The Constructivist Approach to Student's Metacognitive Formation

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Abstract
Success in education and learning is determined by the willingness and ability of students in designing and planning learning. The ability to plan, design, implement, and evaluate learning is included in metacognition. The urgency in the research is that not all teachers are able to design a learning approach for the development of students' metacognitive abilities. Some of the learning approaches implemented by the teacher are still not applicable. If this is allowed, it will have an impact on students' low metacognition. The type of research used is pre-experimental One Group Pre-test – Post Test Design. The research target schools were 186 Bandar Lampung State Elementary Schools. The sample was taken by stratified random sampling, namely SD with an Accreditation so that 40 State Elementary Schools were obtained. The research subjects were students in grades 1, 2 and 3 in each sample school. The results showed that the constructivist approach can improve students' metacognitive abilities. Students who have high metacognitive abilities can develop knowledge, find ideas, conclude lessons, develop problem solving strategies, estimate time estimates, have high creativity and have independence in learning.
Keywords: Constructivist, Metacognitive, Learning, Evaluation

INTRODUCTION

Metacognition is the knowledge and control that a person has over his or her way of thinking or learning activities (Cross & Paris, 1988). In another sense, metacognition is a person's ability in the learning process to plan learning, conduct learning, control the learning process, evaluate, and continue the learning process in order to obtain effective strategies so as to obtain maximum results. Metacognitive abilities are needed by students so that they are able to determine the right steps and strategies in the learning process. A teacher must have a way so that students are able to develop metacognitive abilities in learning because the success of learning is determined by the students themselves. This means that metacognition is included in high cognitive abilities, namely synthesizing and creating learning steps as the basis for fostering inquiry and creativity abilities.

The constructivist approach leads to metacognition, namely: the formation of creativity, self-confidence and forming human lifelong learners. The problem that has emerged so far is that learning has been designed using a constructivist approach, but has not fully formed meta-cognitive abilities. Existing education is only oriented to the development of low-level thinking processes. Learning should familiarize students with metacognitive skills, not only cursory thinking with shallow meanings, but also teaching students to design a strategy or steps to get maximum results. The school curriculum in Indonesia requires teachers to apply a learning approach, one of which is able to develop metacognitive in addition to other aspects, which will be able to trigger the formation of student creativity. The urgency in the research is that not all teachers are able to design a learning approach for the development of students' metacognitive abilities. Some of the learning approaches implemented by the teacher are still not applicable. If this is allowed, it will have an impact on students' low metacognition. Students who have low metacognitive abilities are not able to plan, design, implement, and

evaluate learning so that educational attainment is not optimal. The urgency of the research findings will be one of the models for elementary school teachers in developing students' metacognition. Therefore, a teacher must have something as a facilitator and guide students so that they can explore knowledge and foster concepts that are obtained through learning experiences (constructivism). Constructivism approach is expected to be an effective way for teachers to improve students' metacognitive abilities. In general, this study aims to determine the differences in constructivist learning models on the metacognitive formation of students in elementary schools in Bandar Lampung City. The research contributions are: (a) for teachers, assisting teachers in developing students' metacognitive, (b) for school principals, as a basis for socialization and providing motivation for teachers to apply a constructivist approach to learning so that metacognitive development develops.

(Olsen, 1999)argues that the general perspective of constructivism is that students' knowledge construction is basically a learning process that involves change. Students of the digital age of the 21st century are more demanding and more need to connect new information with their previous knowledge with other disciplines. From this, the teaching process using constructivism becomes effective in the intellectual and sensual development of students (Savas et al., 2012). Constructivist activities empower learners to remember their experiences and beliefs to create new knowledge (Gunduz & Hursen, 2015).

RESEARCH METHODS

The type of research used is pre-experimental research with the design in this study is One Group Pre-test-Post Test Design. The design was used in the study because it used one group to see the difference in results due to the treatment given (constructivist approach). By using one group, it will show the difference in results due to the treatment given.

Table 1. Research Model Design

Start	Treatment	End
0_1	X	0_2

Description:
01 = Value before being treated
X = Treatment (constructivist approach)
02 = Value after being treated

Participant

The research was conducted in elementary schools in the city of Bandar Lampung, Lampung, Indonesia. The number of schools that became the research target was 186 State Elementary Schools. The sample was taken by stratified random sampling, namely SD with an Accreditation so that 40 State Elementary Schools were obtained. The research subjects were fifth grade students of public elementary schools who were ranked 1, 2 and 3 in each of the sample schools in the city of Bandar Lampung. The total number of samples in this study was 120 students. The distribution of students in the Lampung area is expected to provide real results as expected with minimal bias/error. Teachers from each sample school have been conditioned to provide constructivism teaching, especially in mathematics. The final value after treatment will be used as the result of the study as a comparison of the initial and final values of the study.

Data Collection

The constructivist approach research was conducted by fifth grade school teachers in the sample schools in mathematics. The data was collected by the teacher by giving an initial

test to the students as a pre-test score. Furthermore, the implementation of constructivist-based learning is carried out by classroom teachers in particular mathematics subjects. The final score is taken by the teacher by giving a final test as a result of giving treatment as a post-test score. Data from the pre-test and post-test results will be processed using SPSS to see the differences in students' initial and final abilities after receiving constructivism learning treatment. Furthermore, the mean difference test was carried out using SPSS. The results are the mean difference between the pre-test and post-test, the difference between the mean pre-test and post-test, the t-count value, and the sign value. Hypothesis testing is done by comparing the value of t-count with t-table. If the results of t-count> t-table, then the alternative hypothesis is accepted and the null hypothesis is rejected. On the other hand, if the t-count < t table, the null hypothesis will be accepted and the alternative hypothesis will be rejected. Before testing the hypothesis, the data is first tested for normality to ensure that the data used is normally distributed.

RESEARCH RESULTS AND DISCUSSION

Preliminary research has been conducted on fifth grade elementary school students in Bandar Lampung with the following results:

Table 2. Metacognitive Elementary School Students Grade V

No	Component	Indicator	Yes	No
1	Planning	Determine initial information related to the problem	v	
		Deciding what to do	v	
		Calculate the time required		v
		Ensure the suitability of information with problems		v
2	Monitoring	Manage every step goes well		v
		Analyses important information	v	
		Deciding what steps to take		v
3	Evaluation	Make sure every step has run	v	
		Re-examine special considerations in solving problems		v
		Estimating other possible ways that can be used to solve the problem		v
		Estimating the possible use of strategies that have been used to solve other problems.		v

Based on an initial study of several teachers, there are still several indicators of the metacognitive component that have not been mastered by students (Table 1) as the problem of this research. For this reason, it is necessary to develop a constructivist approach for the metacognitive formation of fifth grade students at SD Bandar Lampung City. The initial research was conducted to see the gap between expectations and targets in learning that occurs in schools. In the constructivism learning model all indicators must be met like planning, monitoring, and assessment. Each indicator is developed into several sub-indicators. Planning indicators can be developed into: initial information, things to be done, estimated time, and suitability of information with problems. The monitoring indicators are developed into several indicators setting the steps to be taken, analysing the information, and determining what will be done. The assessment indicators are developed into several indicators: ensuring steps are running, checking and solving problems, determining the possibility of using other methods, and estimating one strategy to solve other problems.

In the planning component, educators have determined initial information related to the material problems to be studied. Educators also determine the things that will be done during the learning process. However, educators do not take into account the time needed to achieve learning targets are achieved. Time is crucial in learning because education requires a target

time taken. Learning in schools is limited by time, so the estimation of time calculation is very necessary before teaching so as not to collide with other subject matter and also to ensure learning outcomes within a certain period of time. In terms of the suitability of information with the problems to be discussed, educators also do not ensure its suitability. Educators do not think about what problems are appropriate to convey in a subject matter so that the relationship between the material and the problem becomes synchronous.

In monitoring indicators, educators have not ensured every step used in learning. Educators also have not decided what will be done during the teaching and learning process but educators have analysed important information about learning materials. In terms of monitoring the steps that will be taken by educators should have been planned before learning begins. Educators have determined what will be done in the classroom, educators have decided later to do learning in what way, and also educators have planned various possible steps that will be taken. Determination of learning steps is the task of educators before teaching. Determination of steps is very important in the learning process so that educators when in class are not confused about what to do. Learning should not go without a plan because the results of unplanned learning will most likely not succeed optimally.

In the assessment indicators, educators do not examine special considerations in solving problems. Educators only do one way to solve problems in a learning material. Educators should consider other possible ways of solving a problem. One problem can be solved in various ways, so that students have some picture in solving problems in many ways. There are various ways that make students think at a higher level because students will take into account the right time estimate in solving problems. Educators should teach a way to solve various problems and also educators teach one problem can be solved in several ways. This must be done so that students think more critically and creatively about a problem they face. The assessment process must be carried out by educators to ensure the achievement of the learning process that has been carried out. The research was conducted by giving treatment to students in the sample schools on mathematics subjects, namely teachers teaching the constructivist method for 2 months. Furthermore, students are given a metacognitive basis which has previously been tested for validity and reliability against experts. Furthermore, the normality test was carried out as a prerequisite for data analysis. The results of the pretest and posttest scores are as follows:

Table 3. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	53.2167	120	7.06772	.64519
	Posttest	67.8833	120	7.54057	.68836

Summary of the results of descriptive statistics from the two samples studied, namely the pre-test and post-test scores. The mean value of the pre-test was 53.22 while the mean for the post-test was 67.88. The number of samples used in the study was 120 students. Mean post-test (67.88) > mean pre-test (53.22), descriptively there are differences in the average student learning outcomes with constructivist learning methods. To prove that the difference between the pre-test and post-test is real, a paired sample t test is carried out.

Table 4. Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			

Pair 1	Pretest-posttest	-14.667	5.733	.523	-15.703	-13.630	-28.027	119	.000

Research Hypothesis:

H_0 = There is no average difference between pre-test and post-test learning outcomes with constructivist learning models

H_1 = There is an average difference between pre-test and post-test learning outcomes with constructivist learning models

Output table 4 Paired Samples Test contains a difference in the mean value of 14.667 which means that the difference in the mean between the post-test and pre-test. Furthermore, the value of t count is 28.027 and t table (0.05/2; 119) is 2.270 or the sign value is 0.00. The basis for decision making is to compare the value of t arithmetic with t table, namely 28.027 > 2.270 or 0.000 < 0.05, it can be concluded that H_o is rejected and H_1 is accepted. The final result states that there is an average difference between the post-test and pre-test learning outcomes with the constructivist learning model.

Discussion

Learning with the concept of constructivism shows an increase in the final score of students. This is evidenced by the mean pre-test value of 53.2167 and the post-test mean value of 67.8833. A higher average post-test value indicates that there is an increase in the average score of students after learning to use constructivism theory. These differences can be ascertained due to the influence of the learning model with constructivism applied by the teacher. Learning by using constructivism model effectively increases knowledge. Thus, teachers are advised to use a constructivist learning style. The success rate of learning is influenced by many things, one of which is the applied learning model. Learning motivation, teacher support, school support, environmental conditions also greatly affect student learning outcomes. However, in this case the teacher teaches with a constructivism model, high student learning motivation, and school support will bring changes to the final learning outcomes.

The results of the statistical test in table 4. The paired sample test shows that the mean value of the pre-test minus the mean post-test is -14.667. A negative result indicates that the mean value of the post test is greater than the mean value of the pre-test. From these brief results, it can be concluded that the mean post-test is better than the mean pre-test. This shows that there is a change in the mean value of students after learning with constructivism and research on the submission of alternative hypotheses and null hypotheses. The research alternative hypothesis states that there is an average difference between pre-test and post-test learning outcomes with the constructivist learning model. The null hypothesis states that there is no average difference between pre-test and post-test learning outcomes with the constructivist learning model. Hypothesis testing was carried out to see the t value of 28.027. Next, look at the t-table value with a margin of error of 0.05 and a degree of freedom (df) of 119 (120-1) of 1.980. Comparing t-count with t-table is 28.027 > 1.980. Because t-count is greater than t-table, the alternative hypothesis is accepted and the null hypothesis is rejected. The conclusion is that the alternative hypothesis is that there is an average difference between pre-test and post-test learning outcomes with the constructivist learning model. Conclusions can also be drawn by looking at the sign value (2-tailed) of 0.000. Sign value (0.000) <0.05 which states that accept the alternative hypothesis and reject the null hypothesis. The conclusion obtained is that there is an average difference between pre-test and post-test learning outcomes with the constructivist learning model.

Constructivism theory states that learning does not have to be by remembering a fact, rote/concept, or standard rule. Rather, learning is the process of forming (constructing) knowledge by students personally, in other words, students must be active in the learning process, active in thinking, actively drafting concepts, and active in giving meaning to what is being studied. (Mahnaz Moallem, 2001) states that constructivism speculates that knowledge does not exist independently of the learner, but is constructed by the learner. Learning is basically a social activity (Vygotsky, 1978). Constructivists claim that it is we who form or construct knowledge, based on our theory or experience, (Nola, 1997, p.32). Knowledge development in the learning process requires the active involvement of the learner (Jenkins, 2000, p.601). Constructivism teaches students to think independently, think actively, conclude a material that has been studied, and create a new concept about the material being studied. Science must be sought and not exist by itself. The concept teaches that each individual must seek knowledge in various ways. To gain knowledge, students must try themselves by reading books, listening to the teacher deliver the material, and also even by doing practice questions.

The constructivism learning model is proven to improve students' metacognitive abilities. In this case, constructivism-based learning must be carried out by the teacher in an effort to solve the problem of students' low metacognitiveness. Constructivism learning can improve students' higher-order thinking skills and creativity. The constructivism learning model can make students become independent so that they are accustomed to solving problems and choosing a solution strategy. Constructivism states that knowledge already exists in students. According, (Tobin & Tippins, 1993) constructivism is a form of realism where reality can only be known personally and subjectively. Piaget expressed students' reactions as experiences in the learning process. Vygotsky's perspective explains that social constructivism has an important role in changing meaning from experience to knowledge (Prince & Felder, 2006). Knowledge must be developed by a student actively to formulate concepts based on previous experience and knowledge. The constructivist learning model is a learning model with active students contributing directly to learning and gaining knowledge from classes. Students who practice diligently will get a lot of learning experience. The more diligent students are to study; the students will be able to conclude the material they are learning. Constructivism learning style will be successful when students have the awareness to learn independently. Constructivism learning style must get a boost in a person's intrinsic motivation. Teachers have an obligation to direct students to continue learning and motivate students. Schools provide encouragement and support the achievement of constructivism learning models. Constructivism will work well if students have high motivation, teachers provide support, and schools provide support in the form of facilities and infrastructure.

In metacognitive learning, teachers must carry out planning, monitoring, and assessment. 1). Planning is done by determining initial information related to material problems, determining the learning to be carried out, taking into account the need for learning time, and ensuring the suitability of the learning material with the problem. 2). Supervision is carried out by regulating every step in the learning process, analysing important information, and deciding the right steps to be taken. 3). Assessment is carried out by ensuring that every step has been carried out, re-examining special considerations in solving problems, estimating other possible ways that can be used in solving problems, estimating the possible use of strategies that have been used to solve other problems. The application of metacognition-based learning model is the most effective way for teachers to improve metacognitive skills. The learning model is for example problem-based learning (Haryani et al., 2018). Problem-based learning is a metacognitive learning. Learning in the class that uses a problem-based approach will teach students actively to everyday problems

that exist in the environment. Students can directly observe the occurrence of a problem, look for causes and identify problems. Thus students learn to solve problems by reviewing concepts and linking them to the lesson being studied. The more students get used to everyday problems; the learning process will be more interesting and attract students to continue learning. Identifying problems and solving problems is a metacognition of the lesson. The more students are taught with various real-life problems, the more students learn is not in vain. If the concept of metacognition is taught effectively in schools, student achievement will increase significantly. In other words, when teachers integrate metacognition-based learning into their teaching, student learning outcomes are optimally enhanced (Perry et al., 2019). Therefore, in the learning process it is recommended to apply various forms of learning that can optimally empower students' metacognitive skills (Fauzi & Sa'diyah, 2019).

Each teacher is expected to develop a constructivism-based learning method so that students' metacognitive knowledge increases. The planning process is carried out to ensure every step the teacher will take in the teaching and learning process. Good planning will have an impact on the smoothness of the teaching and learning process. Planning begins with finding the right problem topic with the subject matter and determining the estimated learning time. Learning must take into account time efficiency so that teachers can maximize teaching well. The second step, namely the supervision of learning, is carried out by observing the on-going process of education and also deciding the appropriate steps to be used. The last step is the assessment step. Education will be based on the end result, which is to see the success of learning by ensuring the right steps. Cognitive science is a thought about the mind in the human brain (Daniels Friedenberg & Silverman, 2005), so learning about cognitive is changing the way of thinking for the better. Metacognition is one of the most important functional processes in the learning process (Gurbin, 2015). In learning activities, students use metacognitive strategies even though they are not aware of it directly (Gaudensia Bria & Laos Mbato, 2019). To improve students' ability to think and decide on a problem, educators must make careful learning plans. Constructivism-based learning can improve students' metacognitive abilities. Critical and creative thinking skills are part of students' metacognitive abilities. Consideration of estimated learning time should be taken into account by educators because learning must take into account achievement. Therefore, in learning must consider empowering students' metacognitive skills through the application of appropriate learning strategies. Metacognitive skills training increases students' awareness to learn, to plan their learning, to control the learning process, build critical thinking to evaluate self-efficacy in learning, reflect on learning, and to evaluate own strengths, abilities and weaknesses (Bahri & Corebima, 2015). Educators must have their own strategies in dealing with the diversity of students. Educators must have various ways to overcome the problem of plurality of educators in terms of the level of thinking ability. Educators must also have many plans to achieve and ensure the learning process can be carried out well with maximum results.

The most important thing is the use of the same strategy to be used in solving various other problems as well as learning many strategies to solve problems. The final result is that students have high metacognitive abilities by having a variety of good problem-solving strategies that will be used to solve the same or different problems. Metacognitive means that students can think at higher levels by considering the time of completion, using various ways of solving problems, and students can draw conclusions every step of the way. Constructivist reciprocity is high student metacognitive. With good metacognitive students' creativity becomes good and learning runs smoothly for all subjects because students are used to being independent. Developing metacognitive skills has an important role in improving critical thinking skills and controlling students' learning processes. Metacognitive skills can be

improved through the application of learning strategies that involve higher-order thinking (Amin et al., 2020) . Metacognition is the strongest trigger in learning critical thinking (Ingle, 2007). Students who are aware of their metacognitive abilities will be able to improve their learning and academic abilities (Perfect & Schwartz, 2002). People who think cognitively ideally can create theories, build ideas/opinions and can understand the world (Lakoff, 1987). Metacognitive activities are carried out by planning learning, monitoring, self-regulation so that they can contribute optimally (Harris et al., 2010). In constructivism-based learning, there are several indicators that must be carried out by educators, namely: planning, monitoring and assessment. Each indicator must be implemented by educators properly. Each indicator must be well planned as well. If all indicators are carried out and planned, then learning will run smoothly with maximum results. In research, researchers ensure educators to carry out planning, monitoring and assessment in the learning process. Each sub-indicator must be carried out by the teacher in order to ensure the learning process runs smoothly.

In the first indicator, it is planning, the educator must determine the initial information to be carried out, determine the things that will be implemented, consider the estimated learning time, ensure the suitability of the information with the problems discussed. Determination of initial information is carried out by educators to open the class well, ask how things are, check class conditions, check student attendance, repeat past learning, provide information about the material to be discussed today. This process must be carried out as a stimulus for students before carrying out core learning. Furthermore, educators do things that have been previously planned so that the learning process goes well. Adjustment of problems given to students should be related to everyday life so that students can better appreciate and understand learning that is connected with real life. Learning feels more interesting when learning material is connected to real problems that actually happen and experienced by students directly. Students become interested in a subject matter and students feel that the material presented is useful in real life. In learning a teacher must also ensure the estimated time used in the teaching process. Studying too long will make students bored, while learning that is too short makes students not fully understand the learning process. The teacher must ensure that the time used for learning is appropriate. The condition of students must also be considered, considering that not all students have the same ability to learn.

The second indicator (monitoring) is managing each step used in learning, analysing important information, and deciding what steps to take. Educators must ensure that each learning process runs well. The planning that has been done previously is applied during the learning process. Good planning will make the final learning outcomes good. Educators must have multiple plans, not just one plan. If the first plan fails to be implemented, then the teacher can move to the second plan that has been prepared previously. The information conveyed during the learning process must also be ensured in accordance with the learning materials, according to the age of the students, and in accordance with the students' thinking abilities. Educators must understand the extent to which the ability to capture and think of their students. Synchronizing the suitability of the information provided, the problems presented and the abilities of students are important for educators to do.

The third indicator (monitoring) with several sub-indicators ensures the learning process is learning, re-examines the considerations in solving problems, predicts that a problem can be solved in several ways, and uses one method to solve other problems. The learning process must be ensured by educators that it runs according to the initial plan. If a learning process is deemed inappropriate, educators must ensure that learning continues by considering other ways that can be used in the learning process. Furthermore, to improve critical and creative thinking skills, educators must introduce students to several ways of

solving problems. A method can be used to solve various kinds of problems so that students' thinking levels increase in this case higher-order thinking skills. Educators also teach students to solve a problem in various ways so that educators can think of the most appropriate way to solve a problem. Critical and creative thinking skills are included in metacognitive abilities. Students taught with appropriate constructivism methods will have high metacognitive abilities. Educators must fully understand the metacognitive steps by arranging learning steps according to constructivism indicators.

CONCLUSION

The constructivist approach can improve students' metacognitive abilities in Bandar Lampung Elementary School. This is evidenced by the difference in the average initial score of students before receiving treatment of 53.22 and the average final score of students that is equal to 67.88. Statistical tests showed that there were differences in the results of students' metacognitive abilities before and after being given constructivist learning treatment. t value of 28.027 and t-table value with a margin of error of 0.05 and a degree of freedom (df) of 119 (120-1) of 1.980. Comparing t-count with t-table is 28.027 > 1.980. Because t-count is greater than t-table, the alternative hypothesis is accepted and the null hypothesis is rejected. The conclusion is that the alternative hypothesis is that there is an average difference between pre-test and post-test learning outcomes with the constructivist learning model. Conclusions can also be drawn by looking at the sign value (2-tailed) of 0.000. Sign value (0.000) <0.05 which states that accept the alternative hypothesis and reject the null hypothesis. The conclusion obtained is that there is an average difference between pre-test and post-test learning outcomes with the constructivist learning model. Teachers must develop a constructivist-based learning approach so that students' metacognitive abilities increase. Students who have high metacognitive abilities can develop knowledge, find ideas, conclude lessons, develop problem solving strategies, estimate time estimates, have high creativity and have independence in learning.

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