The Effects of Applying PISA Lesson on Mathematical Process Skills of Elementary Students

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Abstract

The purpose of this study is to discover the effects of applying Pisa Lesson on the mathematical process skills elementary students. The participants of the study were Grade 4 students in Academic Year 2016. Purposive sampling was employed to 915 students from 12 schools, 6 school in Bangkok and the other 6 in the regional part. The research instruments were: 1) PISA Lesson; 2) Manual of applying PISA Lesson in teaching mathematics; 3) a survey of students' opinions on using PISA Lesson in learning mathematics; and 4) a survey of teachers' opinions on using PISA Lesson in teaching mathematics to the sample group of students. The data analysis employed matched-pairs dependent t-test, percentage, and frequency. The results of the studies were found as follows: 1) the mathematical process skills of the students who have used PISA lesson were significantly higher (0.05); 2) most of the students agreed that PISA lesson applying in mathematics was interesting and desired to study mathematics with PISA lesson in the next academic year; and 3) most of the teachers who used PISA lesson in their teaching mathematics agreed that is was interesting and helped students be able to apply mathematical skills into daily life better, and it should be applied into teaching mathematics in every primary grade.

Keywords: PISA Lesson, Mathematical Process Skills

Background of the Study

The world is changing. Everything is changing including believes, attitudes, values, etc. However, there is only one thing that time cannot change or devalue: "value of thoughts." People in every period of time have believed that those who think critically are more beneficial and successful in everything. Considering mathematics, the subject concerning thinking process and problem solving, it has been found that children's mathematics proficiency, especially thinking evaluation and problem solving, is the lowest comparing to the other subjects. Mathematics teachers in primary levels also lack reliability and enough proficiency to apply the five processes skill of mathematics into teaching. The five processes skill of mathematics, according to The Basic Education Core Curriculum B.E. 2551 (A.D. 2008), consist of 1) problem solving proficiency, 2) reasoning, 3) mathematical communication and presentation, 4) mathematical knowledge linking to other skills, and 5) creative thinking. The Institute for the Promotion of Teaching Science and Technology (IPST) (2018b, p. 76), Pipithkul (1987), and Khammani (1992) agreed that teaching students to be able to think critically is very necessary, yet it is not very easy to do so. This is because thinking processes is abstract and complicated so that it is difficult to make a distinct result. Also, the announcement of National Institute of Educational Testing Service (2017) indicated that the mathematics test result of O-NET of primary level students has been relatively low. This can result in the higher-level students' mathematical proficiency. Programme for International Student Assessment (PISA), with the collaboration of The Institute for the Promotion of Teaching Science and Technology (IPST) and Organisation for Economic Co-operation and Development (OECD), has assessed the sample group of 15-year-old Thai students in the fields of Mathematics, Science, and reading in 2012. The assessment was focused on mathematics and was

found that Thai students' score has been far lower than Singapore and Vietnam (PISA THAILAND, 2013, pp. 1-9). The result in 2015's assessment shows that Thai students got approximately only 415 scores, which is lower than the 2012's for 11 scores. It was also lower than the standard identified by OECD, 490 scores. The result shows that Thai students' mathematics score is in the fifty-forth from seventy countries around the world (The Institute for the Promotion of Teaching Science and Technology (IPST), 2018a, p. 14). This information definitely shows that Thai educational standard is still far from excellency.

Concerning the nature of mathematics subject, it is the subject of giving reasons and thinking to solve problems as mentioned earlier. It has been also accepted in teaching mathematics that the main factor of mathematics involving the processes of thinking and reasoning is the problems. LeBlanc (1977) and Branca (1980) have agreed that the main components of mathematics in primary level consist of concept, mathematical skill, and problem solving. Of all three components, problem solving is the most important one. The goal of teaching to solve the problems is to teach students to understand the process of problem solving. However, based on the evaluation of the types of mathematical problems in primary level, mathematicians have agreed that problems in mathematics consist of two main types: Standard Textbook Problems and Process Problems. Standard Textbook Problems are general found in mathematical textbooks. The remarkable feature of this type is the use of normal process, and most of the problems are routine problems. On the other hand, Process Problems are Non-Routine Problems, which students can solve problems by using many parts of mathematical process (Panichsuay, 2012). Mathematical process, therefore, is the weak point that students should be consistently trained. Teachers should also adapt new teaching strategies by applying mathematical processes in every lesson

Those mentioned problems result in the question of whether there is any method or strategy of mathematics learning management to improve Thai students. A number of educators propose to distribute computers to students in order that they can reach to technology; however, the relationship analysis of using computer and mathematics scores shows that there is not positive relationship, but those who use computers got lower scores. Therefore, the lack computers does not significantly effect on the quality of education. PISA THAILAND (2009) and Kennedy, Tipps, & Johnson (2008, p. 83), also agreed with this concept, suggested that computers cannot solve educational problems, especially mathematics teaching. Teaching components and teacher's competence are also considerable. When instruction media like computers are not the main factor to improve the quality of education, another media like "skill training" will be focused. This type of instruction media is important in skills teaching. It helps teachers and students find out the error in teaching and solve it immediately. Also, it does not use much cost. However, this type of instruction media is also found generally applied in mathematical teaching. So, there is the consequent question that whether this type of media should be in particular. Miss Sunee Klainil, the Specialist at The Institute for the Promotion of Teaching Science and Technology (IPST), has spoken about mathematical education in Thailand school that even though there were new innovations applied into teaching mathematics, this subject still has special contexts by not having added social dimension yet" (Clainin, 2015, p. 4). This speech is in accordance with the concept of PISA which does not only focus on contents, but also processes and contexts. As a result, if there is a particular skills training form to train mathematical processes, which is based on the concept of PISA, to be applied in primary levels, it could be one of the students' mathematical processes improvement methods. It also is the preparation of Thai students to be a part of PISA assessment in the future.

In order to solve those above mentioned problems, the research team proposed the study titled: The Effects of Applying Pisa Instruction on the Mathematical Process Skills of Elementary Students. The research study consists of

two phrases. Phrase I was supported by National Research Council of Thailand (NRCT), which is already completed. The Phrase I plan is the forming stage of mathematical processes and studying stage of the overall primary students' mathematical knowledge. The research plan of Phrase II, budget year 2017, is the stage of forming and developing PISA Lesson into Grade 4 students. The period of study takes 6-8 weeks to investigate the effect of PISA Lesson on the mathematical process skills of elementary students. The data of the study will be explained in this article.

Objective of the Study

To investigate the effects of applying PISA Lesson on mathematical process skills in primary students

Study Framework

In order to be able to apply the result of the study for the most benefits of teaching management, the research team has indicated the framework of the study as follows:

1. The study has selected the sample group of Grade-4 students who were at the good stage to learn about each group of learning and were not obligated by the response and practice of the research instruments

2. The study focused on forming training format concerning mathematical examination in Programme for International Student Assessment (PISA), which will be called in this study as "PISA Lesson".

3. The independent variable of the study was the application of PISA Lesson into mathematical subject. The dependent variables of the study were the students' competency on mathematical process skills after the application of PISA Lesson, the teachers' and students' opinions on the application of PISA Lesson into mathematical subject for 6-8 weeks.

Research Methodology

Phrase I: Study and Preparation

The research team considered mathematical measuring form which was used as the research instrument (Panichsuay, Waiboonya, Suphkit, Loungkeaw, Choondee, Chanapai, & Noimai, 2017), in order to use as data for creating PISA Lesson concerning with problem and readiness and competency of the primary level students.

1. The characteristic of the mathematical process skill test is 4-chioce test, 30 items divided into 2 parts. Part 1 is the problem analysis test, 7 items; while Part 2 is 9 items of situational/problem test, 2-3 items each.

2. The quality of mathematical process skill test consists of reliability (0.73), (p) between 0.28-0.78, and (r) between 0.26-0.65.

3. The mathematical process skill test was examined in the sample group of Grade 4 students from 12 schools: 6 Bangkok schools, and 6 other regional schools including Northern, North-eastern, and Southern school, 2 school each. The sample group included 461 students in total. The result of the study was found that there was the sample group who got lower than 50 percentage, 63.12 percentage. There was the sample group who got higher than 80 percentage for only 3.04 percentage. The mathematical process skill test can be explained as following.

Part I: Problem Analysis

1. Srongchai bought a pair of shoes for 350 baht and a pair of socks for 54 baht. He gave the merchant 500 baht, how much change would he get? Which of the following symbolic sentences is not correct?

a. 500 − 404 = ☐ b. 500 − 350 − 54 = ☐

c. 500 − (350 + 54) = ☐ d. 500 − (350 − 54) = ☐

2. 65 + (65 + 17) = ☐ Which of the following problems is agreed with this symbolic sentence?

a. Uncle is 65 years old. Aunt is 17 years older than uncle. How old is aunt?

b. Tong is 65 kg weight. Jumbo is17 kg heavier than Tong. How much does Jumbo weigh?

c. Wuth has 65 goldfish. He has 17 less of silver fish than goldfish. How many fish does Wuth has in total?

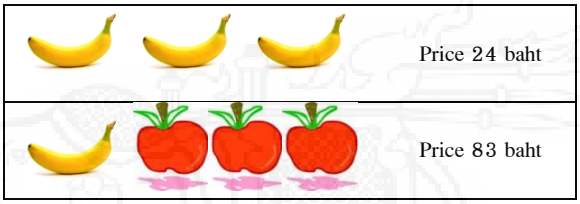
d. Eak got 65 scores from Thai test. His mathematics is 17 scores higher than Thai. How many scores did Eak got from the two tests?

3. There are 3 ropes that are 120 cm., 180 cm., and 95 cm. long. When we tie all the three ropes together, how long will the rope be if each connecting spot loses 7 cm.?

a. 120 + 180 + 95 = ☐ b. (120 + 180 + 95) − 7 = ☐

c. (120 + 180 + 95) − (2 × 7) = ☐ d. (120 + 180 + 95) − (3 × 7) = ☐

4. According to the picture, how much does one apple cost?



a. 8 baht b. 25 baht c. 50 baht d. 65 baht

Part II: Situational/Problem Test

Rare Stamps

Many people like to collect stamps as a hobby. Keng has collected a large number of stamps. Many of them are rare ones which are expensive. These are the stamps that Keng has collected. The number of the parentheses, ( ), is the number of each type of stamps he has. He needs to sell some of them in order to use money for buying some important things. However, he will always keep one of them.

		
Type 1 Price 320 baht (4)	Type 2 Price 500 baht (2)	Type 3 Price 380 baht (3)
		
Type 4 Price 270 baht (2)	Type 5 Price 250 baht (4)	Type 6 Price 300 baht (3)

Read the story of "Rare Stamps" and answer Items 1-3

1. Which one is correct and appropriate when Keng wants to buy a pair of shoes, price 900 baht? a. Sell 2 of Type 3 stamps b. Sell 3 of Type 6 stamps c. Sell 3 of Type 1 stamps d. Sell 4 of Type 5 stamps	2. If Keng wants 1,000 baht, what should he do? a. Sell 2 of Type 2 stamps b. Sell Types 1, 3 and 6, one of each c. Sell Types 2, 5, and 6, one of each d. Sell Type 3, 4, and 5, one of each	3. If Keng sells Type 3 stamps, how much money will he get the most? a. 380 baht b. 760 baht c. 770 baht d. 1,140 baht

Figure 1 Sample of Mathematical Process Skill Measurement

Phrase II: Forming of Research Instrument

The methodology to create PISA Lesson which is the main research instrument can be explained as following

1. Identify type of the lesson to be in accordance with mathematical test (PTSA THAILAND, 2014) in Programme for International Student Assessment or PISA. PISA assess the ability which will be called "Mathematical Literacy". PISA tests are interesting and various in real life situations. Each situation may include many kinds of questions such as choices, short answers, or long answers. Mathematical Literacy, according to PISA, means competency to think, use, explain mathematics in various situations, and giving reasons in mathematical process. It can also predict and scope the evaluation covering three compositions: processes, contents, and contexts.

2. Indicate the scope of the instruction for 20 stories to apply in the classroom for 20-30 minutes, 2-3 times a week for 6-8 weeks. Each story presents interesting problems/situation leading students to follow and find out the answers. The strategies to create a lesson are adapted from various suggestions and concepts as following:

2.1 Using word or story problem continually, Lester (2003, p. 85) emphasized that teaching mathematics must focus on problems/situations which must be obviously indicated within the curriculum. Problems/situations should not be occasionally added in the classroom because teaching mathematics with stories will help learners understand mathematics more (Roe and Smith, 2012, p. 499).

2.2 Designing various problems/situations which include both convergent questions and divergent questions. Divergent questions will improve students to think diversely and be confident with the complexity of real-life situations (Orlich et al., 2009, pp. 220-221).

2.3 Designing the performance contexts to help learners to solve problems/situations by themselves. Briggs & Davis (2008, p. 14) and Dick, Carey, & Carey (2009, p. 25) have agreed that teaching problems/situations should focus on learners and design the contexts that learners can solve by themselves. Haylock & Thangata (2007, pp. 88-89) also suggested that the contexts in each home and school were different, parents should use other contexts apart from school e.g. department stores, in order to improve mathematical skills. Donaldson (2012, p. 25) and Tucker (2014, p. 12) also added that manage the environments for learning mathematics or being almost like real-life situations is important. Encouraging and inspiring learners to desire to learn and giving opportunities to communicate and consult are the factors that should not be avoided. These mentioned factors will help learners experience and realize the value of mathematics. Van de Walle, Karp, Lovin, & Bay-Williams (2014, p. 19) also suggested that presenting situations/contexts that stimulate learners to find out the answers is also the way to make learning mathematics lively and beneficial.

2.4 Using easy language in problems/situations or the contexts. In new strategies of teaching mathematics which focuses on finding answers from problems/situations/contexts, what cannot be avoided is language. Molina (2012, p. 1) has indicated in the book *The Problem with Math is English* that there were 2 complexities in teaching mathematics including the subject itself and the language and symbols. Therefore, teachers should use easy language because if the students do not understand the problems/situations/contexts, there will be the problem of understanding mathematics.

2.5 Designing problems/situations for encouraging learners to use reasons in real-life situations. Bartlett (2014, pp. 6-8) gave an opinion about this concept that mathematics subject is in everywhere, so we should learn and use it according to our real-life situations. For instance, a teacher will take 40 students to a field trip by mini-buses. If the teacher allocates 12 students in each bus, how many mini-buses should the teacher prepare?

Those students who answer 3.33 buses will show that they lack real-life reasoning, because the teacher should actually prepare 4 mini-buses.

3. Submit PISA instruction designed by the research team to 3 experts to review and then apply the revised version of PISA Lesson to try out. Try-out examination were carried with the students in the same schools, both Bangkok and other regional schools for 5 classes, 187 students. This examination was carried with a small group of 41 students and a large group of 146 students. This is because PISA Lesson consists of 20 stories in each examination. Therefore, students would take only 4 stories. The results of the examination were improved until PISA Lesson was completely created with adequate difficulty/simplicity, appropriate language and problems/situations with Thai contexts. Finally, PISA Lesson was completely created and ready to be applied into the sample group of students, as exampled below.

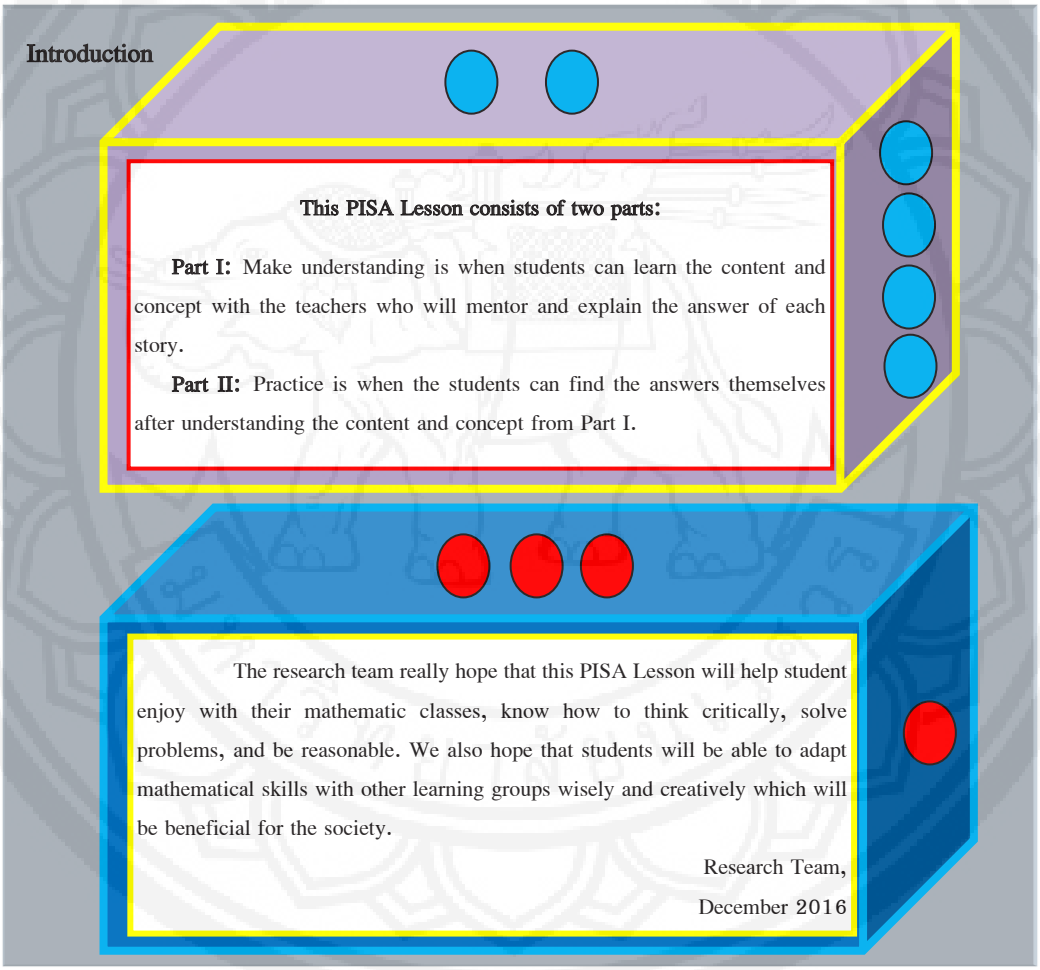


Figure 2 Sample of Introduction of PISA Lesson

Foods

Part I: Make Understanding

Foods contain different number of calories. Calorie is a unit of energy. If you want to lose weight, you must eat low-calories food in order to control calories not to transform to be fat in the body. The below Table shows the number of calories in each kind of food. Look at the Table and answer the questions.

			
Fried basil with rice and fried egg 630 calories	One Rose Apple 20 calories	Thai Sweetmeat 223 calories	Rice Congee Mixed with Meat 230 calories

Mark ✓ in the ☐ of the correct answer

1. If there are 2 kinds of food, which food that those whose weight is over the standard should avoid?
   ☐ Rice Congee Mixed with Meat ☐ Fried basil with rice and fried egg
2. Which of the following should be the food for those who are on a diet?
   ☐ Rice Congee Mixed with Meat and two rose apples
   ☐ Fried basil with rice and fried egg and one rose apple

Part II: Practice

Look at the menu and answer the questions

			
Clear extra small noodle soup with meat balls 225 calories	Natural-taste yogurt 95 calories	Frapped green tea 319 calories	One orange 50 calories
			
One rambutan 15 calories	Hainanese chicken rice 596 calories	Hot coffee 60 calories	Hot low-fat milk 65 calories

Mark ✓ in the ☐ of the correct answer; or fill in the blank

1. The doctor suggested father to lose weight, which of the following should be his breakfast?
   ☐ Hainanese chicken rice, frapped green tea, and one orange
   ☐ Clear extra small noodle soup with meat balls, natural-taste yogurt, and two rambutans
2. Aunt Koi is hungry almost at the bed time, which one between hot coffee and hot low-fat milk should she drink?
   Drink ..... Reason .....

Notice: There are more types of food and questions in the real PISA Lesson.

Figure 3 Sample of PISA Lesson

4. Create other research instruments e.g. Manual of PISA Lesson, survey of students' opinions on applying PISA Lesson into learning, and survey of teachers' opinions on applying PISA Lesson in teaching.

Phrase III: Sampling and Using Research Instruments

1. The study employed purposive sampling to Grade 4 students in Academic Year 12 from 12 schools, 6 in Bangkok and the other regional schools such as Northern (2 different Office schools in Phitsanulok), North-

eastern (2 different Office schools in Udon Thani), and Southern (2 different Office schools in Trang). There were 915 participants in total.

2. Examine the PISA Lesson with mathematics teachers of the sample group of students by operating a training titled "PISA Lesson and the Use of PISA Lesson into Teaching Mathematics". The participants were mathematics teachers: 6 schools from Bangkok, 2 from each school, 12 in total; 6 schools in other regional schools, 2 from each school, 12 in total. In total, there were 24 mathematics teachers participating.

Phrase IV: Data Collection and Summarization

1. Examine 877 participants from the sample group of students for their mathematical process skills before applying PISA Lesson

2. Apply PISA Lesson into the classes where the sample group of students were for 6-8 weeks, 2-3 times a week, 20 minutes per time based on the appropriateness of each class and school.

3. Examine 878 participants from the sample group of students for their mathematical process skills after applying PISA Lesson

4. Survey for the students' opinions on applying PISA Lesson into learning mathematics

5. Survey for the teachers' opinions on applying PISA Lesson into teaching mathematics

6. Collect and analyze the data via percentage and frequency from the surveys; and compare the results of the study with before and after the application of PISA Lesson by using Matched-Pairs Dependent t-test

7. Summarize and report the result of the study

Results of the Study

1. Comparison of Mathematical Process Skills Before and After the Application of PISA Lesson

According to the examination of the mathematical process skills of the 915 students from 12 schools, there were 877 participants took the examination before and 878 participants after the application of PISA Lesson, 850 took both examinations. When the scores of 850 participants were analyzed by Matched-Pairs Dependent t-test, it was found that the participants got significantly higher scores after the application of PISA (0.05), as shown in Table 1.

Table 1 Comparison of Mathematical Process Skills Before and After the Application of PISA Lesson ($H_1: \mu_1 \neq \mu_2$)

School No.	Mean Score		No. of Students	95% Confidence Interval of the Difference		t
	Before PISA	After PISA		Lower	Upper	
1	14.07	17.84	75	-4.59	-2.96	-9.24
2	11.60	11.38	50	-0.89	1.33	0.40
3	11.10	14.60	84	-4.40	-2.60	-7.70
4	12.36	17.29	59	-5.98	-3.88	-9.39
5	14.54	17.95	61	-4.36	-2.46	-7.21
6	13.64	20.26	66	-7.59	-5.65	-13.65
7	11.78	14.38	77	-3.54	-1.64	-5.43
8	10.94	15.15	52	-5.31	-3.11	-7.69
9	15.46	20.71	72	-6.08	-4.42	-12.66
10	12.42	15.96	83	-4.57	-2.52	-6.89

Table 1 (Cont.)

School No.	Mean Score		No. of Students	95% Confidence Interval of the Difference		t
	Before PISA	After PISA		Lower	Upper	
11	12.92	16.55	84	-4.47	-2.79	-8.58
12	12.25	15.63	87	-4.23	-2.53	-7.93
Total	**12.77**	**16.52**	**850**	**-4.04**	**-3.47**	**-26.02**

The results of the mathematical process skills examination after the application of PISA Lesson was significantly higher than before the application (0.05). Considering into the details, it was found that there were 11 schools score of after the application of PISA was higher, except School No. 2 where the score of after the application was lower than before the application.

2. Students' Opinions of the Application of PISA Lesson in Learning Mathematics

According to the survey of the sample group of students' opinions on the application of PISA Lesson into learning mathematics, there were 878 participants answering the survey; and it was found that most of the participants (more than 50 percentage) agreed that PISA Lesson was interesting and desired to use PISA Lesson in the next academic year, as shown in Table 2.

Table 2 Students' Opinions of the Application of PISA Lesson in Learning Mathematics

Details	Most Likely	Likely	Fair	Unlikely	Most Unlikely
1. PISA Lesson is interesting	61.9	25.9	11.7	0.5	0.1
2. PISA Lesson has an appropriate difficulty and simplicity	33.1	37.9	26.8	1.6	0.6
3. PISA Lesson is disturbing learning mathematics in class	6.9	3.2	16.4	34.0	39.5
4. PISA Lesson improves the mathematics class to be more joyful	59.4	19.3	14.1	5.4	1.8
5. PISA Lesson improves learning mathematics in class	50.3	32.5	13.5	2.3	1.4
6. PISA Lesson helps students adapt more mathematical knowledge and skills into daily life	56.6	25.7	14.4	2.1	1.3
7. Students can learn PISA Lesson by themselves	4.3	16.6	47.7	20.6	10.9
8. Students cannot understand PISA Lesson without the explanation of mathematical teachers	21.5	11.4	49.1	14.0	4.0
9. PISA Lesson should be applied into teaching and learning mathematics in every level of the primary education	52.4	24.4	14.8	5.3	3.2
10. Students desire to use PISA Lesson in the next academic year	63.5	16.0	13.0	3.1	4.3

According to the result of the survey, it indicates that PISA Lesson is the instruction media of mathematics that most people (more than 50 percentage) were satisfied the most, for example being interesting, helping the classes for be more joyful and improved, wanting PISA Lesson in the next academic year. In case of difficulty and simplicity PISA Lesson, it followed the research team's purposes which were that PISA Lesson should be adequately simple/difficult; and teachers would be the main factor to manage learning and skill training in the primary level students.

3. Teachers' Opinions on the Application of PISA Lesson into Teaching Mathematics

According to the survey for the opinions of 24 teachers who applied PISA Lesson into teaching mathematics, the participants were 4 males and 20 females; and 16 graduated in bachelor's degree, 7 in master's

degree, and 1 in doctorate degree. Almost half of them (11 participants) has been teaching for more than 15 years. The result of the survey indicates that most of the participants (12) agreed that PISA Lesson was interesting and improved students' knowledge and skill to adapt in daily lives more than before. In addition, it was suitable for applying into teaching mathematics in every level of primary education; and it should be applied in the next academic year, as shown in Table 3.

Table 3 Teachers' Opinions on the Application of PISA Lesson into Teaching Mathematics

Details	Most Likely	Likely	Fair	Unlikely	Most Unlikely
1. PISA Lesson is interesting	20	3	1	-	-
2. PISA Lesson has an appropriate difficulty and simplicity	6	14	4	-	-
3. PISA Lesson is disturbing learning mathematics in class	-	3	6	9	6
4. PISA Lesson improves the mathematics class to be more joyful	6	15	2	-	1
5. PISA Lesson improves learning mathematics in class	11	13	-	-	-
6. PISA Lesson helps students adapt more mathematical knowledge and skills into daily life	18	6	-	-	-
7. Students can learn PISA Lesson by themselves	5	12	7	-	-
8. Students cannot understand PISA Lesson without the explanation of mathematical teachers	1	1	17	4	1
9. PISA Lesson should be applied into teaching and learning mathematics in every level of the primary education	19	4	1	-	-
10. Sample group of students should use PISA Lesson in the next academic year	15	8	1	-	-

According to the survey, it indicates that PISA Lesson was not only interesting, improved students' knowledge and skills to adapt into daily life, and was suggested to continually use in the next academic year, most of the participants agreed that PISA Lesson had adequate difficulty and simplicity. It also improved the learning environment to be more joyful. Moreover, students could understand PISA Lesson by themselves.

Discussion

1. The result of the study was found that the sample group of students' mathematical process skills after the application of PISA Lesson was significantly higher than before the application of PISA Lesson (0.05). The sample group of students from 11 schools had higher score after the application of PISA Lesson. This result was in accordance with the study of Scusa (2008): *Five Processes of Mathematical Thinking*. Scusa had found a problem when his 18 of his Grade 7 students lacked mathematical reasoning. Therefore, he created a 5-lesson instruction in which contained mathematical process skills for solving students' problem of reasoning. In his study, he let the students solve problems together in either small or large groups for 2 weeks/lesson, and it was found that the students had gradually better reasoning both writing and talking. The School No.2 where the score after the application of PISA Lesson was lower was due to the fact that the sample group of students in one from two classes was the combined class of special children, i.e. attention-deficit-disordered children, learning disabilities, and other behaviors. Therefore, it was the initial notice that PISA Lesson might not work with those types of children.

2. The result of the student survey was found that most of the participants (more than 50 percentage) were most likely satisfied with the application of PISA Lesson. Being interesting, improving the mathematics class to be more joyful and wanting it in the next academic year were all positive. This result was in accordance with Scusa (2008) that found that students liked problems/situations in classes; and the lessons helped students to participate in learning mathematics, respect others' opinions, and want to know how their classmates thought about the problems/situations.

3. The result of the teacher survey was found that most of the participants (more than 12) agreed that PISA Lesson was interesting, helped students adapt knowledge and skills into daily life; should be applied into teaching mathematics in every level of primary education; and should be continually applied with the sample group of students in the next academic year. Those opinions were also positive. According to the collection of suggestions from the survey and from the meeting, a number of students asked to do the PISA Lesson in advance and some of them, who were ready for mathematical learning, had done before the class. Those information were the reasons why teachers should apply PISA Lesson to teach how to solve problems/situations in mathematics. It was in accordance with the suggestion of Polya (1985, p. V) in his book *How to Solve It,* "teachers always have opportunities to teach process and skills to the learners in order that they will be free to think and solve mathematical problems. If teachers waste the time teaching only routine operations (plus, minus, multiple, divide), it will be the obstruction for learners' competency development." Scusa (2008, p. 44) also supported this concept by suggesting that we should believe and determine to teach mathematical process skills even though it was complicated and took more time.

Suggestions

Suggestion for Implementation

1. Mathematical teachers in primary levels should clearly understand that the heart of teaching mathematics in primary levels should make the students understand the overall concept. Then, teachers should train the learners the skills of calculating. Finally, the learners will understand and be able to adapt mathematical process skills into solving the problems/situations. After that, teachers should train the learners to solve problems in various situations what the teacher or the teacher with students identify together. In this step, the teacher can apply PISA Lesson which was introduced in this study to the learners.

2. Even though the PISA Lesson presented in this study was a good instrument to improve the learners' mathematical process skills, the better instrument which would give more benefits should be the lesson that is made based on the contexts of each school/community.

3. Mathematical lesson/exercise, created by the teachers for their own learners, can be not only beneficial for learners to get ready for being the "mathematical literacy" as indicated by PISA, the learners would have positive attitudes for the lesson/exercise. The teachers should not set that every learner should do the lesson/exercise in the same amount. The teachers should also consider each learner's readiness.

Suggestions for Further Studies

The further studies should be designed for primary-level teachers to be able to create their own mathematical process skills by adapting the concept of Action Learning and Action Research (ALAR) by Zuber-Skerritt (2001) as the conceptual framework.

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