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## Developing students' writing skills in mathematical problem-solving classroom using lesson study and open approach

 Phattaraphong Kunseeda<sup>1, \*</sup>, Maitree Inprasitha<sup>2</sup>, Narumon Changsri<sup>2</sup>
<sup>1</sup> Mathematics Education, Khon Kaen University, Khon Kaen, Thailand.

<sup>2</sup> Centre of Excellence in Mathematics, CHE, Si Ayutthaya RD., Bangkok, Thailand.

 \*Corresponding author: Phattaraphong\_Kunseeda@hotmail.com
 

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### Abstract

The purpose of this research was to develop students' writing skills in mathematical problem solving classroom using Lesson Study and Open Approach. Target groups were 1<sup>st</sup> grade students in fourteen mathematics classrooms using Open Approach as a teaching approach. Data were collected by using questionnaire of students' learning skills. The research findings found that students' writing skills in mathematics classroom using open approach were as follows; 1) students took note follow the rule of writing in notebook. (50%), 2) students wrote a well organize of their ideas in notebook. (21.43%), 3) students presented their ideas using picture or table and found their fault in presentation or explained their ideas and others' ideas. (85.71%), 4) students wrote a summarize of the procedure, reasonable and easy to understand and found advantage and different from their friends' presentation. (57.14%), 5) students explained their reasons consistent with expectations and could be summarized their ideas based on the problems (35.71%).

**Keywords:** *Writing skills, Mathematical Problem Solving Classroom, Lesson Study and Open Approach*

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### 1. Introduction

Learning skills in 21<sup>st</sup> century consisted of creativity and innovative, critical thinking and problem solving, communication and collaboration. [1]. Levy and Murnane said that in 21<sup>st</sup> century, thinking and communication skill are new skill in life and the teacher cannot teach but students must learn by themselves.

In the context of teaching, students must acquire the skills and need to succeed in daily life so that thinking skills are a key skill for humanity in the 21<sup>st</sup> century. So that Isoda, Morita and Nobuchi said that how to learn about 3 learning skills; writing skill, speaking skill and listening and questioning skill with teacher evaluate their classroom and students evaluate their skill [2]. Because of writing is a very difficult skill for students [3] and there are very divergent assumptions about how different writing tasks might lead to learning [4]. So, the writing process has been linked to the development of students' problem solving skills [5]. Inprasitha said that in the classroom which teachers try to stimulate their students to express how to solve the problem, students represent their ideas with writing or they present by word- all of that are basic skills that can be derived from learning skills [2].

In the classroom, teaching and learning must be interdisciplinary integration, so STEM Education are Science, Technology, Engineering and Mathematics, is a one choice to teach in the class because the nature of the teaching and learning process of each branch is a perfect combination for all learners to solve the problem of mathematics and concerning the skills necessary for 21<sup>st</sup> century [6]. In problem solving classroom using an Open Approach as a teaching approach, it's essential that teachers must try to understand the students' ideas and students' mathematical development up to a higher level and allow students to explain their ideas through language, mathematical symbols [7] and consistent with the National Council of Teachers of Mathematics (NCTM) stated that communication about mathematical concepts is a way for students to make meaningful words, to clarify the system and to gather ideas such as oral, gesture, image, object and symbol [8].

In mathematics classroom using open approach, problem solving classrooms use the open approach as a teaching approach that are consists of four steps: (1) Posing open-ended problem, (2) Student self-learning, (3)

Whole class discussion and (4) Summarize through connecting students' mathematical ideas emerged in the classroom) [9]. And Inprasitha said that Open Approach is a new approach to teaching mathematics that addresses problem solving, encourage students to take open-ended activities to observe students' learning skills by integrating to Lesson Study; Collaboratively Plan, Collaboratively Do, and Collaboratively See [9]. Cheah stated that Lesson Study is an appropriate method for teachers to improve or develop classroom communication in class and considering learning management as a process of interaction between teachers and students [10].

Teaching and learning in mathematics classroom, students need to learn and use other skills when they solve the problem and they must try to express their ideas in their worksheet. So that, it's necessary to develop student's learning skills as writing skills in the context of classroom using Lesson Study and Open Approach because of this is a necessary and consistent skills in the 21<sup>st</sup> century.

## **2. Materials and methods**

### *2.1 Research Objective*

The purpose of this research was to develop students' writing skills in mathematical problem solving classroom using Lesson Study and Open Approach.

### *2.2 Research Framework*

#### *2.2.1 Learning Skills*

Phanit mentioned 21st Century Skills, it will determine the students' readiness into today's more sophisticated to work, such as creativity and innovation, Critical thinking and problem solving and communication and cooperation [1].

Learning Skills is 21<sup>st</sup> century Skills that determines a student's readiness into a more complex world of work. Nowadays, such as reading, writing, critical thinking, solving teamwork problems by Isoda Morita and Nobuchi [2] one of learning skills is writing skills are mentioned.

Writing skills, is one of learning skills that requires effort and practice, writing, expressing ideas. the level of learning of writing skills is divided as follows:

Level E is writing based on rules for writing in the book.

Level D is writing is well-ordered.

Level C is represented by a figure or table or students can find errors in the presentation or explanation.

Level B is written step-by-step and logically. And they can correct the missing part of their concepts.

Level A they can be written exactly as they planned and write as expected.

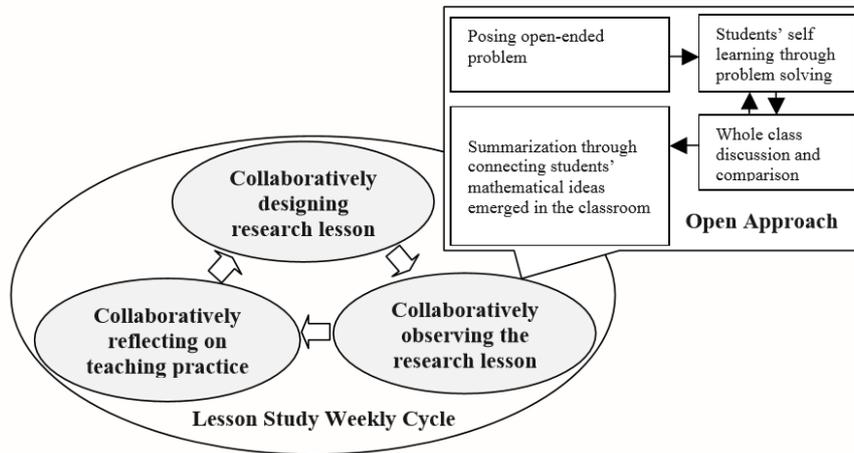
#### *2.2.2 Lesson Study and Open Approach*

The Lesson Study implementation in Thailand, has developed in teacher development. There are three processes that teachers work together with the goal of developing Thai mathematics instruction. And the Open Approach that starts with a way for a discussion about the problems faced by teachers, such as instructional activities, that depends on teaching, explanations and problems. According to Inprasitha's conceptual framework [9] [11] there are the following;

- 1) Collaboratively design a research lesson (Plan), researchers, research assistants, and teachers share their ideas and effort, choosing the tools and content to teach as an open-ended problem, and transforming the design, tools, and instructional media appropriately. Start by identifying open-ended math problems and learning activities. The problem situation is developed from mathematics textbook in teacher development project.
- 2) Collaboratively observe the research lesson (Do), is an activity for using classroom plans that are planned by the Lesson Study teams; including researchers, research assistants, and other teachers. And observe student ideas in Mathematics classroom. The main purpose of observing is to observe students' thinking processes, not to observe teachers' teaching skills. But focus on observing responses to students' open-ended problems and how students think.
- 3) Collaborative discuss and reflect on the research lesson (See), as an activity that the Lesson Study teams bring the results of classroom learning activities from classroom observation to a common discussion of classroom learning activities to improve learning management plans for use in other classes or to discuss ideas. Students ideas occurred in the classroom so that Lesson Study teams have opportunity to reflect what they learn from observation and teachers will reflect on teaching.

In mathematics classroom, Open Approach was used as a new mathematics teaching approach that focused on problem solving process. And applied to the Lesson Study according to the Inprasitha [9] with consisted of four steps as follows.

- 1) posing open-ended problem. Teacher posed open-ended problems situation that designed form Lesson Study teams.
- 2) students self-learning through problem solving. After teacher posed open-ended problem situation, students try to find how to solve the problems. They can organize activities into groups or single depends on what they designed the activity. In this phase, teacher gives opportunity for students to express their ideas freely.
- 3) whole class discussion and comparison. After students solve this problem, they will present what they think in front of the class and others discuss together.
- 4) Summarization through connecting students' mathematical ideas emerged in the classroom.



**Figure 1** The four steps of Open Approach as a teaching approach that integrated with Lesson Study ]9[ in mathematics classroom and integration into the 21st century skills focusing on writing skills.

## 2.3 Research Methodology

### 2.3.1 Target group

Target groups were 1<sup>st</sup> grade students in fourteen mathematics classrooms using Open Approach as a teaching approach. They were assigned into 6 pairs. In each pair, the students were same class and could work together. Their personality was expressive by talking to express their opinion, discussing, proposing their approach or ideas in providing reasons solve the problem. They volunteered to participate as a target group.

### 2.3.2 Research instruments

In conducting this research, the researcher used 2 kinds of research instruments: the instrument using for data collection, and the instrument using for data analysis, as follows:

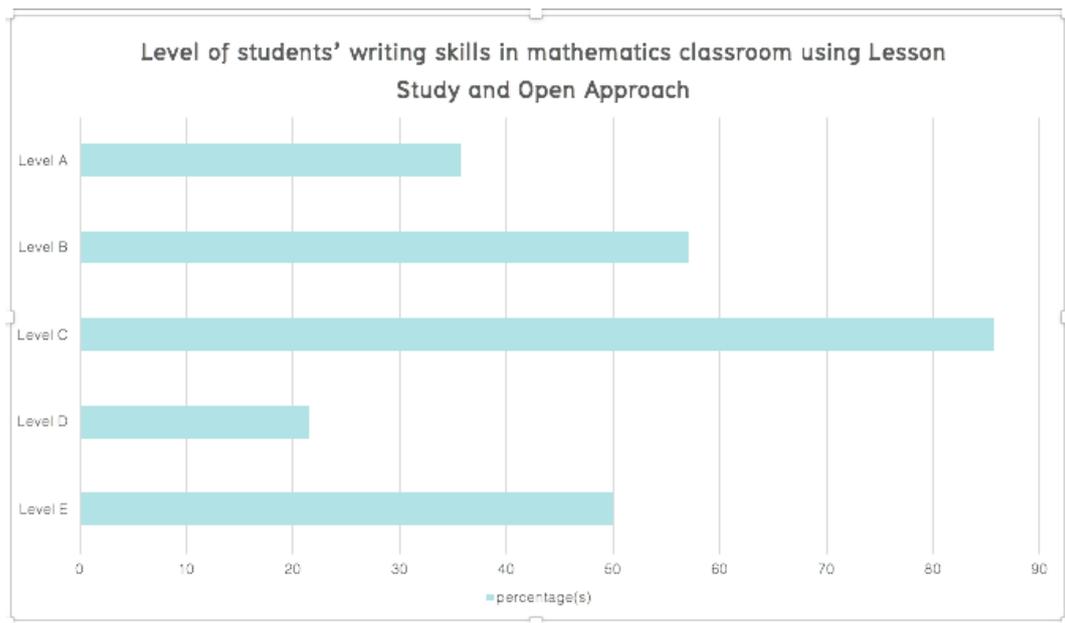
- 1) Lesson plans in addition learning units that designed from Lesson Study teams.
- 2) The fieldnote for the researcher to record problem solving behavior while the students were collaboratively solving the mathematical problem.
- 3) Video recorder, camera, and audio tape recorder
- 4) Questionnaire about writing skills based on framework of Isoda, Morita, and Nobuchi [2].

### 2.3.3 Data collection

Data were collected by classroom observation addition learning unit and video recording classroom and using questionnaire in the second semester of 2016 academic year and analyzed based on framework of Isoda, Morita, and nobuchi [2].

## 3. Results and discussions

The research findings found that students' writing skills in classroom using open approach were as follows;



**Figure 2** Level of students' writing skills in mathematics classroom using Lesson Study and Open Approach

**Table 1** The results of the assessment of students' writing skills.

Level	Items	Total of classroom	Percentage(s)
☆	Students' writing based on rules for writing in the book.	7	50
☆☆	Students' writing is well-ordered.	3	21.43
☆☆☆	They represented by a figure or table and they can find errors in the presentation or explanation.	12	85.71
☆☆☆☆	They wrote step-by-step and logically and they can correct the missing part of their concepts.	8	57.14
☆☆☆☆☆	They can be written exactly as they planned and write as expected.	5	35.71

The result of this research shown as follow;

- 1) Level E; Students took note follow the rule of writing in notebook. (50%)
- 2) Level D; Students wrote a well organize of their ideas in notebook. (21.43%)
- 3) Level C; Students presented their ideas using picture or table and found their fault in presentation or explained their ideas and others' ideas. (85.71%)
- 4) Level B; Students wrote a summarize of the procedure, reasonable and easy to understand and found advantage and different from their friends' presentation. (57.14%)
- 5) Level A; Students explained their reasons consistent with expectations and could be summarized their idea based on the problems. (35.71%)

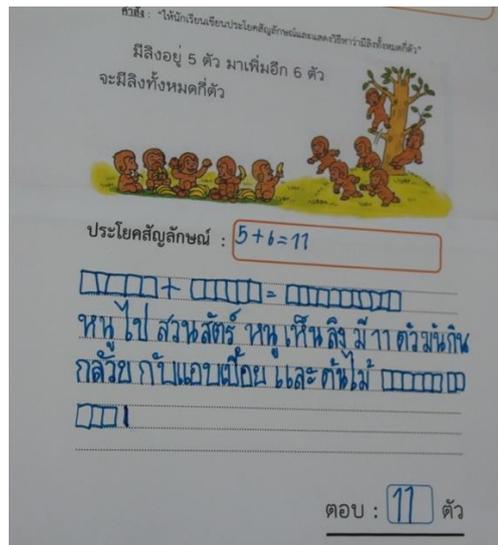


**Figure 3** Problem situation was designed by Lesson Study teams: There are 5 monkeys and then add 6 monkeys, how many monkeys are there?



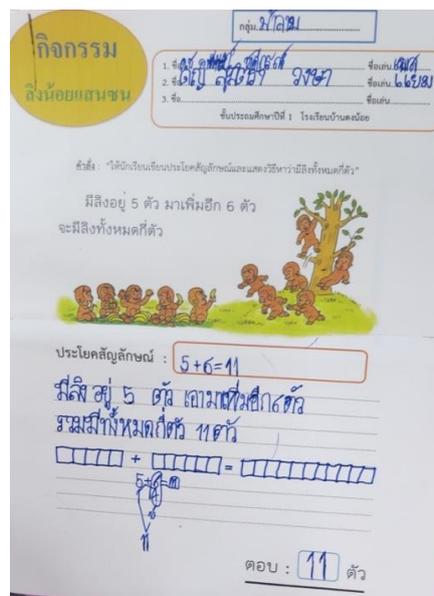
**Figure 4** Students' worksheet after teacher posed open-ended problem situation

From problem situation, after students write mathematics sentence, in the worksheet, 5 blocks in the left side represent 5 monkeys and the right side are 6 monkeys. They presented their ideas using blocks to represent groups of monkeys and write the total of monkeys are 11.



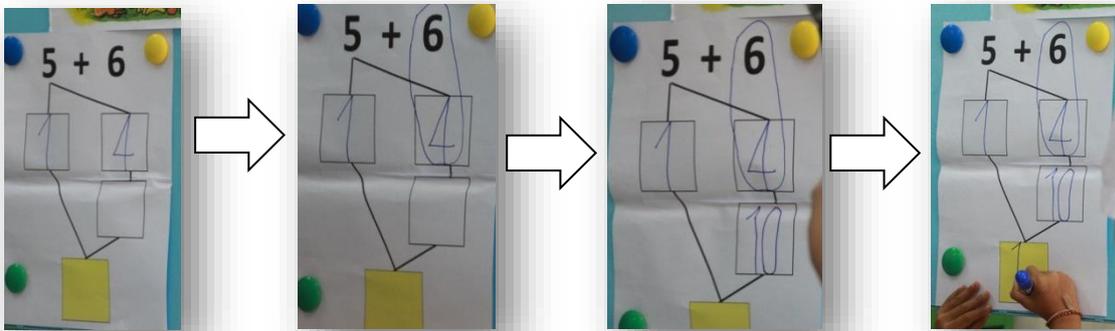
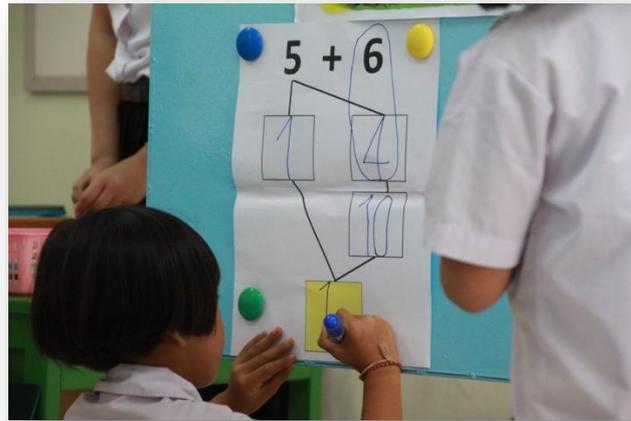
**Figure 5** Students' worksheet after teacher posed open-ended problem situation

In the second group's worksheet, 5 blocks and 6 blocks are 11 blocks that represent total of monkeys. So that, students presented 11 blocks represented 11 monkeys and describe from problem situation connected with real world in daily life.



**Figure 6** Students' worksheet after teacher posed open-ended problem situation

From problem situation, students write mathematics sentence and they used blocks to represent groups of monkeys and diagram how to find the solution. First, they write mathematics sentence  $5+6 = 11$  and used blocks to represent 2 groups of monkeys- 5 monkeys and 6 monkeys. The last, they used diagram how to calculate  $5+6$ . They used how to based 10 to calculate.



**Figure 7** Students try to find the solution with how to from the past lesson.

From problem situation, students try to summarize from mathematical ideas emerged in the classroom with their peers. They used how to such as based 10, decomposing of number etc. In this figure, firstly, they decompose 5 are 1 and 4, and then, 6 plus 4 are 10, the last, 10 and 1 are 11.



**Figure 8** Show the blackboard was planned by Lesson Study teams to manage all such as students' worksheet, the problem situation, task and mathematical ideas.

#### 4. Conclusions

This research was to develop students' writing skills in mathematical problem solving classroom using Lesson Study and Open Approach based on Isoda, Morita and Nobuchi's conceptual framework [2] in mathematics classroom focused on problem solving using open approach as a teaching approach. In each phase of Lesson Study and each steps of Open Approach, Lesson Study teams must design learning unit for all students to learn and give opportunity to learn freely. Collected data by classroom observation addition learning unit and video recording classroom and using questionnaire in the second semester of 2016 academic year in 1<sup>st</sup> grade students. The result of this research shown that each level of students' writing skills. The highest level is level C; 85.71 percentages, students presented their ideas using picture or table and found their fault in presentation or explained their ideas and others' ideas. They used "how to" to learn. Lesson Study teams designed mathematical activity based on problem situation is closely students' daily life that consisted with Inprasitha [2] put it; how to assesses writing skills, the best quality of mathematics classroom is level E and down level until level A. Then developing students into grade A, which is applicable to all levels of elementary education. And in this research, we chose grade 1 as the target group. Interestingly, if we want to develop in-depth study or develop more skills, what is a better way? What are the factors that will develop those skills? That's interesting issues for further study

#### 5. Acknowledgements

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