

Boosting Student Participation in English Lessons Through Mathematical Story Problems

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Observations of an English-Speaking Parent to First High School *Sankanbi* English Class

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- A lot of reading and vocabulary explained by the teacher in Japanese.
- 90% of class time is teacher talking.
- Students sitting in rows, silent, uninvolved looking at textbooks: BORING!

It was worse when I saw my son's homework.

- The school issued a statement about its plans.
- I must admit I don't like much contemporary music.
- They had an adequate amount of money for the trip.
- Wind power is a potential source of energy.
- Some didn't follow the formal decision of the party.

American native English speakers of the same age would have trouble with these words.

But the core problem is this: Students NEVER use these words in conversation.

SOME RESULTS OF A 2017 SURVEY OF TOKUYAMA KOSEN STUDENTS

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1. Students perceive English is important to learn.
2. They do not perceive English will be useful in their life after school.
3. “English is important” is a general idea they receive, but it is disengaged from their daily experience.

SURVEY STATEMENTS

S4: My friends and peers see English as important to our future.

S10: Learning another language helps me to be a better person.

S5: People outside of school (parents, friends, members of my community, etc.) do a good job of helping me understand how English is relevant to my life after graduation.

S6: I will use English in my future career.

SURVEY DATA

	S1	S4	S5	S6
Average	3.89	4.21	3.44	3.57
Standard Error	0.07	0.06	0.07	0.06
Median	4	4	3	4
Mode	4	4	3	3
Standard Deviation	1.48	1.27	1.49	1.40

	S7	S9	S10
Average	3.70	3.63	4.47
Standard Error	0.07	0.06	0.06
Median	4	4	5
Mode	4	4	5
Standard Deviation	1.51	1.43	1.29

WHY CLIL?

Current methods of teaching English did not satisfy students' learning goals:

“I want the teachers to provide more explanation of key points in Japanese as well as English.”

CLIL CLASSES...

- increase time students are exposed to English
- provide additional learning opportunities
- create a greater sense of engagement
- give more authenticity of purpose

The Real of CLIL

- In these lessons, the English arises out of a real necessity to communicate the concepts being studied.
- This is not English immersion, or learning in English: Activities are designed to make students talk together in English in order to accomplish real goals, not necessarily to learn mathematics.
- The end goal is to communicate concepts that are not exclusively about mathematics, but about general situations the students might encounter in real life.

Why Math?

- Students are comfortable with this simple Math, increasing their confidence.
- Familiarity with Math helps the English story problems seem less intimidating.
- Solving problems in English provides chances for students to feel the foreign language is useful.

Key Principles

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Simple math.

Few new words.

Communication focus.

Adaptable to other situations.

When the math is simple, the language is flexible.

“added to, sum of, more than, in addition to, plus, and”

“minus, less than, subtracted from, taken away”

“per, divided by, into”

“times, by, per”

“equals, is”

Teacher should focus
on 2 or 3 per lesson.

Sample Story Problems

In September, the school added 5 students to Class A. Now the sum of Class A's students and Class B's students equals 50. In August, Class A had 20 students. How many students does Class A have now? How many students does Class B have?

Hiroki's age is 2 years less than Nao's age, and Nao's age is 4 years more than Erika's age. Nao is 16 years-old. How old are Hiroki and Erika?

Lesson Overview

The following lesson is targeted at 1st year high school students at a technical school. Class time is 40 minutes.

Teacher has chosen a target language and number of readings. In this case, the largest language will be “more than” and “less than.” Students will make predictions about their classmates.

At the start of the lesson, the teacher asks a question which ties directly into the target language. In this example, the teachers asks: “How many students like cats?”

Students talk together in pairs, and then encouraged to give an answer in English. No correction given.

Today, we are going to work on two types of mathematics operations: addition (+) and subtraction (-).

	Key word = Operation	Equation
The <u>sum</u> of John's age and 15 equals 29.	sum = addition	$x + 15 = 29$
Six <u>less than</u> John's age is 8.		
23 <u>more than</u> John's age equals 37.		
John's age <u>minus</u> 10 is 4.		
Two <u>taken away</u> from John's age is 12.		
John's age <u>added to</u> 10 equals 24.		

Methods

- 1) Teacher reads introduction and confirms comprehension.
- 2) Students work in pairs to complete the chart.
- 3) After students have completed the chart, they work in groups to check their answers.

NOTES

No Japanese allowed.

Students can use dictionaries or cellphones to look up vocabulary.

To check answers, students read aloud the equations written.

$$x + 15 = 29$$

$$x - 6 = 8$$

$$x + 23 = 37$$

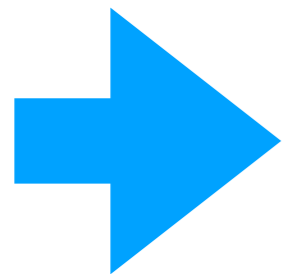
etc...

Teacher writes them on the board. Teacher makes mistakes, encouraging students to use different expressions.

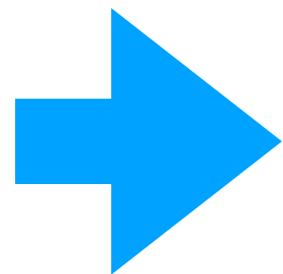
To ensure group participation, teacher could have each group member read one word aloud at a time.

Next, students read a passage(s) that matches the vocabulary and concepts to be covered in class.

Hiroki's age is 2 years less than Nao's age, and Nao's age is 4 years more than Erika's age. Nao is 16 years-old. How old are Hiroki and Erika?



Students work first in pairs, then as a group, to produce both the answers and the equations. The teacher chooses how many readings to cover, based on student ability.



For this lesson, the teacher has chosen the target language “**more than**” and “**less than**”.

Teacher writes on the board:

Less than It is less than $x < 15$ It is less than 15
More than It is more than $x > 15$ It is more than 15

Teacher asks: “How many students in this class like cats? Is it more than or less than 15? Ask everyone in your group: Do you like cats?”

After students have finished, teacher asks: “How many students like cats? Is it less than or more than 15? What do you think?”

Teacher writes on the board, while students listen and repeat:

Students who like *natto* = 25

Students who don't ride a bicycle to school = 5

Students who study English every day = 2

Students who don't have a sister = 15

Students who eat breakfast every morning = 20

After confirming comprehension, teacher assigns each group a sentence.

1. Teacher asks: "Do you think it is more or less than #?"
2. Teacher writes prediction on the board next to the sentence.
3. Students then ask all classmates and count the results.
4. Groups present their results based on the following model: "More than/
Less than # students _____."

Finally, groups produce two sentences about classmates. For example:

“More than 10 students watch TV at night.”

“Less than 5 students don't take a bath at night.”

These sentences are read aloud, giving the teacher a chance to provide quick correction if necessary, and their predictions checked by a show of hands.

In Conclusion



- Math word problems provide students chances to read, listen to, speak, and engage with others in English with real goals in mind.
- Adapting the target language to situations relevant to the students enables students to convey a real message.
- For technical students, word problems provide much needed practice in communicating mathematical equations in English. Students perceive a real use for the English studied.
- Because the word problems are in a non-native language, the tasks engage students on many levels of cognitive ability, challenging students yet building confidence.
- Given the already high level of math education in Japan, such lessons could easily be adapted to the jr. high school level (or possibly earlier).

Possible Adaptions

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- Students ask teacher questions about how their was at the same age.
- Groups compete to get the highest number of predications correct.
- Groups produce word problems for others to solve.
- Teacher focuses on the language of agreement/disagreement by encouraging students to use “I think so/I don’t think so” in response to predictions.
- Flip the classroom: have students complete math word problems on Khan Academy before attending class, so they can teach these problems to the teacher.

Khan Academy

- Online education site.
- It is free to join and use.
- High quality materials and instruction.
- Points and badges encourage continued use.
- www.khanacademy.com



40 / 92 completed



Algebraic expressions

12 / 27 completed

[Resume](#)



Linear equations and inequ...

16 / 45 completed



Graphing lines and slope

15 / 43 completed



Systems of equations

8 / 30 completed

Chemistry

[See all \(16\)](#)



Atoms, compounds, and ions

1 / 23 completed

[Start](#)



Chemical reactions and stoi...

1 / 37 completed



Electronic structure of atoms

2 / 33 completed



Periodic table

4 / 16 completed



3 / 42 completed



Coordinate plane

5 / 32 completed



Area and perimeter

8 / 57 completed

[Resume](#)



Volume and surface area



Pythagorean theorem

2 / 24 completed

Cosmology and astronomy

[See all \(4\)](#)



Scale of the universe

1 / 21 completed

[Resume](#)



Stars, black holes and galaxies



Earth geological and climatic history



Life on earth and in the universe

“How Do You Evaluate Students?”

- **2 statements:** Education is the single most powerful force for positive change in society. Education (in a foreign language) is not just a tool for getting a certificate or employment: it transforms people’s worldviews and assumptions.
- **2 questions:** Does student evaluation improve the quality of education? Does student evaluation encourage students to become learners, or does it encourage students to perform without question within existing structures of society?

In 17 years of working at Nova *eikaiwa*, I never heard students claim they learned more English, or more effectively, at a high school or university. And our teachers were overwhelmingly not trained teachers. This should be cause for questioning the efficacy of evaluation, and for concern.

Ultimately, if unavoidable, students should be evaluated in terms of their contribution to class, not their mastery of the mathematics. The math is below their actual ability, though the English should be a challenge. Suggested targets for evaluation could include...

- ability to understand story problems and write corresponding equations.
- ability to write story problems based on equations.
- ability to communicate equations in English.
- ability to ask for or provide clarification.
- written assignments: story problems, translations of equations into written English, etc.