



Students' Ideas Anticipation through Flow of Lesson in Collaborative Lessons Planning for Classroom Using Lesson Study and Open Approach

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Abstract

This study analyzed students' ideas anticipation through a flow of lesson in collaborative planning of a lesson team for a math class using a Lesson Study and Open Approach. The teacher of the classroom used the Open Approach as a teaching approach and the lesson study as an improvement of the teaching approach's qualities. Research methodology relied on a qualitative research by employing a participatory observation in which a researcher was a member of the lesson study team, composed of five members, who collaboratively worked on the steps of the lesson study approach. Thai version of Japanese textbook was used as a principle tool for collaborative planning the lessons. The textbook emphasis on problem situations that connects the students' daily life, as a result, the students could make sense of the problem situations. Research results found that the teacher team solved problem situations inside the textbook, then anticipated the students' ideas through each component of the flow of lesson as follows: (1) considering representations of students' real world to anticipate the students' difficulties, (2) considering semi-concrete aids to anticipate the students' ways of problem solving and (3) considering representations of students' mathematical world to anticipate the students' ideas. The students' ideas focused on mathematics and emphasis on problem solving, the lesson study team, as a result, used the students' ideas to collaboratively design other components of lesson plans for the classroom using Lesson Study and Open Approach.

Introduction

A concept of a new teaching practice relies on a new didactic triangle that changes a definition of learning entirely from a traditional didactic triangle in which components are teacher, student, and content. These components are reflected through a traditional teaching practice; the teacher passes on the contents to the students,

and the students just memorize such knowledge. While the components of the new didactic triangle are teaching process, learning process, and thinking process. These components are related to the students' ideas used for accessing the students' learning or thinking processes (Inprasitha, 2017a; 2017b; 2018).

In Thai context, Inprasitha has proposed two

innovations; Lesson Study and Open Approach (Inprasitha et al. 2003) for changing a paradigm teaching practices of teachers and improving the teaching practices consecutively. The Open Approach emphasizes on individual differences, especially differences in each students' thinking, and is composed of 4 phases: (1) Posing Open-ended Problem, (2) Students' Self-learning, (3) Whole Class Discussion and Comparison and (4) Summarizing through Connecting Students' Mathematical Ideas Emerged in Classroom. The Lesson Study, besides, emphasizes on improving collaborative working of teachers for improving and developing the Open Approach directly, composed of 3 steps: (1) Collaboratively Design Research Lesson (Plan), (2) Collaboratively Observe Research Lesson (Do) and (3) Collaboratively Reflect on Teaching Practice (See) (Inprasitha, 2011; 2015a; 2015b). These two innovations are incorporated in weekly cycles as illustrated in Figure 1.

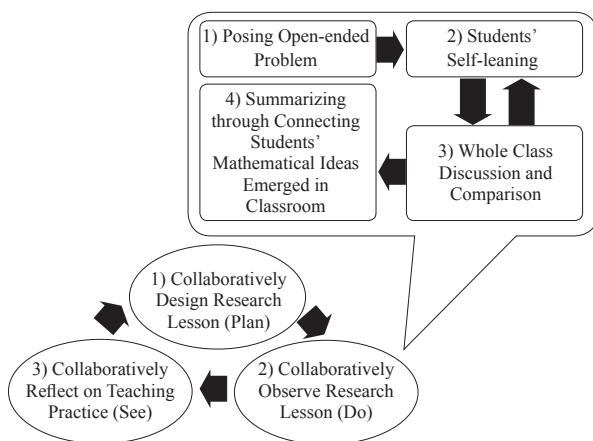


Figure 1 Open Approach Incorporated in Lesson Study (Inprasitha, 2010; 2011)

In the processes of the lesson study, the lesson study team will start with the Collaboratively Design Research Lesson (Plan) (Inprasitha, 2010; 2011). An important point of lesson planning is making notes of what has been designed and will encourage teachers to use their deep and profound thinking (Smith & Stein, 1998). In addition, when the teachers try to anticipate the classroom image, there will be a learning of the teachers through solving problems they have designed. In consequence, the teachers develop abilities to look for patterns, inspect conditions and hypotheses, determine information, and other processes of problem solving (Stein, Grover & Henningsen, 1996).

In this study a classroom using the Lesson Study and Open Approach focused on mathematics where teachers used the Open Approach as a teaching approach and used the Lesson Study as a way to improve the teaching approach (Inprasitha, 2015a). Moreover, the study was conducted in a real classroom context, implementing a Lesson Study which identified changes for students' learning improvement as well as interchange knowledge and problems with other teachers (Loipha & Inprasitha, 2004). The students, in addition, learned from sharing ideas together in which their own views were derived from problem solving activities. In consequence of a principle of this classroom is accessing the students' ideas from the problem solving. Also, a lesson study team, which was composed of teachers who collaboratively plan, do, and see that encapsulate the steps of the Lesson Study, allowing increase access and learning from the students' ideas in various ways (Inprasitha & Isoda 2011; Inprasitha 2015a). This method of deriving subject matter from students ideas is different from a traditional classroom where the subject matters is pre-determined.

A new teaching method for mathematics has been increasingly called, for as an example a connection between out-of-school mathematics and school mathematics, adaptation of school mathematics in daily life of students, and also adaptation of out-of-school mathematics to make sense about school mathematics (Abreu, 1995; National Council of Teachers of Mathematics [NCTM], 2000; Inprasitha, 2017b). This topic has been mentioned in the 13th International Congress in Mathematical Education (ICME-13) (Gueudet, diSessa & Verschaffel, 2016). As a result, extreme interest of mathematics educators are focused on the connection of out-of-school mathematics and school mathematics as a method to enhance students' ideas in mathematical problem solving.

Even though, there are continual requests about the connection of out-of and in school mathematics, there is nothing obviously in practices for a mathematics' classroom. Therefore, a "Flow of Lesson" has been coined by Inprasitha (2017b), in order to connect students' real world and mathematical world, composed of three components: (1) Representations of real world (2) Semi-concrete aids (3) Representations of mathematical world. As a result, the students' ideas are accessible, and teachers use this tool for working together through the steps of the Lesson Study and Open Approach.

Furthermore, in the mathematics classroom

emphasis on the students' ideas as a crucial part of the classroom contain steps for searching the subject matter of the mathematics classroom; (1) find the students' difficulties, (2) collect the students' way of solving those difficulties, and (3) group the ways of problem solving to be the students' ideas. These steps will lead to the subject matter of the mathematics classroom that emphasize on the students' ideas, as illustrated in Figure 2.

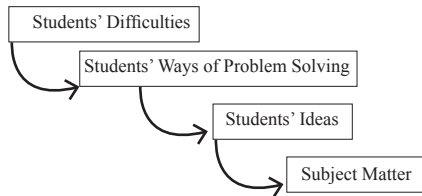


Figure 2 Subject Matters in Mathematics (Inprasitha, 2017a)

In addition, Inprasitha (2017a; 2017b) has noted that the students' ideas anticipation is an important part of the collaborative lesson planning for the classroom using the Lesson Study and Open Approach. Most teachers have questioned how to anticipate the students' ideas or what are a basics for the students' ideas anticipation. These questions have caused trouble in a practical way for the classroom lesson planning.

Objective

This research analyzed how a lesson study team, who collaboratively works in a weekly cycle following the steps of the lesson study approach, anticipate students' ideas by using the flow of lesson in a process of collaborative lesson planning.

Research methodology

Research methodology relied on a qualitative research by employing a participatory observation in which a researcher was a member of a second-grade lesson study team in Lampang province. This school has been participating in the Project of Students' Mathematical Higher Thinking Development in Northeastern of Thailand, Khon Kaen University, and has been using the Lesson Study and the Open Approach since 2009 academic year. The lesson study team was composed of five members,

1) two in-service teachers who worked with the pre-service to use the Lesson Study and Open Approach since 2009 academic year,

2) two pre-service teachers who were fifth-year students in Mathematics Education program, Faculty of Education, Khon Kaen University and worked with in-service teachers in school for a year, and

3) the researcher, who was a researcher assistance for the Center for Research in Mathematics Education, Khon Kaen University from 2009-2015 academic year.

The lesson study team collaboratively planned the lessons, taught and observed the lessons, and reflected about the lessons following the steps of the Lesson Study in weekly cycles. A Thai version of a Japanese textbook was used as a main tool for collaborative planning the lessons (Gakko Toshō, 2005). The textbook emphasized on problem situations in which connecting the students' real world in daily life for supporting students developing meaning from the problem situations and to try to solve the problems by themselves (Inprasitha & Isoda, 2010; 2011). The lesson study team, therefore, designed the problem situations based on the textbook as a guide to connect the students' real world and the mathematical world.

1. Data Collection

Processes of data collection started from 2016 academic year in which the researcher was at the research site to collaboratively observe the students' mathematical learning in the classroom with the in-service teachers and to collaboratively reflect about the students' ideas that emerged in the mathematics classroom. The data gathered in 2017 academic year and collected from the lesson study team while the ongoing processes of the collaborative lessons planning was obtained from the following research materials.

1.1 Thai version of Japanese textbook in Grade 2 of Length (1) learning unit (Inprasitha & Isoda, 2010; 2011)

1.2 Lesson plans of the Length (1) learning unit from 2016 academic year for a basic information of the lesson study team used for planning the lessons from 2017 academic year, has added a topic of the flow of lesson into the structure of the lesson plan (Inprasitha, 2017c),

1.3 Glossary of Mathematics Textbook Grade 2, Volume 1 (Inprasitha & Isoda, 2014)

1.4 Teaching Guidebook of Mathematics Textbook Grade 2, Volume 1 (Inprasitha & Isoda, 2014)

1.5 Audio, Video, and Photograph Recording.

Audio, video and photograph recording were done along 9 consecutive lesson plans in which previous lessons were established and a new 'how to' or 'tool for

learning' for the next lessons.

2. Data Analysis

The collected data led to analyzed data; (1) Lesson plans of the Length (1) learning unit, and (2) protocol of the collaborative lessons planning derived from video-audio tapes, and (3) photos of the lesson study team while they were collaborative planning the lessons. The first period of the learning unit "Length (1)" was adapted to indicate how the lesson study team anticipate the students' ideas through components of the flow of lesson by using these two conceptual frameworks, as follows:

2.1 Flow of lesson is the steps of the mathematics lesson that starts from the students' real world and connected to the students' mathematical world (Inprasitha, 2017b). It is composed of three components as follows:

1) Representation of real world is a performance of using figure or other materials for communicating the students' real world experience related to the problem situations,

2) Semi-concrete aid is a performance of using relevant objects or concepts related to the students' ideas emerged from the students' understanding of the problem situations and solving those problems,

3) Representation of mathematical world is a performance of using numbers and symbols for communicating mathematics meaningfully related to the students' ideas.

2.2 Subject Matters in Mathematics Classroom is the steps of accessing the students' ideas that are the subject matter of the mathematics classroom emphasizing on problem solving (Inprasitha, 2017a). It is composed of three steps as follows.

1) Students' difficulty is an authentic students' problem or the real obstacle that the students need to overcome by themselves,

2) Students' way of problem solving is a process used to overcome the students' difficulties,

3) Students' idea is a category of those students' processes of overcoming the students' difficulties.

There was an analytic description used in accord to those conceptual frameworks to interpret the analyzed data, as the following research results will detail.

Results

The lesson study team first solved a problem situation inside the learning unit of the Thai version of

Japanese mathematic textbook, as shown in figure 3, by themselves. The lesson study team, after that, were considering classroom flows and decided to form into two flows after the team recognized two problems that the students have to encounter when the students would be shown this problem situation. Then, the team collaboratively anticipated the students' ideas through each component of the flow of lesson, as the following details shows:



Figure 3 Mathematics Textbook (First Period of Length (1) Learning Unit) (Inprasitha & Isoda, 2011)

1. Students' anticipation through the flow of lesson in the first flow of classroom

1.1 Considering representations of students' real world for anticipation of students' difficulties

After the team had solved the problem based on the problem situation in the textbook, the team considered the students' difficulties by using a representation of students' real world to support what the thought the students' difficulties could involve. In this phase, the representation of students' real world is to mold a plasticine snake and to make it as long as possible in order to compare with peers. The students' experiences are snake's characters that they know; long and tapering to a head, as well as knowing how to mold the plasticine. Therefore, the team considered the students' difficulties to be how to mold the plasticine as long as possible to be their own snake and use the snake made from molded plasticine to compare with others, as a following protocol.

Team #4:	So, selecting couple of snakes to compare, and they have to be similar in length because it will be hard to look by the students' eyes
Team #2:	And we have to limit the time also.
Team #3:	If we do not limit the time, the snake made from molded plasticine will be longer. <i>The students in this classroom love to play with snakes made from molded plasticine.</i>

1.2 Considering semi-concrete aids for anticipation of students' ways of problem solving

The team considered the students' ways of problem solving by using a semi-concrete aid to support what they think about the students' ways of problem solving. In this phase, the semi-concrete aid in which connecting the students' real world and mathematical world is laying the snake made from molded plasticine to compare with peers in order to figure out which one is longer. Therefore, the team considered the way of solving the students' difficulty is how to compare the snake made from molded plasticine with others, as a following protocol.

Team #5:	<i>Pencils, pens</i> are additional materials, right?
Team #3:	<i>Straws, pencils.</i>
Team #1:	These will be used as main materials, but we will treat as the additional materials <i>and functioned as a semi-concrete aid.</i>
Team #3:	<i>If we use the pencils, there are both short and long, we will use the pens and straws instead because the pencils are different in length.</i>

1.3 Considering representations of mathematical world for anticipation of students' ideas

The team considered the students' ideas by using a representation of mathematical world to support what they think the students' ideas could be. In this phase, the representation of mathematical world is a direct comparison (Inprasitha & Isoda, 2014) the snake made from molded plasticine. Therefore, the team considered the students' idea to be the direct comparison, as a following protocol.

Team #1:	Next, <i>representation of mathematical world, unit or sense making of unit</i>
Team #3:	This is a mathematical unit, or not?
Team #1:	This is still not the mathematical unit. <i>There are tiles, pencils, straws as a basic unit of length measurement, using number to represent the length of using basic unit. We could separate them. First sentence compare length by using the basic unit. Second sentence, represent the length by using number of those basic unit.</i>

2. Students' anticipation through the flow of lesson in the second flow of classroom

2.1 Considering representations of students' real world for anticipation of students' difficulties

The team considered the students' difficulties by using a representation of students' real world to support what they think the students' difficulties could be. The representation of students' real world in this phase is the students do not have an idea of how to identify the difference in length. Therefore, the team considered the students' difficulties to be identifying the difference between the snake made from molded plasticizes, as a following protocol.

Team #4:	At last, we will select only the student who has the longer snake made from molded plasticine from each pair, to compare the length.
Team #3:	<i>So, the students have to find a unit to measure their snake to compare.</i>
Team #2:	<i>The problem will be the difference such as the snake is about seven and a little bit, then what materials do the students choose as a measure tool?</i>

2.2 Considering semi-concrete aids for anticipation of students' ways of problem solving

The team considered the students' ways of problem solving by using a semi-concrete aid to support what they think about the students' ways of problem solving. In this phase, the semi-concrete aids in which connecting the students' real world and mathematical world are materials such as plate, pencil, straw, paper, and tile. Therefore, the team considered the way of solving the students' difficulty is using those materials as an arbitrary unit to quantify the difference of the snake made from molded plasticine, as a following protocol.

Team #1:	During this period we would like to find how to compare the snake's length, i.e., direct comparison and indirect comparison.
Team #4:	<i>Indirect comparison is using pens to compare, right?</i>
Team #3:	<i>Maybe pens, and straws located in the classroom.</i>
Team #1:	We will make sense of unit and lastly the students have to identify numbers of a basic unit that are used to make comparisons, like the snake made from molded plasticine is about ten tiles or seven pens

2.3 Considering representations of mathematical world for anticipation of students' ideas

The team considered the students' ideas by using a representation of mathematical world to support what they think about the students' ideas. In this phase, the representation of mathematical world is numbers of the arbitrary unit used to identify the differences of the length of snakes made from molded plasticine. Therefore, the team considered the students' idea to be the numbers

of arbitrary unit as a unit to compare length, as a following protocol.

Team #5:	It is based on approximates, for example, <i>seven pens and a little bit.</i>
Team #1:	<i>If one student answers that four pens and another student answers that four pens and a little bit. We have to see which one is longer. The first one is approximated and another one is close to that one, so mark the difference.</i>
Team #2:	<i>If the snake of this student like this and mark it, then see another one and mark again.</i>

The lesson study team had anticipated the students' ideas by using each components of the flow of lesson, as shown in table 1. Furthermore, the students' ideas have been considered as a subject matter of the classroom using the Lesson Study and Open Approach (Inprasitha, 2017a; 2017b), or the classroom in which provides the opportunities for the students to solve the problems by themselves. The lesson study team, as a result, used the anticipated ideas for planning other components of the lesson plan, such as objectives and main ideas of the lesson, problem situation, and materials that would be used for the lesson. In other words, this classroom uses the students' ideas to proceed with lessons (Inprasitha, 2017a; 2017b; 2017c).

Table 1 Relationship between Students' Ideas Anticipation and Flow of Lesson

Steps of students' Ideas Anticipation	Components of the flow of lesson		
	Representation of students' real world	Semi-concrete Aids	Representation of Mathematical world
Considering students' difficulties	✓	✓	✓
Considering students' ways of problem solving	✓	✓	✓
Considering students' ideas	✓	✓	✓



Figure 4 The lesson study team had proposed the student' ideas through each components of the flow of lesson

Discussion

The results correspond with Fang & Lee (2015) who stated that the most difficult part of adaptation in the Lesson Study is the anticipation of the students' responses or the students' ideas that occur when the students encounter a problem situation. Therefore, the lesson study team should utilize each component of the flow of lesson to access the students' difficulties, ways of solving a problem, and ideas, respectively.

In addition, in a process of lesson planning the teachers anticipate students' responses to problem situations through components in the flow of lesson to clarify what they need to ensure student's learning. This research result is in line with Schoenfeld (2010) who explained that "lesson image" is teachers' anticipation about students' interpretation of tasks or activities and what will be connected to those interpretations and methods, strategies, and concepts that the teachers need for the students' learning. In other words, teachers create the challenge for their students and then anticipate the various responses of the students to those tasks or activities.

Moreover, the problem situation is designed close to the students' real world or the students' experiences, is very crucial part of the classroom in order to be comfortable to anticipate the students' ideas and involve the students to the problem situation as much as possible. This is in accord to Nunes, Schliemann & Carraher (1993) noting that in early stages of mathematics learning, should start from things that are familiar with the students' experiences. This will lead to the meaningful learning for each student in the mathematics classroom.

Finally, the lesson study team are a key success to the process of anticipation of students in the process of lesson planning corresponding to Murata (2011) who described that knowledge of a team working in the lesson study as formed by collaborative questioning and sharing about the students' responses and to distribute what they have observed from the classroom. When the teacher could practice these processes continuously, the teachers will have plenty of chance in discussing about the students' learning.

Concluding Remarks

Research results found that the team anticipated the students' ideas through each component of the flow of lesson as follows:

1. considering representations of the students' real world to anticipate the students' difficulties,

2. considering semi-concrete aids to anticipate the students' ways of problem solving, and
 3. considering representations of the students' mathematical world to anticipate the students' ideas, as illustrated in Figure 5.

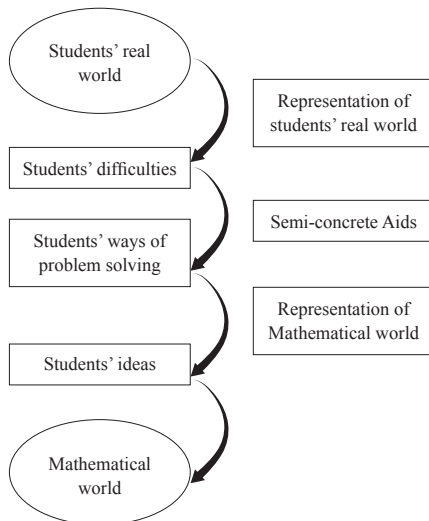


Figure 5 Students' Ideas Anticipation through Flow of Lesson in Collaborative Lessons Planning

Suggestions

In the mathematic classroom where the emphasis is on the students' ideas, the teachers could use the flow of lesson as a tool for accessing the students' ideas in the process of collaboratively planning the lessons, in order to derive the students' ideas from the students' difficulties and ways of problem solving, respectively. For the next study, the problem situation connecting the students' real world with the mathematical world would be interesting, especially the use of flow of lesson to establish the problem situations in the collaborative planning of mathematics lessons.

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