Theoretical-based on Learning Goal in E-learning System

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Abstract
E-learning system plays an important role as one of new trends of educational system. It is, however, lack of theory to support each learner's goal. There are a lot of theories that simulate learning environments and design each learner's role in order to achieve his/her own personnel goal. In this paper, we proposed learning goal and shows some examples on applying the goal in e-learning system.

1. Introduction
Due to the spread of Internet usage, e-learning become a major role in computer-based education. It allows participants to learn at their own pace and access materials through the Internet when it is convenient for them. In general, each participants in e-learning system is expected to achieve his/her own personnel goal, while organizations is aimed to get the success from the individual achievement. To construct an effective e-learning system, it is necessary to answer “how to construct the learning system that achieve the learning goal for both personnel perspectives and organization perspectives”.

There are a lot of theories that explain the situation to reach an objective for whole group depending on participants’ individual goal. In this paper, we define the personnel goal and social goal, Personnel goals is classified into two types; I-goal is the learning goal that represents what a learner acquires, and Y<=I goal is the learning goal that represents the means to attain I-goal. Social goal is defined as W-goal. It is a whole group goal that represents the situation setting up to attain Y<=I goals. Applying these goals to e-learning system will help us achieve both personnel perspectives and social perspectives.

In this paper, we illustrate the design on e-learning system, mixing between individual learning and collaborative learning approach based on the learning goal that we proposed. After that we give some case studies on e-learning through learning goal. The LearningNuke e-learning system which is constructed by NECTEC and EGAT is shown as example.

2. Learning Goal for e-learning system
There are many theories that explain on environments for grouping learner by concentrating learner's role, activity and goal. For instance, Sociocultural Theory[31], Zone of proximal development[31], Constructivism[3,10], Self-regulated learning[12,26], Situated cognition[19], Cognitive apprenticeship[20], Cognitive flexibility theory[27,28], Observational learning[1], Distributed cognition[25], and so on. These theories are
goals as an example where three learners: $L_A$, $L_B$, and $L_C$ exist. Learner $L_A$ has an I-goal to attain through this learning process and this goal is described in the Figure 1 as $G: I(L_A)$. Both $L_B$ and $L_C$ have I-goals, and they are represented by $G: I(L_B)$ and $G: I(L_C)$ respectively. $G: Y(L_B)<=I(L_A)$ is a $Y<=I$-goal between $L_A$ and $L_B$ observed from $L_A$’s viewpoint: the reason why $L_A$ interacts with $L_B$. Concerning this interaction between $L_A$ and $L_B$, there is a $Y<=I$-goal observed from $L_B$’s viewpoint, too: the reason why $L_B$ interacts with $L_A$. This $Y<=I$-goal is represented as $G: Y(L_A)<=I(L_B)$. Both $G: I(L_A)$ and $G: Y(L_B)<=I(L_A)$ are personal goals of $L_A$. $G: W(L_A,L_B)$ is a W-goal of the learning group ($L_A$ and $L_B$). $G: W(L_A,L_B,L_C)$ is a W-goal of the learning group ($L_A$, $L_B$ and $L_C$).

Table 1 shows the I-goals. The learner is expected to achieve these I-goals through interaction with another learner. Table 2 shows the $Y<=I$-goals. For example, to personal goals. W-goal expresses the situation setting up to attain $Y<=I$-goals and we describe the goal as $G: W$. W-goals are social goal as a whole group.

Figure 1 represents the structure of learning

<table>
<thead>
<tr>
<th>I-goal</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition of Content-Specific Knowledge (Accretion Tuning Restructuring)</td>
<td>To add new knowledge concerning the target domain to existing schemata, to understand it, and then to (re) construct knowledge structure</td>
<td>[1], [3], [4], [6], [7], [11], [14], [15], [22], [24]</td>
</tr>
<tr>
<td>Development of Cognitive Skill (Cognitive Stage Associative Stage Autonomous Stage)</td>
<td>To get knowledge concerning cognitive skills such as diagnosing and monitoring, to practice them, and then to refine them</td>
<td>[2], [3], [13], [24]</td>
</tr>
<tr>
<td>Development of Metacognitive Skill (Cognitive Stage Associative Stage Autonomous Stage)</td>
<td>To get knowledge concerning metacognitive skills for observing self-thinking process, diagnosing it and regulating or controlling of self-activity, to practice them, and then to refine them</td>
<td>[8], [12], [24], [26]</td>
</tr>
<tr>
<td>Development of Skill for Self-expression (Cognitive Stage Associative Stage Autonomous Stage)</td>
<td>To get knowledge concerning the skills for externalizing self-thinking process and presenting the learner's self-perspectives, to practice them, and then to refine them.</td>
<td>[4], [27]</td>
</tr>
</tbody>
</table>
Table 2. Y<=I goals

<table>
<thead>
<tr>
<th>Y&lt;=I goal</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning by Observation</td>
<td>Learning indirectly by observing other learner's learning processes</td>
<td>[1]</td>
</tr>
<tr>
<td>Learning by Self-Expression</td>
<td>Learning by externalizing self-thinking process, such as self-explanation and presentation</td>
<td>[4], [27]</td>
</tr>
<tr>
<td>Learning by Teaching</td>
<td>Learning by teaching something he/she already knows to other learners</td>
<td>[4], [15]</td>
</tr>
<tr>
<td>Learning by being Taught</td>
<td>Learning directly by being taught by other learners</td>
<td>[15]</td>
</tr>
<tr>
<td>Learning by Apprenticeship</td>
<td>Learning by observing other learners' behavior and then imitating it</td>
<td>[5]</td>
</tr>
<tr>
<td>Learning by Doing</td>
<td>Learning by applying knowledge or skills to a specific problem</td>
<td>[19], [20]</td>
</tr>
<tr>
<td>Learning by Diagnosing</td>
<td>Learning by diagnosing other learners' processes</td>
<td>[7], [16]</td>
</tr>
<tr>
<td>Learning by Reflecting</td>
<td>Learning by rethinking and observing the learner's self thinking process</td>
<td>[27], [28]</td>
</tr>
<tr>
<td>Learning by Discussion</td>
<td>Learning by discussion with other learners</td>
<td>[9], [24], [25]</td>
</tr>
</tbody>
</table>

Table 3. W-goal

<table>
<thead>
<tr>
<th>W-goal</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>Peer Tutoring (PT)</td>
<td>Setting up the situation where a learner teaches something to another learner</td>
</tr>
<tr>
<td>Anchored Instruction (AI)</td>
<td>Setting up the situation where a learner diagnoses another learner's problem and then solve it (Problem-based Learning)</td>
<td>[7]</td>
</tr>
<tr>
<td>Cognitive Apprenticeship (CA)</td>
<td>Setting up the situation to learn knowledge or skill as an apprentice</td>
<td>[5]</td>
</tr>
<tr>
<td>Sharing (meta-)cognitive skill between learners (SC)</td>
<td>Setting up the situation to share cognitive or meta-cognitive function between learners based on Sociocultural Theory</td>
<td>[30], [31]</td>
</tr>
<tr>
<td>Sharing Multiple Perspectives (CE)</td>
<td>Setting up the situation to evoke a learner's reflective thinking based on Cognitive Flexibility Theory</td>
<td>[14], [27], [28]</td>
</tr>
<tr>
<td>Setting up Distributed Cognition (DC)</td>
<td>Setting up the situation where full participants, whom knowledge bases are different each other, discuss problems</td>
<td>[24], [25]</td>
</tr>
<tr>
<td>Setting up Cognitive Constructivism (CC)</td>
<td>Setting up the situation where full participants discuss problems</td>
<td>[23]</td>
</tr>
<tr>
<td>Composite</td>
<td>Setting up Community for Legitimate Peripheral Participation (CPP)</td>
<td>Setting up the community of practice for peripheral participant</td>
</tr>
<tr>
<td>Setting up Observational Learning environment (OL)</td>
<td>Setting up the situation to share other learner's learning processes</td>
<td>[19], [20]</td>
</tr>
</tbody>
</table>

Table 4. Learner's Role and Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Definition</th>
<th>Role in W-goal</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing</td>
<td>Observe other learner's processes</td>
<td>Observer OL</td>
<td>[1]</td>
</tr>
<tr>
<td>Tutoring</td>
<td>Explain other learners about his/her knowledge</td>
<td>Peer Tutor PT</td>
<td>[6], [11]</td>
</tr>
<tr>
<td>Presenting</td>
<td>Explain other learner's processes on problem solving, cognitive, and self-thinking</td>
<td>Problem Holder AI Panelist CE Client SC</td>
<td>[7], [27], [30], [31]</td>
</tr>
<tr>
<td>Advising</td>
<td>Advise other learner's processes on problem solving, cognitive, and self-thinking</td>
<td>Anchored Instructor AI Diagnoser SC</td>
<td>[7], [30], [31]</td>
</tr>
<tr>
<td>Reviewing</td>
<td>Compare among learner's processes</td>
<td>Audience CE</td>
<td>[27], [28]</td>
</tr>
<tr>
<td>Imitating</td>
<td>Observe and imitate behavior of other learners that have much more knowledge and skill</td>
<td>Apprentice CA</td>
<td>[5]</td>
</tr>
<tr>
<td>Guiding</td>
<td>Guide and explain the processes for applying knowledge or skill to other learners</td>
<td>Master CA</td>
<td>[5]</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>Solve problem with other learners</td>
<td>Peripheral Participant LPP Full Participant CC CD</td>
<td>[19], [20], [22], [25]</td>
</tr>
</tbody>
</table>
apprentice. Table 3 shows the W-goals. Each W-goal can be expressed by a set of I-goals and Y<=I-goals. Table 4 shows the activity and role for each participants in W-goal.

The information in details on each goal and functionality can be found in [18,29]. With these goals, the instructors, who initiate a learning process for learners, can identify learner's personnel goal, both I-goals and Y<=I goals and can design various kinds of environments for grouping appropriate learners under W-goal. It will helps instructors can predicate educational benefits gained through the learning goal.

3. LearningNuke

LearningNuke is an open source e-learning system which is provided by the collaboration between EGAT(Electricity Generating Authority of Thailand)and NECTEC(National Electronics and Computer Technology Center). The main purpose is to support the ITEd project [17], a project on the Capacity Building on the Development of Information Technology for Education, under the support by Japanese government and JICA.

3.1 LearningNuke Architecture

LearningNuke composed of three main components; Learning Management System (LMS), Learning Content Management System (LCMS) and Learning-supported Tools as shown in figure 2. Features on each component can be explains as follows

3.1.1 Learning Management System

Learning Management System is a component that mainly administrate learners in the system. It is composed of the five modules; Student Management Module, Course Management Module, Student Skill Assessment, Activity Monitoring and Tracking and Education History Report.

LearningNuke System

![LearningNuke System Diagram]

**Figure 2. An architecture on LearningNuke system**
Assessment Module, Student Activity Monitoring and Tracking Module, and Activity Reporting Module.

3.1.2 Learning Content Management System

Learning Content Management System is a component that mainly helps instructors to apply content to the system. It is composed of the two modules: Authoring Tools Module and Content Exchange Supporting Tools Module.

3.1.3 Learning-supported Tools

Learning-supported Tools is a component that mainly support learners to assist two-ways communication. It is composed of the seven modules: Virtual Classroom, Chat Room, Web board, E-mail System, Education History Report, Notepad, and Schedule Manager.

LearningNuke is available as a trial version at http://ited.nectec.or.th. Figure 3 shows examples on Student Page, Course management Page, Virtual Classroom, and Member's role setting Page. The system supports SCORM standard and is possible to view a course content in Web-based, MS Office, and PDF format. It can show in text, speech, graphic, and animation.

3.2 Member Types in LearningNuke

Member in LearningNuke can be classified into four types. User is a member who has the lowest priority in the system. The member who joins the system as a student is usually assigned in this type. Helper is a member who helps instructors to motivate and give advises to students. Instructor is a member who joins a system as a teacher, instructor can construct the course outline,

Figure 3. Examples on pages in LearningNuke
manage a flow of course content and evaluate their courses, guideline, teaching method
students' result. Administrator is a member through the content in the system. Students
who manage modules in the system, assign can access to the system and learn the contents
role of members in the system and essential by themselves. Traditional e-learning system
component for learning environments. This member type has a highest priority in the
system.

4. Apply learning goal to LearningNuke

LearningNuke provides components to help constructing the course content, anywhere
anytime accessible tools for students and collaborative tools for communication among
all members in the system. Furthermore, LearningNuke provides four member types. With these fulfill environments, it is possible to apply various kinds of W-goals to set the
appropriate learning environments.

4.1 Apply LearningNuke as individual perspectives

Normally, we apply e-learning system as a system that provide a course content from
instructors to students. Instructors can design

4.2 Apply LearningNuke as social perspectives

It is possible to apply member types to construct other learning environments. If we
assume that A teacher act as an administrator, he/she can define student's role in e-learning
system and monitor the results from the system. It is possible to construct W-goal as shown in Table3.

Figure 4. An Example on Apply LearningNuke based on W-goal
Figure 4. shows an example on applying LearningNuke based on W-goal. There are three W-goals are combined in the figure; Peer Tutoring, Sharing (meta-)Cognitive skill between learners and Observational Learning. Peer tutoring is taken place at virtual classroom. A Tutor (Instructor in the system) will construct a course content by using Authoring tools and/or use Content exchange tools to transfer contents from others LMS systems that are constructed under the SCORM standard. Tutor will attain the teaching skill, self-expression skill and the acquisition of knowledge in tuning and restructuring stage. Tutees (User type in the system) will read and understand the content. They will get the acquisition on knowledge. Sharing (meta-)Cognitive skill between learners is a situation that a client (Helper type in the system) has an interaction with tutees. In this activities, he will attain diagnosing skill from giving a score to tutees. Diagnoser, who is the same person as Tutor(Instructor type in the system), will diagnose clients' activity and advise him/her. Diagnoser will attain his autonomous stage in skill acquisition. Observational Learning environment is taken place at others learning tools, such as web board, chat. Observer (Users who do not join this course in the system) can observe the interaction between tutor and tutees, between tutees and client, or among tutees. Observer will attain the acquisition of knowledge in accretion stage from observing activities. In some cases, observe can also understand the content from virtual classroom.

5. Conclusion and Future Work

We explained the three kinds of learning goals, which is derived from variuous learning theories and apply them to our e-learning system, LearningNuke, which is an open source e-learning system. It is possible to construct a more complex learning environments in order to achieve not only knowledge acquisition aspects, but also skill acquisition aspects. In order to accomplished this, one important topics is how to construct the appropriate content, how to design a flow to induce learners to get both I-goal and Y<=I goal. We are considering the methods to construct a good authoring tools to reach our goal as a future work.

Acknowledgement

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References


