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Abstract. The learning process with scientific learning focuses on students' abilities in observing, questioning, associating, experimenting, and communicating. This current study aimed to determine the effectiveness of scientific learning in terms of Problem Based Learning (PBL) and Guided Inquiry Learning (GIL) in improving students' reflective thinking skills and self-efficacy. This research was an experimental study with the subject population of all eighth-grade students of junior high school in Bandar Lampung. The samples of the study were students from two selected schools representing high-rank schools and middle-rank schools. The sample was chosen by purposive random sampling technique. The research design is a pretest-posttest control group design. The data were obtained through mathematical reflective thinking skills test and self-efficacy scale. The data were analyzed quantitatively and qualitatively to obtain a comprehensive description of the impact of learning on improve in both skills. The results showed that (1) student's mathematical reflective thinking skills in PBL and student's mathematical reflective thinking skills in GIL were higher than student's mathematical reflective thinking skills in conventional learning, (2) student's self-efficacy in PBL and student's self-efficacy in GIL were not different from student's self-efficacy in conventional learning. Therefore, it can be concluded that scientific learning effective to improve students' mathematical reflective thinking skills but it has not meaningful contributions to improving students' self-efficacy.

1. Introduction

Education is one of the basics for creating quality and potentially human beings. Through education, people are educated to have expertise and skills so that they become skilled people who work, are creative, innovative and productive. This is in corresponding with the 2013 curriculum's goal, which is to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative and effective and able to contribute to social, national, state and civilization life.

Improving the quality of education in all aspects needed to achieve the 2013 curriculum goals, one of which is in mathematics learning. One of the goals of mathematics learning that must be achieved by students is to understand mathematical concepts, explain the interrelationships of concepts, and use these concepts in solving problems. This corresponds with the opinion of Bruner who states that learning mathematics will be successful if the teaching process is directed at the interrelation between concepts in problem-solving. [1] defines the process of explaining the interrelationship of concepts in problem-solving as a definition of reflective thinking. This is in line with [2] defines reflective thinking as a process of directed and appropriate activities where individuals analyze, evaluate, motivate, get the deep meaning, use appropriate learning strategies. So, by reflecting, students can develop thinking skills by linking the knowledge gained and their previous understanding of solving new problems. Based on this, reflective thinking ability is one of the abilities that must be possessed by students in order to achieve the goals of mathematics learning.

The importance of mathematical reflective thinking skills has not yet been supported by the achievement of mathematical reflective thinking skills itself. In fact, there are many problems in mathematics learning that cause reflective thinking skills to be sub-optimal. Based on the results of the TIMSS 2015 survey in mathematics with one of the cognitive indicators assessed was the ability of students to solve non-routine problems. Indonesia ranks 45^{th} out of 50 countries with an average score of 397. In the TIMSS survey, the questions used were divided into 4 levels, namely advance, high, intermediate and low. In the type of high questions, it turns out that Indonesia is still ranked relatively low, namely Indonesia ranked 47^{th} with a percentage of success in answering questions that is 34%. Types of questions at the high level are expected students can apply knowledge and understanding solving problems [3].

Solving problems requires reflective thinking. [4] which states that reflective thinking is a process that requires skills that mentally provide experience in solving problems, identify what is already known, modify understanding in order to solve problems, and apply the results obtained in other situations, so improving students' mathematics reflective thinking skills needs to be done. According to [1], reflective thinking is "active, persistent, and careful consideration of any beliefs or supposedly from knowledge in the light of the grounds that support it and the conclusion to which it tends". This corresponds with [5] states that reflective thinking skills is the ability to think that observes the assumptions (known hypotheses or elements) and its implications based on reasons or evidence to support a conclusion. According to [4], reflective thinking mentally involves cognitive processes to understand the factors that cause conflict in a situation. Therefore, reflective thinking is an important component of learning. Indicators of reflective thinking skills that used in this study are indicators adapted from Surbeck, Han, and Moyer [4], namely reacting (reacting with given problems), comparing (evaluating what is believed by comparing reactions and other experiences), and contemplating (describing, informing, and reconstructing problems).

In addition to cognitive aspects, affective aspects also need attention in the mathematics learning process. Learning will be more successful when cognitive abilities and affective abilities are developed together. One of the affective abilities that can be developed is self-efficacy. Learning can run well and achieve the desired goals if students feel comfortable and not depressed and have high self-efficacy. [6] defines self-efficacy as an individual's belief in his or her ability to achieve a specified level of performance. [7] states that self-efficacy determines how people feel, think, motivate themselves and behave. This concept is related to the beliefs that people have about their capacity to complete a specific task. In addition, [8] states that self-efficacy is an individual's beliefs or beliefs about an individual's ability to organize, implement actions to display certain skills, perform a task, achieve a goal, produce something in overcoming life. This is in accordance with [9] which states that self-efficacy affects one's choices in behavior regulation, the amount of effort to complete a task, and the length of time they face obstacles. Students who have high self-efficacy will continue to persevere in their efforts despite many difficulties and challenges in completing a task.

The dimension of self-efficacy is magnitude, strength, and generality. Magnitude is the level of task difficulty a person believes she can attain. Strength is the conviction regarding magnitude as strong or weak, and generality is the degree to which the expectation is generalized across situations [10]. [6] states that the perception of self-efficacy can be formed by interpreting information from four sources, namely authentic experiences, experiences of others, verbal persuasion, and psychological indices. Authentic experience is the most influential source because the failure or success of past experience will reduce or increase one's self-efficacy. The experience of others is a source of information needed to make a judgment about one's own abilities. A social or verbal approach is an approach that is done by convincing someone that he has or does not have the ability to do something. A psychological index is a physical and emotional status that will affect a person's ability.

Junior high schools in Bandar Lampung City have characteristics like schools in Indonesia in general. Reflective thinking ability and self-efficacy of students, in general, are still low also occur in these schools. This is based on the results of interviews with teachers and observations, obtained information that most students have difficulty when dealing with problems in the form of contextual questions related to higher-order thinking skills. Students have difficulty doing analysis and connecting the given problem with a problem that has been faced before. This was an indicator of students' mathematical reflective thinking abilities. The results of these observations conclude that students' mathematical reflective thinking abilities were still underdeveloped. Based on interviews with several students, they obtained the information they could not understand the problem and forgot how to solve the problem. Students focused on the difficulty of the problem given, not on their ability to solve the problem presented. In addition, the learning model used tends to be teacher-centered, and students only passively receive information from the teacher.

A scientific approach is an approach that emphasizes the ability of students in observing, questioning, associating, experimenting, and communicating. The learning process based on a scientific approach must be combined with the rules of the scientific approach. This approach is characterized by highlighting the dimensions of observation, reasoning, discovery, validation, and explanation of truth [11]. [12] states that the steps in scientific learning begin with students observing the phenomena/patterns/ events of an everyday event or problem, learners ask questions or question how and why they occur and what happens if events do not As observed/heard/ read, students explore and reason in the form of trying, experimenting, investigating, collecting data, concluding from various facts/data and concepts, and presenting their learning results to friends.

Many learning models use scientific approaches including problem-based learning (PBL) and guided inquiry learning (GIL). [13] defines PBL as a learning model where students are given an authentic (real) problems so that they are expected to be able to compile their knowledge, develop inquiry and HOT's, and develop self-regulated learning. Also, Jonassen in [14] said that in the PBL, learning focus is on the selected problem so that students not only learn the concepts related to the problem but also the scientific method to solve the problem. The same as in PBL, The application of GIL not only improve students' ability to understand the material but also can improve the skills of process and scientific work [15].

Through this activity, predicted to develop students' mathematical reflective thinking skills and self-efficacy. Based on the background described above, the purpose of this study is to determine the effectiveness of scientific learning in terms of PBL and GIL in improving students' reflective thinking skills and self-efficacy.

2. Method

This research was an experimental study to determine the contribution of the application of scientific learning to the improvement of the students' mathematical reflective thinking skills and self-efficacy. The population in this study was all eighth-grade students of State Junior High Schools in Bandar Lampung City which were distributed in 33 schools. The research sample was students from two schools selected as samples, each representing high-rank and middle-rank schools with a purposive sampling technique. Sampling was done by randomly choosing one school for each rank. Selected SMPN 22 Bandar Lampung (high-rank school) and SMPN 8 Bandar Lampung (middle-rank school). Then at each selected school, two classes are taken randomly. One class follows GIL and one class follows conventional learning in high-rank school. In middle-rank school, one class follows PBL and one class follows conventional learning. The research design used was a pretest-posttest control design. The study began with taking a pretest in the experiment and control class, then conducting scientific approach learning in the experiment class and conventional learning in the control class, then performing posttest in both classes.

This research uses two types of research instruments, namely test and non-test. The test used to measure mathematical reflective thinking skills was developed from descriptions and indicators of reflective thinking skills. The indicators measured in the test are reacting, comparing, and contemplating [4]. The stages of development of the test were making a blue print of test items, making the problem and compiling the test item, making answer problem and scoring guidelines of test which were compiled based on indicators of mathematical reflective thinking skills. After that, the test was tested and then the results of the testing were analyzed to find out the quality of the questions including validity, reliability, level of difficulty, discrimination power. An example of a problem that represents mathematical reflective thinking skill is "*Karin wants to make bags from yarn with a combination of 2 colors (red and black). She will make bags with two different designs namely design A and design B. She needs 5 meters of red yarn and 10 meters of black yarn to make bags with design A, while 10 meters of red yarn and 5 meters of black yarn to make bags with design B. If she has 50 meters of red yarn and 75 meters of black yarn, she estimates can make 4 bags A and 3 bags B. Is Karin's estimation correct? Show it*!".

The non-test was the self-efficacy scale used to measure students' self-efficacy in learning mathematics. The self-efficacy scale is compiled by a Likert scale with four choices: strongly agree (SA), agree (A), disagree (DA), and strongly disagree (SDA), with no neutral option. The dimension of self-efficacy adapted from [6] was magnitude, strength, and generality. Before being used, the self-efficacy questionnaire was checked for eligibility by experts to see the suitability of the self-efficacy indicator with the statement given. To analyze the research data, it was tested the Normality and Homogeneity of Variants and the Test of Two Average Differences

3. Result and discussion

3.1 Result

The data of mathematics reflective thinking skills is obtained through pretest and posttest conducted at the beginning and the end of the learning. Descriptive analysis of pretest and posttest of students in scientific learning and conventional learning are presented in Table 1.

Tabel 1. The data of of mathematics reflective thinking skills

			High-rank school – GIL[a]							
			Experiment				Control			
Data	N	Max Score	x_{min}	x_{max}	$\bar{x}$	s	x_{min}	x_{max}	$\bar{x}$	s
Pretest	28	40	3	11	6,43	2,15	11	18	6,54	3,69
Posstest		40	11	39	25,50	8,98	8	33	19,71	7,79

			Middle-rank school – PBL[b]							
			Experiment				Control			
Data	N	Max Score	x_{min}	x_{max}	$\bar{x}$	s	x_{min}	x_{max}	$\bar{x}$	s
Pretest	28	64	0	22	6,48	5,79	0	26	8,18	7,33
Posstest		64	17	62	37,14	12,73	6	56	28,54	14,84

[a]Guided Inquiry Learning
[b]Problem Based Learning

Based on the data in Table 1, in high-rank school and middle-rank school, the average of pretest score students' mathematical reflective thinking skills in the experimental group and control group was not significantly different. Furthermore, the pretest data were analyzed using the t-test so that it was found that the prior mathematical reflective thinking skill in both classes was the same. The posttest score of students' mathematical reflective thinking skills in the experimental group was higher than the control group. Then, the highest posttest score was found in students in the experimental group while the lowest posttest score was found in students in the control group.

From the data that has been described in Table 1, then several hypotheses are tested related to the students' reflective thinking skills. For this purpose, the normality test is performed using the chi-square test against both groups of data. The results of the calculation of the normality test of the data for each research data showed that the data of students' reflective thinking skills in the experimental group and the control group for high-rank school and middle-rank school came from the population with a normal distribution.

Test the homogeneity of variance on the data in the experimental class and control class using the F-test. Based on the results of the homogeneity test it is known that both data groups have homogeneous variances. Furthermore, a summary of the results of the average difference test for research data on students' reflective thinking skills is presented in Table 2.

Table 2. t - test to posttest score of students' reflective thinking skills

High-rank school – GIL					
Class	Mean	Df	t_{count}	t_{table}	Decision
Experiment	25,50	54	2,58	1,67	H_0 rejected
Control	28,54				
Middle-rank school –PBL					
Class	Mean	Df	t_{count}	t_{table}	Decision
Experiment	37,14	54	2,29	1,67	H_0 rejected
Control	28,54				

Based on the results presented in Table 2, the results of the test analysis with the α level = 0.05; the average difference test between the experimental class and the control class by testing two parties at the middle-rank school was showing that t_{count} = 2,29 > t_{table} = 1,67. So, H_o rejected. This shows that students' mathematical reflective thinking skills in PBL were higher than the mathematical reflective thinking skills of students in conventional learning. Furhermore, the result of t-test at high-rank school show that t_{count} = 2,58 > t_{table} = 1,67 with α level = 0.05. So, H_o rejected. This shows that the students' mathematical reflective thinking skills in GIL were higher than the mathematical reflective thinking skills of students in conventional learning. After processing the posttest result data for students' self-efficacy in the experimental group and the control group, obtained data as presented in Table 3

Table 3. The data of self-efficacy

High-rank school – GIL									
		Experiment				Control			
N	Max Score	x_{min}	x_{max}	$\bar{x}$	s	x_{min}	x_{max}	$\bar{x}$	s
28	120	61	109	86	9,08	66	111	87,54	8,51

Middle-rank school – PBL									
		Experiment				Control			
N	Max Score	x_{min}	x_{max}	$\bar{x}$	s	x_{min}	x_{max}	$\bar{x}$	s
28	80	39	71	55,54	6,58	38	65	55,32	6,52

Based on the data in Table 3, in high-rank school and middle-rank schools, the average of students' self-efficacy scores in the experimental group was relatively the same as students' self-efficacy in the control group. Furthermore, the standard deviation in the control group and experimental group was not significantly different. From the data that has been described in Table 3, then several hypotheses are tested related to students' self-efficacy.

For this purpose, the normality test is performed using the chi-square test against both groups of data. The results of the calculation of the normality test of the posttest data for each research data showed that the data of students' self-efficacy in the experimental group and the control group for high-rank school and middle-rank school came from the population with a normal distribution. Test the homogeneity of variance on the data in the experimental class and control class using the F-test. Based on the results of the homogeneity test it is known that both data groups have homogeneous variances. Furthermore, a summary of the results of the average difference test for research data on students' self-efficacy is presented in Table 4.

Table 4. t - test to score of students' self-efficacy

High-rank School - GIL					
Class	Mean	Df	t_{-count}	t_{-table}	Decision
Experiment	*86,00*	*54*	*-0,65*	*1,67*	*H_0 accepted*
Control	*87,54*				

Middle-rank School - PBL					
Class	Mean	Df	t_{-count}	t_{-table}	Decision
Experiment	*55,54*	*54*	*0,12*	*1,67*	*H_0 accepted*
Control	*55,32*				

Based on the results presented in Table 4, the results of the test analysis with the α level = 0.05; the average difference test between the experimental class and the control class by testing two parties at the high-rank school and middle-right school was showing that t_{-count} was in the Ho reception area. Thus, Ho was accepted. This means students' self-efficacy in PBL was not different from the self-efficacy of students in conventional learning and students' self-efficacy in GIL was not different from the self-efficacy in conventional learning.

3.2 Discussion

Based on the results of data analysis and hypothesis testing it can be seen that students' mathematical reflective thinking skills in PBL were higher than students' mathematical reflective thinking skills in conventional learning and students' mathematical reflective thinking skills in GIL was higher than students' mathematical reflective thinking skills in conventional learning. Therefore, it can be concluded that scientific learning has contributed to improving students' mathematical reflective thinking skills. This is consistent with research related to mathematical reflective thinking and scientific learning, including the research of [4], [16], [17].

The PBL can influence students' mathematical reflective thinking skills because PBL steps provide students opportunities to improve their mathematical reflective thinking skills. At the beginning of learning, students were given contextual problems, so that students' abilities in responding to a given problem (reacting) can be improved because students have been trained to mention what they know, what is asked, as well as the relationship between the two given problems. Then, The ability to analyze and clarify individual experiences to evaluate actions that are believed (comparing) can be increased through discussion activities to present the results of the work, because in this activity students develop the ability to explain effective methods to solve the given problem, connecting the problem being asked with the problem being addressed students have faced before, and explain the intentions and answers that have been obtained from the results of the discussion. Furthermore, the ability to inform and analyze the correctness of answers (contemplating) can be improved through problem-solving evaluation activities, because in this activity students detect the truth and error of determining the answer to a problem, correcting errors, and concluding information correctly. This is in accordance with the opinion of [18] that the problem-based learning model can train reflective thinking skills. Based on the explanation above, it can be concluded that the application of PBL models affects students' mathematical reflective thinking skills. This is consistent with the results of [4] which shows that increasing the mathematical reflective thinking skills of students who get PBL models was higher than students who get conventional learning.

The contribution of scientific learning to the improvement of students' mathematical reflective thinking skills is also seen GIL class. This is consistent with the result of research [19] which show that students' mathematical reflective thinking skills using collaborative inquiry learning were higher than students' mathematical reflective thinking skills that did not use collaborative inquiry learning.

GIL has six steps that provide students opportunities to improve their mathematical reflective thinking skills. The steps of GIL namely orientation, formulating problems formulating hypotheses, collecting information, testing hypotheses and formulating conclusions. In the orientation step, students are given information about the main points of learning activities and provide motivation through explanation related to the importance of topics to be learned for life. The second step is formulating the problem, at these steps, students work in groups, students are given the opportunity to identify problems related to what is known as well as what is asked about the problem given. With groups, students can discuss and exchange information to identify the problems that are given so that with the discussion students will be easier and more effective in solving the problem. Through this activity, the ability of students to responding and investigating the problem given will be increased. Thus, at this step can improve indicators of mathematical reflective thinking skills, namely reacting.

The third step is to formulate a hypothesis. At this step, students formulate answers to the problems given by analyzing the problem then formulate a relationship between the problem being faced with the prior knowledge they have. One way to help students connect problems with prior knowledge is to give questions related to the given problem, this is reinforced by Gagne's learning about information processing. In this information processing theory, the stimulus will not reach short-term memory if the stimulus provided is not a concern. Recalling information in long-term memory will improve if student relates that information to the information that they have when student receive new information so that with questions relating to the problem to be given, students can recall their prior knowledge. Thus, at this step can improve indicators of mathematical reflective thinking skills, namely comparison.

The fourth step is collecting information. At this step, students are given the opportunity to collect information from various sources to support hypotheses that have been formulated previously, based on the formulation of hypotheses from information that has been obtained, then students can make decisions about the appropriate method of solution to be used in solving problems. Next, the fifth step is testing the hypothesis. At this step, students describe each potential solution based on information that has been obtained before. Then, they are given the opportunity to examine carefully to prove the truth of the results of the solution to be the best solution and evaluate what has been done to be used as a solution and conclusions from the problem. Thus, at this step, it can improve indicators of mathematical reflective thinking skills, namely contemplating. The last step is to conclude. In this step, students conclude the results obtained with the guidance of the teacher. At this inquiry learning process, students understand new concepts that they learn meaningfully because students find out solution about the given problem independently and the teacher only guides if there is a misconception. This is consistent with the result of research with the study of [20], that reflective thinking processes are not dependent on student knowledge only, but also process how to use their knowledge to solve problems. If students can find a way to solve problems so that it can achieve its goals then the student has done reflective thinking processes.

Regarding students' self-efficacy, the results showed the students' self-efficacy in PBL was not different from the self-efficacy of students in conventional learning and the students' self-efficacy in GIL was not different from the self-efficacy of students in conventional learning. Therefore, it can be concluded that scientific learning has not meaningful contributions to improving students' self-efficacy. This result study is consistent with the research result of [21]. This is because PBL and GIL model is a new learning model for students and its implementation is relatively short so that students are not accustomed to following the PBL and GIL. This is reinforced by Fukuyama's opinion [22] which states that to improve students' self-efficacy there are at least four ways, first, namely by understanding what must be done or getting used to completing assignments well (mastery learn to do the task well). Second, by finding examples from others and observing how it works (modeling and observing others). Third, by seeking support or support from others or the environment. Fourth, by reinterpreting stress. In the first way, it is mentioned that to improve self-efficacy students must be familiar with the tasks assigned, but in this study, students are not accustomed to following scientific learning because the time given to introduce scientific learning is very short. So, scientific learning has not been able to improve students' self-efficacy with a short time.

4. Conclusion

Based on the results of data analysis, it can be concluded that scientific learning effective to improve students' mathematical reflective thinking skills but it has not meaningful contributions to improving students' self-efficacy. This is seen from: (1) student's mathematical reflective thinking skills in PBL and student's mathematical reflective thinking skills in GIL were higher than student's students' mathematical reflective thinking skills in conventional learning, (2) student's self-efficacy in PBL and student's self-efficacy in GIL were not different from student's self-efficacy in conventional learning. Based on the research, it was suggested that: (1) considering that students' self-efficacy in scientific learning was not optimal, it was necessary to conduct further studies on the application of scientific learning to students by paying attention to several weaknesses in this study; (2) It should be explored about the contribution of other scientific learning models to improving students' mathematical reflective thinking skills.

Acknowledgement

We would like to thanks to the team of research and University of Lampung. This project would never have been possible without the support and guidance of them. Special thanks should also be given to SMPN 8 Bandarlampung and SMPN 22 Bandarlampung for giving us the opportunity to do the research in there.

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