science in Informal Learning Settings

While there has been no shortage of research focussed on “learning” in mobile learning studies and both museum and informal science learning studies, research on the closely-related term engagement has been much less prevalent. This study takes the position that understanding engagement is a fundamental precursor to understanding learning. This has been echoed in the work of a small number of researchers who have argued for the significance of visitor engagement or highlighted a connection between learning outcomes and engagement (Rennie et al. 2003; Rennie and Johnston 2004; Barriault and Pearson 2010). Most influential in this study, has been the work of Barriault and Pearson (2010), who closely examined the meaning of engagement by presenting a framework of seven observable visitor engagement behaviours in science centres, grouped into three levels of engagement leading to learning. Modifications, however were necessary for this project in order to address the particular context of the research—a natural history museum instead of a science centre (science centres have more of a focus on interactivity). Additionally, despite the framework being a ‘Science Engagement Framework’, there was very little specific to science within their framework. Figure 1 presents the final modified version of the framework used to measure changes in the visitor engagement experience.

![Modified Science Engagement Framework](image-url)
3 Methods

Data Collection

The objective of this study was to investigate how the use of personal mobile technologies in a natural history museum context might affect the science engagement experiences of adults. Ethical approval was granted for this project by the King’s Research Ethics Committee (LRS-14/15-0766) prior to conducting the research. Over the course of two phases a mixed-methods approach was used, specifically in order to attempt to increase the validity and reliability of the data through methodological triangulation (although other attempts to address validity and reliability were made as well). The research conducted in Phase 1 consisted of a paper questionnaire administered at the Natural History Museum in London, aimed at answering RQ1 and RQ2 while also helping to build an informed and effective Phase 2 intervention. The questionnaire was initially tested in a pilot phase (n=12). Pilot participants were briefly interviewed on their impressions and understandings of the questionnaire after filling it in. After revisions were made, the final questionnaire was administered to adult visitors around the museum (n=60) May through June 2015. Visitors had to meet three eligibility requirements, that they: were at least 18 years old, spoke relatively fluent English, and owned a personal mobile device such as a smartphone or tablet.

Phase 2 data collection, designed as an experiment addressing RQ3, took place within the NHM’s Earth’s Treasury Exhibition (minerals). The control group was asked to visit the exhibition as they ‘normally’ would. The intervention (‘mobile’) group were first given a list of 12 ways one might use their mobile device to engage with an exhibit (such as taking a photo, making a note, looking up information, etc.), and were then instructed to attempt to use their own mobile devices to engage in at least three different ways within the exhibition. Twenty participants were recruited at the exhibition entrance, both pairs and individuals, February through April 2016. Participants had to meet the same three eligibility requirements as in Phase 1 (although visitors had to not only own a mobile device in Phase 2, but have it with them). Both groups were observed and audio recorded while visiting the exhibition, and interviewed for 20-25 minutes afterwards. The interviews sought to gain a better understanding of who the participants were, how they felt about science and technology, and how they might normally use their own devices. The interviews also investigated the participants’ engagement experiences (mobile and non-mobile) in greater depth. Using the visit field notes and a series of exhibit photos, the participants’ path was re-traced through the exhibition. They were asked questions about exhibits where at least level 2 or 3 engagement behaviours had been noted, such as how they felt about the exhibits, why they stopped there, how they thought the exhibit related to science or natural history, and—if they had used their mobile devices—why they chose to use their device at that moment, if they found it distracting, etc. Finally, participants were sent email questionnaires 3-5 months later to determine if the participants recalled or had revisited any of their instances of engagement. To-date 8 follow-up questionnaires have been received.

Data Analysis

Phase 1 data has begun to be analysed using basic statistical analysis, looking for overall trends in order to gain a better understanding of the participants’ attitudes and habits (using SPSS22). Future plans for analysis include t-tests and factor analysis. The analysis of Phase 2 field notes, visit recording transcripts, interview transcripts, and follow-up questionnaires has so far used two different approaches. First, they were each analysed using open coding analysis (using NVivo 11). This approach is somewhat related to grounded theory, although it also acknowledges prior review of the literature and that research questions were in mind when the analysis was carried out. Second, the interview transcripts, field notes, and visit recordings were analysed using the Modified Science Engagement Framework, looking for evidence of the observable engagement behaviours and organising them into sets of ‘engagement tables’ per participant. These tables contained each ‘engagement instance’, and included supporting evidence for the level of engagement. From this, ‘mobile meta-tables’ were created that focused specifically on the engagement instances where mobile devices were used, thereby allowing specifically for the analysis of the ‘mobile engagement’ experience.
4 Preliminary Findings

RQ1 and RQ2: Perceptions, Attitudes, and Usage Habits

The majority of participants in Phase 1 reported feeling dependent on their personal mobile devices in general. However, when asked how dependent they felt while in a museum, the majority reported that they did *not* feel dependent on them (see Table 1). Participants in Phase 1 were also asked to report on how often they used their mobile devices in general and in the museum in eight different categories: social media, taking photos/videos, sharing photos/videos, communicating with others, looking up information, personal organisational purposes, entertainment, and learning (labelled a-h respectively in Figure 2). Although the most popular method of mobile device use changed whether the participants were responding about general usage or usage in the museum, in every category the overall reported usage decreased in the museum context.

Phase 1 and Phase 2 findings also illuminated the importance of photo-taking to participants. Nearly all of the participants in both phases reported using their personal mobile devices to take photos to some extent. In fact, in the majority of mobile engagement instances in Phase 2 (both prompted and unprompted) participants chose to involve photo-taking in some way (snapchat, Instagram, etc.) Finally, Phase 2 qualitative analysis also yielded further insight into participant attitudes towards mobile devices in museums. The idea that museums were not a place that participants felt they needed or wanted to use their devices was consistently brought up. For example, participant 17 commented: “It’s not really the reason I came here, you know? Like there’s so much stuff here to see and well it would feel like a waste just sitting around on my phone right? You can do that anywhere.” Yet, at the same time, the majority of visitors agreed that they were okay with other visitors using their phones, with caveats such as, “as long as they’re not rude” or “they just shouldn’t have it in front of them every second”.

RQ3: Changes in Science Engagement

Although the Phase 2 data is still in the process of being analysed, from the data analysed so far using the Modified Science Engagement Framework, there is a clear correlation between higher engagement levels and the use of personal mobile devices to engage. Comparing all of the instances of mobile engagement, the majority achieved either level 2 or 3 as the highest level of engagement. However, through further analysis, it was found that in the majority of those high level mobile engagement instances, that highest level was reached prior to the use of the mobile device, and no level increase was found during or after the usage, thereby eliminating a causal effect: mobile devices generally did not cause visitors to more deeply engage with the science content. Rarely was there any additional engagement with the science while or after using the device, and if there was, it was not usually a change in level, but rather the appearance of additional behaviours from that level.

Additionally, during the in-person interviews participants were asked how they felt about the engagement instances, and specifically if they felt the mobile device usage changed their experience or enhanced their understanding of the science. In the majority of mobile engagement instances the participants reported that they did not feel as if the devices made any difference to their scientific understanding of the exhibits. This corresponded with the results of the Modified Science Engagement Framework analysis described above.

Interestingly, preliminary results from the 8 post-visit questionnaires received so far (3-5 months afterwards), show that mobile devices might potentially be helping visitors to have more memorable experiences.
overall. Those visitors who used their mobile devices to engage tended to be able to recall in greater detail general things they may have felt or observed, their memories of their visit to the exhibition, and how the exhibit related to their lives or other topics they were interested in. However, the responses did not seem to suggest that visitors using mobile devices were any better at recalling the science (such as scientific facts or concepts) they had come across and discussed during the interviews. In fact the majority of post-visit questionnaires did not include references to any science from the exhibition. Additional visitor post-visit questionnaire responses (still pending) will help to gain further insight into this preliminary finding.

5 Discussion and Conclusion

Given the preliminary findings above, did the use of personal mobile devices change the science engagement experience of adults at the Natural History Museum? These results suggest that there is a correlation between mobile device use at the exhibits and higher levels of science engagement, however, the use of mobile devices did not facilitate an increase in the level of science engagement. One explanation for the correlation might be that visitors chose to use their mobile devices in instances where they were already interested, not instances where they felt they needed their device to learn. Perhaps visitors see their mobile devices as tools for expression of interest rather than facilitation. If so, this might explain why the devices were used predominantly during already high level engagement instances, and why science engagement levels didn’t change during or after mobile device use. Additionally, from analysis of interviews, it appeared as if participants used their personal devices with three specific motivations: to capture, personalise/take ownership of, and to share. Interestingly, these three motivations focussed predominantly on either the cultural, historical, artistic, or personal connections with the exhibits, suggesting that while mobile devices did not facilitate increased levels of engagement with scientific facts and concepts, perhaps they had a greater effect on more general engagement. The initial results of the post-visit questionnaires discussed above may indeed help to further support this notion.

In addition to completing analysis, there are still many issues that need to be further explored from the perspective of both academia and museum practice. Is interest expression separate from engagement, or could expression just be another aspect of engagement? Should the practitioners shaping the informal science learning experience focus on helping people engage with science specifically, or, given this research, aim to simply help visitors broaden their overall engagement experiences? Should museums look to provide visitors with digital offerings that tap into the capturing, sharing, and personalisation motivations, or continue to focus on developing apps to try and facilitate science learning specifically (as opposed to general engagement)? Given the current push in informal science learning and museum practice to embrace ‘digital’, this research highlights not only a need to potentially re-visit claims of mobile devices facilitating learning, but to re-evaluate the ways in which mobile technologies might best be utilised to improve engagement in informal science learning settings.

6 References


Tablet Technologies and Language Socialization:  
A Study of First Generation Hungarian Immigrant Families Living in Sydney

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Abstract. Internet communication technologies, including tablet technologies have established a strong presence in the Australian households. This study aims to investigate the potential of tablet technologies as a domain for language development and language maintenance among a group of Hungarian first generation immigrant families living in Sydney, Australia. The conceptual framework for this research is developed with reference to Bronfenbrenner’s bio-ecological model aligned with Bourdieu’s social concept of habitus and the concept of language socialization. A multiple case study methodology using a sociocultural approach is adopted and a wide range of data are gathered and subjected to a multimodal interactional analysis.

Keywords: tablet technologies, language development, language maintenance, immigrants, multimodal interaction analysis

1 Introduction and Background Information

Multicultural Context

The context of this study is Australia, a society with a broad diversity of cultures and languages thanks to a long history of immigration. Overall figures indicate that around 18.2% of the population speaks a language additional to English at home. In 2012, the main non-English languages spoken at home were Mandarin, Italian, Arabic, Cantonese and Greek (ABS 2012). The picture changes when only the capital cities are considered. Here, the percentage of people who speak a language additional to English at home is 24.7% (ABS 2012). Nevertheless, the dominance of the English language in Australia is largely unchallenged and as research shows, immigrant communities tend to abandon their languages relatively quickly in generational terms. In addition to this, Australia is perceived as a country where the acquisition and learning of languages other than English is not actively promoted and this too hinders language maintenance efforts (Liddicoat and Curnow 2009).

Hungarians in Australia

The Hungarian community in Australia is medium size (Clyne and Kipp 1997) and one of the ten most dispersed (Clyne 2005). At the 2011 Census, there were 20,883 Hungarian speakers in Australia, representing less than 0.1% of the entire population (ABS 2012). My previous research uncovered that Hungarian immigrants living in Australia have a significant online presence. They are organised in Facebook groups: Hungarians in Australia with 2608 members, Hungarians in Sydney with 2046 members, Hungarians in Brisbane with 794 members, Hungarians on the Gold Coast with 334 members (the number of members are as per 27th May 2016). Blogs are also used in the community as ‘discursive spaces’ (Mitra and Watts 2002) to share and come to terms with their new life (Péter 2013). Hungarians living in Australia are among those ethnic groups, which appear to be language centred, considering their language to be one of their ‘core values’ (Smolícz 1999 p.28). For them, the value of their home language ‘transcends any instrumental consideration, and represents a striving for self-fulfilment that makes the language a symbol of survival, and hence of autotelic significance’ (Smolícz 1999 p.29). However, families do not have many opportunities to use their language outside of home environment. Mix marriages are very common in the Hungarian community; chil-
Children have to travel long distances to go to the only Saturday language school existent in Sydney (and in every major city as well). There is in total two-hour radio broadcast on SBS and 30 minutes Hungarian news on SBS2. Thus every bit of interaction, socialization in their language is extremely valuable. Internet and technology represents an enormous possibility and opportunity for migrant communities to develop and maintain their language, to maintain contact with their families, friends left behind and to keep up with the news in their home country.

Social Media Context

Independent research indicates household Internet penetration in Australia is more than 80% and 63% of the population own a tablet (Alcorn et al. 2014). The Australian social media landscape also marked by both growth and change. Growth in the proportions of Australians that use social media has continued since previous years, while change reflects the adoption of new platforms and uses social media. This grow will steadily continue into 2016 as a greater number of competitively priced devices hit the market. This research proposes to investigate how are tablet devices used in first generation Hungarian immigrant families in relation to the Hungarian language development and maintenance.

Australians are more connected than ever before. Alcorn’s et al. report (2014) shows that Australians express themselves online daily, with 54% updating or checking social media between one and 20+ times a day. This is up 170% since 2013, when only 20% of survey participants updated their social media status daily or almost daily. Keeping up with friends and family is by far the main reason Australians are using social networks. This is consistent globally, with the next most important reasons to be on social media being to keep up to date with breaking news and for the ‘entertainment’ value. Research on use of technology among Hungarian immigrants living in Australia shows the same trend.

Consistent with international trends, an increasing number of Australian schools have implemented “Bring Your Own Device” schemes. It is widely acknowledged that technology plays a huge role in students’ everyday lives (Clifford 2012; Sheninger E. 2011; Lee 2012; Sweeney 2012; Walling 2012 cited in Stavert 2014) and should, therefore, be an integral part of their learning. The argument behind this scheme is that student-owned devices are more likely to be “cutting-edge”, and that students are already familiar and comfortable using them, offers more opportunities for learning to continue at home; enhance student engagement, and enable students to keep work in one place (Stavert 2014). The following section will review some of the literature on tablet technologies and outline the elements of the theoretical framework.

2 Literature Review

Tablet Technologies

New digital technologies, such as smartphones (e.g. iPhones) and tablet computers (e.g. iPads), have become an integral part of our daily lives; are different from previous technologies in that they integrate portability and ease of manipulation of separate digital tools into one, multifunctional and aesthetically pleasing device (Sheehy et al. 2005). Currently tablet technologies, contain a range of ‘older’ technologies, including audio-recorder, picture-camera, drawing pad and an on-screen keyboard. Convergence and the opportunity to create original artefacts such as videos, audio recordings, visuals (drawings, stories, photo albums), with almost a ‘touch of a finger’ are also an important aspect of these technologies. For instance, the iPad has unique capabilities that were unparalleled prior to its introduction. It has most of the capabilities of desktop or laptop computer, but with additional unique affordances, such as a multitouch screen and a seemingly endless variety of applications, that promote previously unseen possibilities for interaction and engagement.

An accumulating body of research has examined the influence of technology on children’s development. In Hsin et al. (2014) study, eighty-seven articles published between 2003 and 2013 were reviewed of empirical studies of how technologies influence young children’s learning. The majority of the reviewed studies revealed that the technologies had positive effects on children’s performance across developmental domains. Particularly, in social domains, most studies showed that technologies enhance children’s collaboration and interaction with others and their development of multiculturalism. It has been also shown that there is a dis-
junction between young people’s use of technology in schools and in their homes or private practices (Morgan and Peter 2014; Luckin et al. 2009; O’Mara 2011; Selwyn 2006). These studies identified disconnectedness between what was happening at school and the use of technology by students beyond the classroom.

Tablet technologies have also attracted researchers’ interest. Neumann and Neumann (2014) in their recent article focused specifically on reviewing touch screen tablets and their potential role in promoting early literacy skills. The evidence suggests that tablets have the potential to enhance children’s emergent literacy skills (e.g. alphabet knowledge, print concepts, emergent writing). However, they concluded that the optimal use of tablets for early literacy learning may be dependent upon the type of scaffolding used by parent or teacher and the availability and quality of literacy applications. Although several studies examined multilingual literacy practices in different linguistic communities focusing on the effectiveness of technology as an important support for language maintenance (Cruickshank 2004; Fitzgerald and Debski 2006; Pauwels 2005; Peter 2013; Szécsi and Szilágy 2012; Walker 2009; Warschauer and De Florio-Hansen 2003) specific focus on the use of tablet technologies in home environment with the purpose of language development and maintenance is completely missing from the literature.

Elements of Theoretical Framework

As shown in the introductory section, the context of this study is very specific and it is important to provide a detailed picture of the nature of this group from social and linguistic perspectives. The purpose of this study is to gain an understanding of the processes involved in the socialization, of a group of Hungarian background children living in Sydney, into a multilingual and multicultural environment and the potential role of tablet technologies in these processes. To do this first Bronfenbrenner’s bio-ecological model is used to understand the multilayered and interrelated nature of the social contexts within children are located. Than the lens of language socialization is used to investigate how novices are socialized to use the Hungarian language and to be competent members in the Hungarian cultural group living in Sydney but in the same time to be a competent member in the multicultural and multilingual Sydney.

Bronfenbrenner’s Bioecological Model

Bronfenbrenner’s theory of human development was in continual state of development and underwent considerable changes from the time it was proposed in the 1970s until his death in 2005. Bronfenbrenner’s theory, initially termed as ecological model or approach, was developed to explain how human development occurs, focusing largely on the impact of context. His initial concepts, micro-, meso-, exo-, macro- and chronosystems were viewed as a set of nested structures, each inside the other like a set of Russian dolls (Bronfenbrenner 1979 p.3). Later he reformulated his original ideas and viewed development as emerging from the interaction of individual and context (Rosa and Tudge 2013). As a result of his later reformulation, the role of the person, time, and most importantly, the proximal processes gain a more central position. The new paradigm was termed as bio-ecological model with Process-Person-Context-Time (PPCT) as core elements. This system model simultaneously influences human beings and development outcomes (Bronfenbrenner 1999). Understanding the connections and interactions between different settings is important in comprehending an individual’s views and behaviors.

Some researchers, such as Houston (2015) have aligned aspects of Bronfenbrenner’s theory with Bourdieu’s social concepts of habitus, field and capital. He argued that Bourdieu’s concepts enable social workers to develop a critical ecology of child development, taking account of power and the interplay between agency and power. Bourdieu (1984) defined habitus as a concept constituted by thoughts, tastes, beliefs, interests and our understandings of the world around us. The external and internal worlds are viewed by Bourdieu (1984) as interdependent spheres and because of the fluid nature of habitus (that changes with age, travel, education, parenthood, migration etc.) no two individual’s habitus are the same. Habitus is also defined as “the society written into the body, into the biological individual” (Bourdieu 1990 p.63). He also talks about the notion of the durable disposition (Bordieu 1984) as a unique way or version of internalized social structure, meaning an inclination to behave in a particular way in a variety of situations. This concept has the potential to enhance understandings of the dispositions of first generation Hungarian families’ of turning towards the opportunities that tablet technologies offer and use them to benefit and enrich their language experiences.
Applying Bronfenbrenner’s bio-ecological model (PPCT) and Bourdieu’s conceptual category (of habitus), allows to gain a deeper understanding of the potential role of tablet technologies in Hungarian first generation children’s socialization in a multilingual and multicultural context, such as Sydney, and the potential role this might have in their language development and language maintenance.

**Language Socialization**

Language is the medium through which children become socialized into the society’s (or adult’s) way of thinking (Vygotsky 1978). Learning, knowledge construction, and socialization are seen to be mutually engaged in by members in a community over time (Duff 2007). Language socialization is a research tradition that approached language development in a different way. It is conceptualized in the metaphor of the learner-as-apprentice (Heath 1982; Ochs 1990; Schieffelin and Ochs 1986, 1996; He 2008). Schiefflin and Ochs (1986) proposed to view language socialization as having two dimensions. The first, based on Heath’s theory (1983), is that children are socialized to use language. Secondly, children are also socialized through language – acquiring cognitive skills (Vygotsky 1978), as well as knowledge about the world they live in (Sapir 1949; Whorf 1941 cited in Schiefflin and Ochs 1986). They viewed these two dimensions as intricately related. Based on this, acquisition of language and literacy are related to the construction of social and cultural identity. Caregivers providing explicit instruction in activity socialization to use language and interactants see their own and others’ social position while socializing through language.

A focus on language socialization entails a view of everyday interactions as language practices. Language interactions in homes between parents, grandparents, siblings, friends contributes to language development and/or maintenance. In this study the focus will be on the interactions that takes place in the course of an activity that involves using a tablet. E.g. Skype-ing, playing a game, watching or creating a video etc. Some features of the tablet and some applications can shape the type of interactions that can happen while using a tablet. Attention will be given not only to reading and writing activities but to gestures, non-verbal ways of interacting, especially spoken language. The dialogues considered will include adult/caregiver – child exchanges and discussions amongst children while using a tablet. I will look for these dialogues’ potential value for learning and development and their functions as well.

An important part of the language socialization research tradition has focused on the dynamics of language socialization in bilingual and multilingual settings. Researches using language socialization as lens for investigation focus on different domains. Some examine the language socialization processes in the home, at school, in peer groups and communities, others in the workplace (Bayley and Schechter 2003). Research focusing on first or home language socialization and the potential role of tablet technologies in this is completely missing from the literature.

To fill the gaps identified in the review of literature this research proposes to address the following questions.

- What affordances, in relation to language development and maintenance among first generation Hungarian migrant families living in Sydney, are provided by tablet technologies?
- What is the collaborative and/or social potential of these technologies within the context of the extended families of first generation Hungarian migrants living in Sydney?
- What is the best way of representing the contribution to language development and maintenance afforded by tablet technologies?
- How can the ‘habitus’ of a group of Hungarian children be best described in multilingual and multicultural Sydney? How does the ‘habitus’ of Hungarian children works in multicultural and multilingual Sydney?

**3 Research Design and Methodology**

**Approach**

To address the above research questions a sociocultural approach within a (multiple) case study framework was chosen using multiple sources of data and analysed from multimodal perspective. Sociocultural theory stresses the interaction between people and the culture in which they live. It is well known that this
approach originates from the work of seminal psychologist Lev Vygotsky (1896-1934), who believed that parents, caregivers, peers and the culture at large were responsible for the development of higher order functions, such as thinking, memory, language etc. The daily interaction with someone who is more knowledgeable linguistically and culturally gives the child the opportunity for constant development. In the sociocultural research field, communication, thinking and learning are treated as processes shaped by culture, whereby knowledge is shared and understandings are jointly constructed. Learning and development are understood by taking account of the intrinsically social and communicative nature of human life (Mercer and Littleton 2007)

With the proliferation of the Internet and diverse communication technologies, recent educational studies have come to see a range of recent technologies as tools of mediation. That is, they can be applied in ways that enhance understanding and assist in the construction of knowledge. Technology mediated learning is a particularly appropriate focus for sociocultural analysis because of the centrality of tool-mediated interactions and the intrinsic potential for learning. This approach places importance upon cultural and material resources, including technologies. Nevertheless, it is important to remember that the approach also encourages a focus on the dialogue or social practices that go on between users while the technology is being used. It is the ways in which recent technologies can actually foster these interpersonal, face-to-face interactions that is particularly interesting (Plowman et al. 2008).

Case studies usually focus on an in-depth investigation of an actual case, describing the activities of a particular group within a specific context (Creswell 2012). The case study approach has been considered most appropriate for the current study, to understand the bounded case of this group of Hungarian migrant families with children in their natural and authentic environment. In the case of this study, the boundaries are not physical or institutional but relate to shared language and culture. Similar research projects using case study approach involving children in their homes investigated language development (Tizard and Hughes 1984; Painter 2015), pretend play (Haight and Miller 1993), use of technology (Plowman et al. 2008, 2010, 2015).

Research Design

Participants

A survey will be sent out to approximate thousand Facebook users registered in Hungarian in Sydney group with an estimate return of ten percent. From this hundred respondents five to ten families will be chosen. The families will have to be first generation Hungarian families with at least one parent Hungarian and with at least one child aged between 2 to 14 years. Owning a tablet and willingness to video record interactions around the use of tablet technologies will also condition their participation.

Methods

One of the important features of case studies that also influenced the choice of method for this study is that allows a variety and a number of methods (Descombe 2007; Creswell 2012). The use of questionnaires, interviews, video recordings and artefacts as data sources will not only capture unique features but will also strengthen the reliability of findings.

Video-recording of human communication, interaction is becoming standard practice in qualitative research (Knoblauch et al. 2006). To avoid intrusion, parents will be asked to video record natural interaction and engagement around and with tablet technologies within their families (e.g. child and parent; child and child; child and other interlocutor - grandparent. These video recordings will enrich the data collected and ensure rigor and validity of the study. The number of video recordings will be negotiated individually with the families, an estimated 20 minutes in total from each family. Data from video recordings will show the specific applications (reading, playing applications) used and the types of interactions these applications create when using tablet technologies. It will also reveal the language used by and between the participants and their level of engagement.

Data Analysis

For data analysis, both qualitative and quantitative analysis will be applied. The quantitative data resulted from the survey questionnaires will be numerically analysed. Relationship between responses to different questions will also be examined carefully to identify significant correlations.
The qualitative data from questionnaires, interviews and video transcripts will be subject to open coding, the analytic process through which concepts will be identified to uncover properties and dimensions of data (Strauss and Corbin 2008). The data will be broken in distinct parts, closely examined, and compared for similarities and differences. The codes resulted and found conceptually similar in nature or related in meaning will be grouped under more abstract concepts.

Multimodal Interaction Analysis

Video recordings are also complex and multimodal. To capture this complexity and multimodality, multimodal interaction analysis (Norris 2004) will be applied. A key feature of multimodal interaction analysis is its primary concern with interaction embedded in social context, rather than on the modal system itself (Kress 2011). Thus it can be useful in exploring language resources Hungarian first generation children utilize to construct their participation in socialization contexts. Multimodal analysis lends itself well to observational data, which aims to explore a holistic perspective of semiotic resources used for communication and meaning making (Norris 2004). In multimodal interaction analysis the focus is on the actions performed by the interlocutors and the modes these actions are constructed (Norris 2004). Norris (2004) suggests deconstructing actions into separate units, called higher- and lower-level actions and focusing on the intensity of modes to understand their impact on the interaction. Multimodal interaction analysis also investigates the psychological levels of attention/awareness besides the phenomenological ones (Norris 2007). This type of analysis will allow answering the questions regarding the role and the potential of tablet technologies in a group of first generation Hungarian immigrant families and the role of the multicultural environment that characterizes Sydney.

The following steps will be followed: recording, create video log, view video data, select instances (episodes) for detailed analysis, discuss/post-interviews with parent, transcribe video data (gaze, gesture, movement, body posture, semiotic action, image, speech – Jewitt and Kress 2003). Fine-grained analysis will unpack the ways in which children and their parents interact and engage with various meaning-making resources (e.g. image and text) on screen as well as among themselves, for instance, who controls the screen activities (e.g. through touching), who initiates the questions and who provides the answers, what is being discussed during the session, whether adults explain the meaning of the images, texts or hyperlinks to the child and how they explain them. The analysis will look at the language itself, whether is Hungarian or English. Other studies that successfully used multimodal interaction analysis focused on cell phones and computer use in the workplace (Norris 2004), teacher-student interactions from first-grade classrooms (Norris 2003) or students’ online learning of Swedish (Nordstrom 2014).

4 Significance of the Study

With the rapid growth of mobile technologies and the proliferation of software applications, the role of tablet technologies in migrant families and their potential for fostering community, language and culture need to be better understood. Given the novelty of the medium, studies evidencing the nature and significance of use of these new tools are only beginning to emerge. So far, most studies focused on their role in educational context. No studies with focus on first or heritage language development and maintenance have been identified so far. This investigation would be a benefit for migration and culture researchers, community language researchers, sociolinguists and media and technology researchers. Additionally the Hungarian community in Australia is an under-research community.

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The Affordances of Mobile Learning for an Undergraduate Nursing Program: A Design-Based Study

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Keywords: affordances, mobile learning, undergraduate program, nursing, design-based research, authentic learning, flexible learning, higher education

Abstract. Mobile learning (M-learning) is significantly different in many ways from current theories of classroom, workplace or lifelong learning. It ensures mobility of learners, covers both formal and informal learning, theorizes learning as a constructive and social process, and analyses learning as a personal and situated activity mediated by technology (Sharples, Taylor & Vavoula, 2007:224). Studies such as those of Walton, Childst and Blenkinsopp (2005:55) have shown how community health students in the UK regard as vitally important the access to learning resources while in the community. A large body of the literature therefore indicates that M-learning can be used to integrate theory and practice. The aim of this study is to explore and describe the affordances of mobile learning in an undergraduate nursing program at a Higher Education Institution in the Western Cape. The methodological design for this research project will be the systematic yet flexible design-based research model using the three phases of the Integrative Learning Design Framework of Dabbagh and Bannan-Ritland (2005:113), integrated with the design-based research approach of Reeves (2006: 126).

1 Problem Statement

The need for research into the use of mobile devices in nursing education was identified at a School of Nursing at a Higher Education Institution (HEI) in the Western Cape Province, Cape Town, South Africa in 2010. In the HEI, where the researcher is working, she facilitated a year level clinical feedback meeting where clinical facilitators voiced their concerns that that their undergraduate nursing students seem unable to connect theory with their clinical practice. They mentioned that students tend not to carry with them into clinical practice the clinical module guides and textbooks essential to assisting them in the achievement of their clinical outcomes. One of the reasons discussed was that undergraduate nursing students may find it challenging and sometimes impractical to ―cart" clinical module guides and textbooks from an academic classroom or library environment into a “restricted” hospital or clinical environment with limited availability of space for research within a hygienically clean or sterile clinical setting.

The meeting identified the need to find innovative ways, such as the introduction of mobile devices, by means of which students can be assisted to address the problem of needing to have resource material available at any time or at any given place to be able to do research on conditions or procedures while off campus and in the clinical field (Cook, Pachler & Bradley, 2008:3). Since 2010, the researcher has observed the while students use the different applications on their mobile devices for social networking or internet research. However, mobile devices are currently not used to enhance learning at the School of Nursing at the HEI where the research was going to be conducted.

This observation led to the researcher to attend an emerging technology course in May and June 2012 offered by experts in mobile technology from HEIs in the Western Cape Province in order to broaden her knowledge on integrating emerging technologies, specifically mobile technology, in nursing programmes. Pachler, Bachmair and Cook (2010:3) see M-learning as a process of discovering how to use this technology successfully within an ever changing learning environment, to enhance the learning process. During the
emerging technology course, experts addressed and described their experiences on the application of mobile technologies at their respective HEIs. The researcher shared the problem of integration of theory and practice in her field of interest with regard to a learning activity with a forum, and the following questions were formulated.

2 Objectives

Phase 1: The Exploration Phase (Situational analysis)

The situational analysis is the exploratory phase and will consist of quantitative and qualitative sub-phases.

Objective 1 is to explore the knowledge of students, lecturers and facilitators on the use of mobile devices. A quantitative, exploratory, descriptive research design method (electronic survey) will be followed to investigate the participants’ knowledge and use of mobile devices. An accessible sample will consist of all third year undergraduate nursing students (n=100) registered for “The Primary Health Care” semester module. The survey, which will take 30 minutes to complete, will provide descriptive statistics, and the results will inform Objective 2.

Objective 2 is to explore and describe the perceptions and viewpoints of students, lecturers and clinical facilitators on the integration of theory and practice of the examination of the head and neck within the primary health care module through mobile learning in an undergraduate nursing programme at a Higher Education Institution in the Western Cape. A qualitative design model will be used in this (Objective 2). Besides the student participants, the non-probability purposive and accessible sample will include a lecturer (n=1) and the four clinical facilitators (n=4) involved in facilitating the module. Qualitative data will be collected by means of focus group individual interviews which will be audio recorded and validated by the participants after transcription, prior to using the data. Data collected will be categorized into themes that emerge from the individual interviews. The qualitative data analysis will be guided by the Tesch (1990) systematic process, and an independent coder will review the data to confirm the themes and categories identified by the researcher. From the results of Objective 2, a plan (intervention) will be developed to address Objective 3.

Phase 2: The Enactment Phase

This phase will explore a proposed intervention solution to integrate theory with practice using the data collected in Phase 1. Trustworthiness during the qualitative phase will be ensured through credibility, transferability, dependability and conformability. The enactment phase (Objective 4) will guide the researcher in an attempt to generate strategies that will be congruent with theories of learning. During the intervention development phase, solutions to integrate theory with practice will be explored and the activity theory of Engeström (2008) will be used to implement the intervention.

Preparation of students, lecturers and clinical facilitators on how to integrate mobile technology in the theory and practice of the examination of the Head and Neck within the Primary Health Care Module will be by means of a workshop on the use of mobile devices to enhance teaching and learning in an undergraduate program at a HEI. The workshop will be facilitated by an expert in the field of mobile technology, and lecturers and clinical facilitators will be invited to attend. There will be a technical presentation by an expert in mobile technology on the use of the various mobile device applications to enhance teaching and learning and students, lecturers and clinical facilitators will be invited. The activity theory of Engeström (2001: 133), as adapted, will guide Phase 2 of this study (Figure 1).

The following four questions will be posed at the workshop: “1. Who is the subjects of learning? 2. For what specific purpose are they learning? 3. What do they learn? 4. How do they learn?” (Engeström, 2001:133-135). The enactment phase will guide the researcher in her attempt to generate strategies that will be congruent with theories of learning (Dabbagh & Bannan-Ritland, 2005:134). During the development of the intervention, solutions for integrating theory with practice will be explored. Methods used during the intervention development process will include collective problem solving, displaying multiple roles, confrontation of and reflection on ineffective strategies and misconceptions, and developing collaborative skills in the work place.
Figure 1. Engeström’s Activity Theory

Phase 3: Reflection

Participants will be requested to reflect (objective 5) electronically on their experiences with the implementation of the plan (intervention) to integrate the theory and practice of the examination of the head and neck within the primary health care module through mobile learning in an undergraduate nursing programme at a Higher Education Institution in the Western Cape. The following question will be asked to start the conversation: “How did you experience the intervention on mobile learning?”

Guidelines for lecturers will be compiled (Objective 6) for specific ways to integrate theory and practice of the examination of the head and neck within the primary health care module through mobile learning in an undergraduate nursing program at a higher education institution in the Western Cape.

3 Methodological Assumptions: Design-Based Research

In this study the methodological design will be design-based research. Wang and Hannafin (2005:6) define design-based research as a systematic yet flexible methodology aimed at improving educational practices through iterative analysis, design, development, and implementation of an intervention. This methodology is based on collaboration among researchers and practitioners in real-world settings; it has the potential to lead to contextually-sensitive design principles and theories (Wang & Hannafin, 2005:6). The three phases of the Integrative Learning Design Framework (ILDF) of Dabbagh and Bannan-Ritland (2005:113) will be used to systematically develop an online learning support for students while they are doing the Head and Neck assessment in the Primary Health Care Module in the third year of the undergraduate Nursing Program. The assumptions of this approach are that:

The elements of quantitative and qualitative research approaches will assist the researcher to ascertain the extent and complexity of the understanding and validation of the integration of mobile devices in undergraduate nursing to enhance teaching and learning (Creswell & Plano Clark, 2010:297).

Students, lecturers and clinical facilitators will participate in or contribute to the design and development of guidelines on how to integrate the theory and practice of the health assessment of the Head and Neck within the Primary Health Care Module through M-learning in an undergraduate nursing program at a HEI in the Western Cape, even though they are not specialists in instructional design (Dabbagh & Bannan-Ritland, 2005:115).

The knowledge gained by the researcher in the exploration of perspectives on learning, enacting specific instructional strategies, and learning from the results, can promote the development of effective instruction in undergraduate nursing programs (Dabbagh & Bannan-Ritland, 2005:115).
4 Concept of Affordances according to Bower (2008)

Bower (2008:3) matches teaching and learning tasks with appropriate learning technologies by looking at the action potential of the technology. The dynamic model of Bower (2008:3) enables a better understanding of how teachers identify different kinds of knowledge as valuable in an attempt to support students’ ability to learn content knowledge. The categories of affordances of mobile technology provided a framework for the data analysis in this exploration of the affordances of mobile devices in integrating theory and clinical practice in an undergraduate nursing programme.

The affordance framework presented in the table below defines not only technological affordances, but includes social and educational affordances.

<table>
<thead>
<tr>
<th>Number</th>
<th>Categories of affordances</th>
<th>Action possibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Media affordances</td>
<td>Readability, writability, viewability, drawability, listenability, speakability, watchability, video-production-ability</td>
</tr>
<tr>
<td>2</td>
<td>Spatial affordances</td>
<td>Resizeability, movability</td>
</tr>
<tr>
<td>3</td>
<td>Temporal affordances</td>
<td>Accessibility, recordability, playbackability, synchronicity</td>
</tr>
<tr>
<td>4</td>
<td>Navigation affordances</td>
<td>Browsable, linkability, searchability, data-manipulation-ability</td>
</tr>
<tr>
<td>5</td>
<td>Emphasis affordances</td>
<td>Highlightability, focusability</td>
</tr>
<tr>
<td>6</td>
<td>Synthesis affordances</td>
<td>Combinability, integratability</td>
</tr>
<tr>
<td>7</td>
<td>Access-control affordances</td>
<td>Permission-ability, shareability</td>
</tr>
</tbody>
</table>

Table. Classification of Affordances


Mobile technology has affordances that can guide the teacher on how to support student learning with use of WhatsApp Messenger a cross-platform mobile messaging application, on mobile devices.

5 Research Setting

This study will take place over a semester during the third year undergraduate Community Health Nursing Programme presented by a School of Nursing at a HEI in the Western Cape Province, Cape Town, South Africa.

6 References


Section VI
Panels
Prefering for a Transparent World – Wearable Technologies in Education

Victor Alvarez¹, Matt Bower², Sara de Freitas¹, Sue Gregory³, Bianca de Wit², Mikhail Fominykh⁴, Carl Smith⁵, Fridolin Wild⁶ and Marcus Specht⁷

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Keywords: wearable technologies, immersive learning design, professional development

1 Rationale

Wearable technologies (WT) are poised to inspire a new generation of mobile learning design. WT sub- tend a range of potentials (or ‘affordances’) to educators, including the ability to provide in-situ contextual information, record the first person point of view, facilitate hands free communication, and provide perfectly situated scaffolding (Bower & Sturman, 2015).

Wearable devices (e.g. Oculus Rift, HTC Vive, Samsung Gear, Microsoft Hololens, Epson Moverio, etc.) are opening the door to new ways of learning that can contribute to overcoming skills gaps and enhancing graduate employability. But in order to harness the pedagogical opportunities of WT, it is crucial for educators to develop an understanding of the pedagogical, technological and logistical issues at stake.

This panel will discuss how mobile wearable computing can support learning. The presentation will focus on the various aspects of design, development and delivery of state-of-the-art WT applications in education, and will encourage participants to discuss and explore the role and impact of WT on society and education.

This panel aims to address these research topics and provide a forum in which academics, researchers and students may voice their ideas, experiences, and expectations on the role and impact of wearable technologies in education.

2 Format

This panel is planned as an event including a presentation of technical and pedagogical considerations, review of case studies and opportunities for participants to engage in the discussion by sharing their own experiences in the field and describing their expectations for the incorporation of wearable technologies in the educational realm.

Dr. Victor Alvarez and Dr. Matt Bower will lead an introductory presentation, which will include contributions and remote participation from the panel members, and it is expected to have 30-45 minutes duration. We also invite contributions from the participants, which may focus on a range of topics from technical and educational aspects, to more specific empirical approaches and case studies. The presentations will be followed by a participatory period to engage participants in discussing the topics and sharing their own experiences and expectations in the field.

The panel will explore a range of case studies and offer an exposé of how wearable technologies can be used for education, showing how they work, providing example WT apps and demonstrations for use in classes. The panel will gather the opinions and contributions of the participants.

3 Target Audience

This panel will prove valuable for academics, researchers and students with interest in the understanding and application of wearable technologies in educational settings.
The panel activities aim at raising awareness for the relevance of wearable technologies in education and the inherent potential of positive outcomes in future teaching and learning initiatives.

4 Panel Members Biographies

Dr. Victor Alvarez – Murdoch University, Australia

Dr. Victor Alvarez is a Senior Research Fellow at the Office of the Pro Vice Chancellor of Learning and Teaching, Murdoch University. In his role, he leads and assists research initiatives in Technology Enhanced Learning, including coordination of cross-disciplinary research development drawing in from scientific and social scientific research groups across Murdoch University, dissemination of edge findings in learning theory and experimental design, development of grant applications, and establishment of Australian and International research collaborative networks.

Victor has worked with some of the top European TEL groups and Research Networks (The European Association of Technology Enhanced Learning, KU Leuven, Open University of the Netherlands, Stockholm University), and lectured for 8 years at the University of Oviedo in Spain. He also has extensive experience in the European telecommunications private sector, working as a technology consultant for British and Finnish companies. His academic research has been published both in top-ranked conferences and ISI JCR journals. He has involved in the editorial board for a number of international conferences and journals. Before coming to Australia, Victor was responsible for the management and coordination of a work package in the research project iTEC (Innovative Technologies for an Engaging Classroom, 2010-2014) funded by the European Commission, Framework Programme 7.

Dr. Matt Bower – Macquarie University, Australia

Dr. Matt Bower has an extensive track record of successful learning innovation project leadership. He was the leader of an OLT project entitled “Blended synchronicity: uniting on-campus and distributed learners through media-rich real-time collaboration tools” (ID11-1931) which has received international recognition through the 2014 Higher Education Horizon Report, the 2015 UK Higher Education Academy learning excellence study, and a 2014 Downes Prize. He was also a team member of the Leadership for Excellence project entitled “A national discipline-specific programme for tutors in the mathematical sciences” (LE9-1248), and is currently an associate team member on the OLT’s largest ever Innovation and Development grant entitled “Transforming exams across Australia: processes and platform for e-exams in high stakes, supervised environments” (ID15-4747).

Dr. Bower has over seventy scholarly journal conference and book publications that have been cited over eight hundred times according to Google Scholar (ref: https://scholar.google.com.au/citations?user=p_md3-sAAAAJ). In the past five years he has attracted over $1.15M of competitive funding for learning technology research and innovation projects (see http://www.educ.mq.edu.au/our_staff/dr_matt_bower). This included a 2014 Macquarie University Innovation and Scholarship Program Grant entitled “Preparing Macquarie for a transparent world – rethinking learning and teaching in the context of wearable technologies”. Dr Bower was the recipient of a 2010 OLT Citation Award for Outstanding Contribution to Student Learning, and is frequently invited to deliver keynote presentations at national and international educational technology symposia.

Prof. Sara de Freitas – Murdoch University, Australia

Sara de Freitas is Pro Vice Chancellor and Professor of Learning and Teaching at Murdoch University. In her role, she leads on strategy for learning and teaching across the university, and provides academic leadership for the Centre for University Teaching and Learning (CUTL) which supports a range of activities including: high quality research in learning and teaching, delivery of the OnTrack enabling program and support for advanced educational innovative technologies. Her previous role was as Associate Deputy Vice Chancellor and Professor of Teaching and Learning at Curtin University where, she led the Curtin Teaching and Learning team which serves 62,000 on-campus and online students with 11 areas of activity, including learning design, assessment and quality, pathway programmes, online learning, learning technology, T&L innovation, Faculty learning engagement teams and the work integrated learning programme. Before coming
to Australia, Sara was Director of Research at the Serious Games Institute, Coventry University, UK. There she led the formation and development of a hybrid model of research, business and study, the first institute of its kind. The Institute attracted millions in research income from the British Council, UK Engineering and Physical Sciences Research Council, European Union and European Regional Development Fund. The Institute also established a network of affiliated organisations in four continents and the business side of operations has successful commercial spinouts in the UK and Singapore.

At Birkbeck College, University of London, she helped to establish the well-known London Knowledge Lab, with its focus upon digital learning. Over the period, she was also the Director of a consultancy company, which provided consultancies for the UK Department of Education and the Joint Information Systems Committee (JISC). Sara currently holds a Visiting Professorship at Coventry University in the UK, Visiting Research Fellowship at the University of London and is an Adjunct Professor in Malta University. Her research interests are focused in learning analytics, technology enhanced learning, higher educational policy and leadership and advanced educational games research and development. Sara has published seven books and over 100 journal articles, conference papers and reports. She currently sits on over 100 programme committees and advisory boards and has undertaken over 100 international keynotes, presentations and public lectures in four continents. Her awards include a teaching award at Birkbeck College, Most Influential Woman in Technology 2009 and 2010 by the US Fast Company and a Fellowship of the Royal Society of Arts.

Dr. Sue Gregory – University of New England, Australia

Dr. Sue Gregory is a long-term adult educator and Chair of Research and member of the ICT team in the School of Education, University of New England, Armidale, Australia. She also holds a Senior Fellowship of the Higher Education Academy. Sue is also an Adjunct Research Fellow with Curtin University. Sue teaches pre-service and post graduate education students how to incorporate technology into their teaching. Through her avatar Jass Eastern, Sue has been using Second Life by applying her virtual world knowledge to expose her students, both on and off campus, to the learning opportunities in virtual worlds since 2007. She has been involved with many national and university projects on creating and using learning spaces in virtual worlds. Sue was the lead for an OLT project “VirtualPREX: Innovative assessment using a 3D virtual world with pre-service teachers”, a team member on three other OLT projects and received an OLT citation in 2012. Since 2009, Sue has been Chair of the Australian and New Zealand Virtual Worlds Working Group. Sue has over 80 publications on teaching and learning in virtual worlds and completed her PhD on this topic.

Dr. Bianca de Wit – Macquarie University, Australia

Dr. Bianca de Wit is an associate lecturer and the assistant director of the Undergraduate Program in the Department of Cognitive science at Macquarie University. In her role, Bianca assists in the development and running of the new Undergraduate major in Cognitive and Brain Sciences, which will be offered for the first time in 2016. Bianca has been a successful application for an innovation and scholarship grant that will enhance the quality of learning and teaching practices in Cognitive Science through the innovative implementation of commercially available technologies into the teaching curriculum. Bianca manages a project that involves the development of two fully functional, portable and cost-effective teaching laboratories, a human brain imaging lab and a virtual reality lab, that will create an innovative and exploratory curriculum for the entry unit into the major in Cognitive and Brain Sciences. In this cornerstone unit, Bianca’s project will give students the opportunity to learn through highly immersive and scaffolded enquiry-driven activities how the mind and the brain work. The lab-activities build on current research undertaken by investigators in the Department, including Bianca’s work. Bianca has extensive experience in the use of the Emotiv EPOC, a consumer-grade portable neurogaming EEG system in both research and teaching settings. This includes published key research validating the use of the Emotiv EPOC as a research tool (Badcock et al., 2015) and teaching demonstrations of the Emotiv EPOC to various audiences ranging from high school and university students to researchers and other stakeholders.

Dr. Mikhail Fominykh – Europlan-UK

Dr. Mikhail Fominykh is a researcher and a project manager in the field of Technology-Enhanced Learning. Mikhail is leading a research lab “ICT in Education and Training” at Europlan-UK ltd and holds an As-
sociate Professor position at Molde University College, Norway. Mikhail obtained his PhD at the Department of Computer and Information Science at the Norwegian University of Science and Technology, (NTNU-Trondheim) and later did a postdoc at the Program for Learning with ICT at the same university. Mikhail has gained solid experience in the area of technology-enhanced learning through participation in several national and international R&D projects (including EU-funded TARGET, CoCreat and TIE). He has also developed and supported technologically several courses and training programs. He has published nearly 45 papers and book chapters on VR-based training and visualization, and presented his research findings at more than 50 academic conferences. In 2015, Mikhail initiated and coordinated the development of a successful grant proposal in the area of training with wearable devices and augmented reality (EU Horizon 2020 WEKIT project, 2.7 mil euro).

Mr. Carl Smith – Ravensbourne, London, UK

Mr. Carl H Smith is Director of the Learning Technology Research Centre (LTRC) and Senior Lecturer in Creative Coding, Learning Technologies and Research based at Ravensbourne. His background is in Computer Science and Architecture. He is an academic expert and developer with over fourteen year's experience conducting R+D into the application of hybrid technologies for perceptual and cognitive transformation. He is working on the newly funded Horizon 2020 project [WEKIT] Wearable Experience for Knowledge Intensive Training which will use the latest in wearable and motion tracking technology to create ‘wearable experience’ - an entirely new form of media. He has also worked on a number of large-scale FP7 and Leonardo Life Long Learning European projects. His research interests include Embodied Cognition, Spatial Literacy, Perceptual Technology and Human Centric methodologies and Pedagogies.

Dr. Fridolin Wild – Oxford Brookes University, Oxford, UK

Dr Fridolin Wild is a Senior Research Fellow, leading the Performance Augmentation Lab (PAL) of Oxford Brookes University, located in the Department of Computing and Communications Technologies. With the research and development of the lab, Fridolin seeks to close the dissociative gap between abstract knowledge and its practical application, researching radically new forms of linking directly from knowing something ‘in principle’ to applying that knowledge ‘in practice’ and speeding its refinement and integration into polished performance.

Fridolin is and has been leading numerous EU, European Space Agency, and nationally funded research projects, including WEKIT, TCBL, ARPASS, Tellme, TELmap, cRunch, Stellar, Role, LTfLL, iCamp, and Prolearn. Fridolin is the voted treasurer of the European Association of Technology Enhanced Learning (EATEL) and leads its Special Interest Group on Wearable-Enhanced Learning (SIG WELL). He chairs the working group on Augmented Reality Learning Experience Models (ARLEM) of the IEEE Standards Association as well as the Natural Language Processing task view of the Comprehensive R Archive Network (CRAN).

Fridolin also holds the post as Research Fellow of the Open University of the UK. Before, Fridolin worked as a researcher at the Vienna University of Economics and Business in Austria from 2004 to 2009. He studied at the University of Regensburg, Germany, with extra-murals at the Ludwig Maximilian University of Munich and the University of Hildesheim.

Prof. Marcus Specht – Open University of the Netherlands

Prof. Dr. Marcus Specht is Professor for Advanced Learning Technologies at Welten Institute (Research Center for Learning, Teaching and Technology) at the Open University of the Netherlands and director of the Learning Innovation Labs. He received his Diploma in Psychology in 1995 and a Dissertation from the University of Trier in 1998 on adaptive information technology. From 2001 he headed the department “Mobile Knowledge” at the Fraunhofer Institute for Applied Information Technology (FIT). His research focus is on Mobile and Contextualized Learning Technologies and Social and Immersive Media for Learning.

In the last ten years Prof. Specht did research on using game design patterns for educational purposes. As the research found game design patterns can be especially efficient for enriching learning experiences and embedding them in real life situations. Since 2012 Prof. Specht also coordinates the European Project
weSPOT (wespot.net), which focuses on mobile inquiry-based learning in schools and higher education making use of mobile technologies for linking formal and informal learning support.

Prof. Specht coordinates several research groups in the Technology Enhanced Learning Innovations program of the Welten Institute. The research topics include a) new user interfaces for learning which makes use of sensor technology, augmented reality, and Internet of Things b) mobile and seamless learning support c) learning analytics and big data d) learning networks and social media. Prof. Specht is an Apple Distinguished Educator, a member of the Board of the Dutch Research School on Knowledge and Information Systems and since 2013 President of the International Association of Mobile Learning.
Mobile Learning Futures: Theory and Practice

Kevin Burden¹, Sandy Schuck², Peter Aubusson², Matthew Kearney², Damian Maher², Deborah Evans³ and Simon Bogert⁴

¹University of Hull, UK; ²University of Technology Sydney, Australia; ³Wahroonga Public School, NSW, Australia; ⁴Killara High School, NSW, Australia

Keywords: mobile futures, theory and practice, professional learning

1 Background and Purpose of the Panel

This panel discussion will examine the relationship between theory and practice in the evolving and future uses of mobile technologies in teacher education. Teacher education faces numerous issues and challenges, many with a global dimension and this panel will address some of these from both a European and Australian perspective. Panelists from the University of Hull (UK) and the University of Technology, Sydney, will outline a series of theoretical frameworks, including the Mobile Learning Framework and Third Space learning, that have been used as the basis of several empirical studies in m-learning. The panel will then debate the relevance and practicality of these theoretical positions in relationship to a series of ongoing projects focused on the professional development needs of teachers and teacher educators using mobile technologies. These include an Erasmus+ project led by the University of Hull (Mobilising and Transforming Teacher Educators’ pedagogies project: www.mttep.eu), an ARC project led by the University of Technology, Sydney (Optimising mobile learning in maths and science) and a project funded by an Industry partner (Mobile-intensive Pedagogies: www.microsoft.com.au/surface-education) and the practical experiences of classroom teachers working in Australia and Europe. As an outcome from the discussion the panel will seek to develop a mobile learning futures agenda for the use of mobile technologies in teaching and teacher education that extends beyond the conference, building upon the work of Schuck, Aubusson and Burden in Teacher Education Futures.

2 Organisation of the Panel

The panel will be organised using a ‘flipped learning’ model (see http://digitaltechnologiesnetwork.co.uk as an example of this approach) whereby the main theoretical frameworks and empirical studies are made available prior to the conference in the form of multimodal, interactive presentations that prepare participants to take an active, participatory role in the panel itself. Using this approach the panel will be able to respond to issues and questions raised prior to the conference making the event more customised and relevant to the interests of those attending. During the panel discussion itself participants and panelists will address the following questions:

- In what ways does the Mobile Learning Framework and Third Space learning theory support teacher educators and teachers in better understanding their practice?
- What role does theory and practice play in shaping an agenda for mobile learning futures?

In June the Conference Program Committee and an International Review Panel will peer-review the papers submitted for inclusion in the Conference Proceedings. In addition, all submitting authors will be required to undertake the reviews of other papers (2 papers for review for each submitted paper). The Topics you selected for your own submission will be used to select papers for you to review. All reviewers will be acknowledged.
Indigenous People and Mobile Learning

Laurel Evelyn Dyson (Chair)¹, Marguerite Koole², Kevin wâsakâyâsiw Lewis², Suzaan Le Roux³ and Philip Townsend⁴

¹School of Software, University of Technology Sydney, Australia; ²University of Saskatchewan, Canada; ³Faculty of Business and Management Sciences, Cape Peninsula University of Technology, Cape Town, South Africa; ⁴CRC-REP, Remote Education Systems Project, Flinders University, Adelaide, Australia

Keywords: Indigenous people, Aboriginal people, m-learning, mobile technology, Indigenous education, benefits of mobile learning, barriers to learning

1 Overview

Indigenous nations are, for the most part, those who have an historical connection with their territory that predates colonization. The United Nations conservatively estimates that there are over 370 million Indigenous people living in some 90 countries spread across six continents. Indigenous people comprise 4% of humanity and speak more than 4,000 of the world’s 7,000 languages.

Indigenous people are an integral part of the revolution in mobile technology, communication and media that is happening all over the world. Whereas landline phones and fixed Internet access often served Indigenous individuals poorly, the explosion of mobile devices and applications in Indigenous communities offers the potential to strengthen the environment for the learning and sharing of knowledge, address the issue of educational provision in geographically isolated regions and to mobile groups of learners, and provide support for cultural and language revitalization. Many of the concepts of mobile learning – such as contextualized learning, and learning on the move anywhere and anytime – are inherent in the traditional education systems of Indigenous people as the original “mobile learners”.

2 Organization

In this panel – held on Gadigal land – some of the leading authors on Indigenous people and mobile learning will present their views on the theme, with time for questions and comments from the audience. During the panel participants and panelists will discuss the specific role that mobile learning can play in the education of Indigenous people. With reference to their extensive experience in this field, panelists will address the issues of: What works and why (benefits)? And: What does not work and why (barriers)?

3 Panellists

Laurel Evelyn Dyson, BSc (Hons), BA (Hons), PhD, MInfTech, is the author of many publications on the adoption of mobile technology by the Aboriginal people and Torres Strait Islanders of the Far North of Australia, and co-editor of Indigenous People and Mobile Technologies, published this year by Routledge. She supported and taught Aboriginal students undertaking degree programs and university preparation courses in Information Technology at UTS for 15 years until her recent “retirement”, and is a winner of the Pauline McLeod Award for Reconciliation 2013 and the UTS Equity and Diversity Award 2007.

Marguerite Koole teaches master’s level courses on instructional design, distance education, and educational technology at the University of Saskatchewan, Canada. In 2006, Dr. Koole completed a Masters of Education in Distance Education (MEd) through the Centre for Distance Education at Athabasca University. Her doctoral thesis was completed through Lancaster University, UK. Dr. Koole has worked in online and distance education for over 15 years. Through the years, she has been involved in language teaching, instructional design, multimedia programming, content management, e-portfolios, and social software. She has designed interactive, online learning activities for various learning purposes and platforms—including print, web, and mobile devices.
Kevin wásakâyâsiw Lewis is a Special Lecturer in Curriculum Studies at the College of Education, University of Saskatchewan, Canada, where he researched and developed the Indigenous Language Certificate Program for the Faculty of Education under the Indian Teacher Education Program and Curriculum Studies Departments. He has also taught at the University nuhelot’įne tháiyots’į nistameyimâkanak Blue Quills, the First Nations University of Canada and the University College of the North. He holds impressive qualifications: Bachelor of Education, Bachelor of Arts in Native Studies, Certificate of Ecological Education, Masters of Education in Indigenous Language and Literacy, and Master of Arts in Indigenous (Cree) Language. He is currently enrolled in the Doctorate of iyiniw pimatisiwin (PhD) in Traditional Cree Language and Cultural Development.

Suzaan Le Roux, MTechIT, PhD, is a Senior Lecturer at the Cape Peninsula University of Technology, South Africa. She has a keen interest in the use of mobile technologies in practical-based subjects especially by South Africa’s historically disadvantaged communities. She is the first person in South Africa to report on “programming on mobile devices” in a higher education environment with Indigenous people, and was recently a co-author of Mobile Learning and STEM: Case studies in Practice, published by Routledge.

Philip Townsend – BEd, BTh (Hons), MEd (Leadership and Management) – is a PhD candidate in the School of Education at Flinders University, Adelaide, South Australia. His thesis is titled: “Travelling Together and Sitting Alongside: How Might the Use of Mobile Devices Enhance the Professional Learning of Aboriginal and Torres Strait Islander Pre-Service Teachers in Remote Communities?” Philip has over 30 years cross-cultural experience in remote contexts among the Western Desert people of Australia and Melanesian people of Papua New Guinea. Philip received a scholarship from the Cooperative Research Centre for Remote Economic Participation under their Remote Education Systems research project.
Re-Imagining Feedback in the Classroom

Elizabeth Hartnell-Young\textsuperscript{1}, Sonia Sharp\textsuperscript{2} and Ben Barnett\textsuperscript{3}

\textsuperscript{1}Melbourne Graduate School of Education, University of Melbourne, Australia; \textsuperscript{2}Principal, Nous Group, Australia; \textsuperscript{3}CEO, Loop Edu, Australia

\textit{Keywords:} feedback, mobile, BYOD, apps, technology, student voice, visible learning, reflection, refine teacher practice

1 Panel Overview

Studies of feedback tend to show very high effects on learning. While the focus is often skewed towards teacher-to-student feedback or teacher-to-teacher feedback, research suggests that student-to-teacher feedback can also benefit teaching and learning.

Our work in schools shows that not only does feedback through technology create very nimble loops between teachers and students, it supports other programs around mobile learning such as BYOD and teacher/student communication beyond the physical classroom. We believe that feedback flows between students and teachers create the foundations for sustainable mobile learning.

The Panel will explore three key themes with respect to student-to-teacher feedback

1. How student feedback can assist teachers to refine their practice
2. How student feedback supports student voice and broader engagement
3. How technology is making student feedback easier than ever

The session will also include “hands on” play with tools used for student-to-teacher feedback.

2 How Student Feedback Can Assist Teachers to Refine Their Practice

A fundamental aspect of teaching is to know your learners, in order to stretch their knowledge and skills. In Australia, the professional standards for school teachers commence with 'know your students and how they learn' (Australian Institute for Teaching and School Leadership, 2014). In this session, we will demonstrate ways to gather feedback from individuals about their learning, which can help teachers to personalise their practice to meet students’ needs, plan their own professional learning and evaluate the benefit of various curriculum activities.

3 How Student Feedback Supports Student Voice and Broader Engagement

‘Student voice’ entails much more than running a survey at the end of a unit. This session includes actual examples from students using a simple software tool. Gathering feedback from students indicates that we value them and their experience, and can lead to greater student agency, especially if acted upon without delay. Mobile tools give students the opportunity to capture, articulate and share their learning at any time.

4 How Technology is Making Student Feedback Easier than Ever

This session explores how technology creates a safe space for feedback, and can be used intelligently to gather feedback at the right moment and from the right people. It can also be used to assist individuals to become properly skilled in how to ask and how to give feedback.
Technology is also enabling new directions of feedback, and we explore how peer-to-peer feedback is creating new paths of development for older students. This includes the creation of e-portfolios, which can be used to support students as they prepare for further study or the job market.

5 Panel Members Biographies

Elizabeth Hartnell-Young – Melbourne Graduate School of Education, The University of Melbourne

Elizabeth is a teacher, educational activist, researcher, writer and presenter, with experience in Australia, Asia and Europe. She has a long history supporting teachers' professional learning through technologies and mobile learning in schools and higher education, and researching from a sociological perspective. She was Director of the ACER Institute at the Australian Council for Educational Research from 2012-2016, and Director of Research and Evaluation in the Victorian Department of Education and Early Childhood Development for four years. Previously, Elizabeth was a researcher in the multidisciplinary Learning Sciences Research Institute at The University of Nottingham, where her particular interests were mobile technologies for learning, new learning spaces and large scale digital systems such as e-portfolios. She has published extensively on these topics.

Dr Sonia Sharp – Principal, Nous Group

With a background in teaching, research and psychology, Sonia is energetic and passionate with a wealth of experience in strategy development, performance improvement, organisational design, and complex system change in education. She has held senior executive positions in three of the UK’s largest education authorities and an Australian State Government where she designed and led a number of ambitious, large scale whole system change initiatives resulting in sustained and marked improvements for students. A popular keynote speaker, she has published a number of books and articles.

Ben Barnett – CEO, Loop Edu

Ben Barnett is the CEO of Loop Edu, which enables feedback from perspectives in the classroom. Ben is also a Principal at Nous Group, where he has worked extensively with schools, universities and not-for-profit educators to improve teaching excellence and learner performance. With a Masters of Philosophy from the University of Oxford, Ben co-wrote and co-delivers the Leading Ethically course for high achieving principals through The Bastow Institute of Educational Leadership. Ben is interested in how feedback can be used to drive more ethical school cultures.
Section VII
Workshop
The Handbook of Mobile Teaching and Learning & Future Possibilities

Aimee Zhang¹ and Dean Cristol²

¹WEMOSOFT, Australia; ²Ohio State University, USA

Keywords: mobile, teaching, learning, higher education

1 Purpose

This workshop aims to increase awareness of this publication and to encourage the audience in the next edition and international collaboration.

2 Description

Mobile technologies have been used in higher education for many years, providing 21st Century teaching and learning available anywhere and anytime. In 2015, Springer published The Handbook of Mobile Teaching and Learning (http://www.springer.com/us/book/9783642541452?token=prtst0416p) focusing on diverse mobile learning projects and practices in higher education in several countries. The book provides comprehensive information and cases studies around mobile teaching and learning with a critical eye on future expectations for new technology in higher education in six sections: design, development, adoption, collaboration, evaluation and future of mobile teaching and learning technology in higher education. The goal for this workshop is to discuss the important elements of the book, present several programs/products in different countries and discuss the new products/programs or ideas for the next edition. The variety of projects and programs in different countries will help boost innovation and discussion for future projects and practices. The workshop discussions will provide guidelines for future design and development of mobile applications in higher education.

3 Showcase Projects and Topics

- TIPS (Tutors in Pockets) – an mobile application for Economic teaching
- Eudic - a bilingual reading platforms, multimedia, multi-platform interactive books to help students across barriers of language and culture
- Mobileclass – how to teach general public through mobile social media (WeChat with 800 million users)
- Future technologies in mobile teaching and learning - Advanced image retrieval technology
- The different adoption level of mobile technology in teaching and learning in different countries – potential international collaboration with 100 authors from 12 countries

4 Panel Members Biographies

Dr. Aimee Zhang, WEMOSOFT, aimee_zy@hotmail.com

Dr. Aimee Zhang is the CEO and founder of WEMOSOFT. She was a Lecturer in the University of Wollongong, School of Economics from 2009 to 2014. She has been teaching economics for more than 5 years. Her innovative teaching and learning with mobile technology received many awards and grants from the university and faculty. Her 5 years working experience in telecommunication industry as remote educational
system designer, developer, project manager, and quality assurance manager in different companies also contributed to the cross-discipline innovations.

Passionate in both teaching and mobile technology, she designed and developed the mobile application “Tutors in Pockets” for mobile teaching and learning for both IOS and Android mobile devices. She also collaborated with different universities and institutions on mobile projects in higher education teaching and learning.

**Dr. Dean Cristol, Ohio State University, cristol.2@osu.edu**

Dr. Dean Cristol is an Associate Professor in the Department of Teaching and Learning in the College of Education and Human Ecology at the Ohio State University. His area of research is to establish and maintain university-school partnerships, professional development, and preparing people to teach and learn in twenty-first-century educational settings. Currently, he is using this research framework to integrate technology into learning contexts, specifically mobile learning and technology. He has researched in many educational settings, from large and small urban school systems in the United States to Mexican preschools, and works closely with governmental and nongovernmental organizations. His research is defined by ways to educate all children, especially disenfranchised children, by understanding why they are marginalized and discovering ways to overcome their lack of access to twenty-first-century educational contexts. He has participated in several national and state partnering grants; published his research in numerous international, national, and state journals; published several chapters in books; presented his research at several international, national, and state conferences; and sits on several journal editorial boards; currently; he is an associate editor for Theory Into Practice.
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