DEVELOPING A CONSTRUCTIVISM APPROACH IN MATHEMATICS LEARNING

Nursupiamin
UIN Datokarama Palu, Indonesia
Email : nursupiamin@uindatokarama.ac.id

Lilies N.Tangge
Universitas Tadulako, Indonesia

Afadil
Universitas Tadulako, Indonesia

Abstract

Mathematics learning characterized by constructivism emphasizes building one's own understanding actively, creatively and productively based on previous knowledge and experience. The teacher's task in applying constructivism to mathematics learning is not only to transmit ideas to students, but also to change the conceptions they have to develop them, therefore teachers need to pay attention to students' initial conceptions before learning begins, this aims to make it easier for students in the process. processing new knowledge that will be received. In the implementation stage of constructivist mathematics learning, teachers must understand aspects of mathematics learning that are based on constructivist theory. In this regard, a number of aspects related to mathematics learning, namely (1) students construct mathematical knowledge by integrating the ideas they have, (2) mathematics becomes more meaningful because students understand it, (3) students' strategies are better assessed, and (4) students have the opportunity to discuss and exchange experiences and knowledge with their friends. Based on these aspects, as much as possible, the implementation of constructivism in mathematics learning must start from basic education for children.

Keywords: Constructivism Approach, Mathematics Learning

INTRODUCTION

The development of science, technology and information that occurs cannot be separated from the services of mathematics as a basic science. Apart from that, mathematics is also useful for solving problems in everyday

life. Considering the very importance of mathematics as a science and for people's lives, therefore, mathematics is studied when children study at the most basic level of formal education, namely at elementary school (SD) (Zain, S. F. H. S., et al, 2012).

Mathematics in SD/MI/SDLB is one of the subjects included in the Science and Technology (IPTEK) subject group which focuses on high-level skills intended to recognize, respond to and appreciate science and technology, as well as instilling habits of thinking and behavior. critical, creative and independent scientific knowledge. The background to the need for mathematics learning in elementary schools is to develop students' ability to think systematically and logically; can use mathematics in problem solving; and communicate ideas or thoughts using symbols, diagrams, or other media. Meanwhile, aspects of mathematics subjects in SD/MI education units in the 2006 curriculum are numbers, geometry and measurement, as well as data processing (Ministry of National Education, P. K. B, 2006).

Laz, H. A., & Shafei, K. E (2014) what causes students' low understanding of mathematics is that students are not given the opportunity to actively construct their own knowledge. This is in accordance with Cobb's opinion (MKPBM Team, 2001) Learning mathematics is a process where students actively construct mathematical knowledge both through experience and the results of interactions. Dewey (Altaftazani, D. H., et al, 2020) said that "learning by doing" means that a person's experience is gained from working or by directly doing it so that the learning results are not easily forgotten "I see I forget; I hear I remember; I do I understand". These principles can be realized through a constructivist approach, because the principle of constructivism is compiling or building students' own knowledge when they try to organize their new experiences based on the cognitive framework that already exists in their minds.

One of the teacher's efforts to improve the quality of learning is by implementing models, approaches and learning strategies that provide opportunities for students to be actively involved in learning the material through actions, experiencing for themselves, discovering and developing the knowledge gained. The approach used in learning mathematics is the constructivism approach (Faulkenberry, E. D., & Faulkenberry, T. J, 2006).

Constructivism is the basis for contextual approach thinking, namely that knowledge is built by humans little by little, the results of which are expanded through a limited context. Knowledge is not a set of facts, concepts or rules that are ready to be picked up and memorized. Humans must

construct that knowledge and give meaning through real experience (Fosnot, C, 2013). According to the constructivist view, applied learning must be centered on building students' knowledge independently. Students are trained to find information independently and be active in developing their own knowledge, so that student-centered learning can be realized (Bada, S. O., & Olusegun, S, 2015). Learning management requires good and thorough preparation so that this constructivist approach runs well. Providing apperception and motivation is very important to build students' enthusiasm for learning so that they can focus their attention on learning. Learning will be more impressive if you use group learning, because the ability to communicate both verbally and in writing also influences students' knowledge (Sarita, P, 2017).

RESEARCH METHOD

The study in this research is qualitative with literature. The literature study research method is a research approach that involves the analysis and synthesis of information from various literature sources that are relevant to a particular research topic. Documents taken from literature research are journals, books and references related to the discussion you want to research (Earley, M.A. 2014; Snyder, H. 2019).

RESULT AND DISCUSSION

Constructivist Approach

A. Understanding Constructivism

In constructivism, the term learning is defined as the process of constructing knowledge carried out by students themselves. Sanjaya in (Prastowo, A, 2019) states that learning is a process of a person's mental activity in interacting with their environment so as to produce positive changes in behavior, both changes in the knowledge aspect. Learning and teaching are two concepts that cannot be separated from each other. These two concepts become integrated in one activity where interaction occurs between teachers and students, as well as students and students during learning. Sanjaya's opinion is in line with what was stated by Skinner in (Susanto, A, 2013). Activities carried out by someone in a conscious state to obtain a new concept, understanding or knowledge. Furthermore, according to Retno in (Von Glasersfeld, E, 2012), learning according to constructivism theory means that students must find complex information

themselves, check new information with old rules and revise the rules if they are no longer appropriate.

Based on this opinion, it can be concluded that learning activities are not seen as activities of transferring knowledge from teachers to students, but learning activities are activities or processes of interaction between teachers and students or students, where students create knowledge or concepts in their own way in order to gain knowledge. through training or experience that results in positive changes in a person.

B. The purpose of Constructivism

Change is one of the things that must occur in the learning process, especially in terms of concepts. Where these changes take the form of assimilation for the first stage and also the second stage which is called accommodation. With assimilation, students will use the concepts they already have to deal with new phenomena. Meanwhile, with accommodation, students change their concepts which no longer match the new phenomena that are emerging. Thus, change remains the main goal even in the realm of constructivism theory (Mills, J., et al, 2006).

Meanwhile, if viewed from the objectives of constructivism theory, there are several other objectives that need to be understood, including:

1. Stimulate Innovative Thinking

   The aim of constructivism theory is indirectly as a form of effort to stimulate us to think innovatively and creatively. Innovative thinking is not easy, we need time and it is quite a long process. Where we need a long time to collect pieces of knowledge over time. Innovation itself will be born because it is supported by the knowledge that it already has. Of course, the knowledge possessed by each person will be different. There are people who have academic knowledge and there are also people who have non-academic knowledge. People who can unite academic and non-academic knowledge can encourage innovative and interesting thinking.

2. Can Increase Knowledge

   When talking about knowledge, we don't always have to get it in a formal setting. However, we can also get it on informal benches. Even when we play, have a picnic, or are gardening in our yard, we can also discover new knowledge. We can gain knowledge based on our sensitivity to the surrounding environment. For example, when person A can discover new knowledge when leaving the house, while person B does not gain new knowledge when leaving the house. So, whether or

not we can obtain knowledge depends on our abilities, desires, and also our sensitivity to the environment.

3. Discover Various New Things

   This constructivism theory aims to help us discover various new things. In whatever form it is, for example, many people seek happiness in various ways. Starting from someone treating their friends, going out with friends, and much more. There are also those who define happiness as having luxury goods. It doesn't matter even if we don't have money, are in debt here and there or work hard to get these luxury goods. Meanwhile, there are also those who define happiness by following the company of their friends. Even though the style is quite expensive, it is not a problem as long as you can still hang out with them.

   The explanation above proves that constructivism theory does not always tell us to follow other people's methods in order to discover new things. However, this new thing can be done in our own way without needing to be influenced by the definitions of people out there.

4. Forming Skills According to Abilities

   Whether we realize it or not, constructivism theory will direct us to find skills according to the abilities we have. Someone who initially had no interest in the world of writing, after learning about the advantages of writing, might encourage that person to become a writer. Or maybe this person already had hidden talents. But because of ignorance that there is hidden talent, an upgrade is needed and a stimulus is needed to activate the talent. So, the talents they have will be honed and can give birth to abilities and skills that match the potential that exists within them.

5. Encourage Independent Thinking

   The next aim of constructivism theory is to encourage us to think more independently and outside the box. At least, people who truly understand the essence of science will be more open-hearted and able to think more maturely. For those who have the ability to think maturely, their independent thinking is not just in the form of thoughts. However, it can also be seen from behavior and attitudes in everyday life. Because that independence will then encourage the quality of that person (Cooperstein, S. E., & Kocevar-Weidinger, E, 2004).

C. Benefits of Learning Constructivism

When talking about the benefits of studying constructivism theory, we will gain a lot. In fact, almost everyone will experience different benefits. Among them are: (Lieven, E., & Brandt, S, 2011).

1. Can Express Ideas Explicitly
   The first benefit of studying constructivism theory is that it helps us express ideas explicitly. It cannot be denied that as long as we study, of course there will be difficulties. This is the difficulty that we will try to solve later.
2. Providing New Experiences
   The benefits that are quite good are that we will get new things, new experiences, and also a new atmosphere related to the ideas we encounter. Because as we know, everyone has ideas. The nature of the idea itself is dynamic, that is, it can change over time and along with experience and the influence of our thinking ability on all things.
3. Inviting Someone to Think About Their Experiences
   This constructivism theory will indirectly lead us to something new. It is new and interesting things that will lead us to discover new experiences and discover new feelings. At least, constructivism theory will invite us to think about the experiences we have had into something more meaningful and sentimental.
4. Provides Opportunities to Identify Changes in Ideas
   As explained previously, the nature of each person's ideas is dynamic. This constructivism theory will provide an opportunity to identify changes from old ideas to new ideas based on logical reasons. Meanwhile, whether this idea is logical or not depends on the sensitivity and sensitivity of the brain and our feelings towards things around us.

Mathematics Learning with a Constructivist Approach

According to constructivism theory, knowledge is the result of construction carried out by humans. Knowledge cannot simply be given from one person to another, but the person who receives the knowledge must first process and interpret it themselves. Even in the learning process at school, students cannot simply receive finished knowledge from the teacher directly because learning is not something that is done to students (Vintere, A, 2018) but requires student activity to build their own knowledge by combining new knowledge and skills with knowledge and skills that already exist within him through previous experience, so that the knowledge he obtains is more meaningful and always remembered. There is almost never a learning process

without individual activity, students learning (Zain, S. F. H. S., et al, 2012). In this case the teacher should only act as a facilitator and motivator, because in essence teaching is not an activity of transferring finished knowledge from teacher to student. This is in line with Piaget's opinion, that knowledge is discovered, formed and developed by students, teachers only create conditions and situations that enable students to form meaning from learning materials through a learning process and store them in memory which can be processed and developed at any time. further (Vintere, A, 2018).

The development of learning using constructivism was carried out by Piaget. Piaget further stated that the theory of knowledge is basically a theory of the adaptation of the mind to reality, such as organisms adapting to their environment (Cemil, İ. N. A. N, 2013) using assimilation, accommodation, and controlled by the principle of balance. Assimilation is the absorption of new information into the mind, while accommodation is the restructuring of the mind's structure due to the presence of new information, so that the information has a place (Quintero, A. H., & Rosario, H, 2016).

Constructivism is an approach that views students as active individuals constructing their own knowledge by experiencing and working on it, in the process of entering the real world continuously, so that facts and skills are learned holistically and a process of connecting new knowledge and skills into new knowledge and knowledge occurs. previously possessed skills. Cobb, P., et al (1991) stated that constructivism is an approach to education and learning which is based on the assumption that cognition is caused by mental development, in other words, students learn by providing new statements with existing knowledge. Therefore, even in learning mathematics, to learn new mathematical material, past learning experiences (initial conceptions) as prerequisite knowledge for students will influence the process of learning mathematics, so the first step that teachers must take when teaching new material is the material. The new knowledge must be linked to existing concepts in the student's knowledge structure.

Elementary school students are generally aged 7-12 years, this age range is in the concrete operational stage, so to make it easier for students to learn new mathematical material, the learning process must be in context (real situations), including real objects as support that link knowledge and the skills they already have with the new material they will learn.

Learning based on a constructivist approach includes four stages, namely: (1) perception stage (revealing initial conceptions and generating students' learning motivation), (2) exploration stage, (3) concept discussion

and explanation stage, and (4) concept development and application stage (Rokaya, B. B, 2021).

The stages in learning with a more complete constructivist approach expressed by Yager (Major, T. E., & Mangope, B, 2012), are as follows.

1. Perception stage
   At this stage students are encouraged to express their initial knowledge about the concepts that will be discussed. If necessary, the teacher asks problematic questions about phenomena that students often encounter every day and relates them to the concept to be discussed, then students are given the opportunity to communicate and illustrate their understanding of the concept.
2. Exploration stage
   At this stage students are given the opportunity to investigate and discover concepts through collecting, organizing and interpreting data in an activity that has been designed by the teacher. Overall, at this stage, students' curiosity about phenomena in their environment will be fulfilled.
3. Discussion and concept explanation stage
   At this stage students think about explanations and solutions based on the results of student observations, coupled with teacher reinforcement. Next, students build a new understanding of the concepts being studied. When students provide explanations and solutions based on the results of their observations plus reinforcement from the teacher, students build a new understanding of the concepts being studied. This makes students no longer doubt about their conception.
4. Concept development and application stage
   In this final stage, the teacher tries to create a learning climate that allows students to apply their conceptual understanding, both through activities and through raising problems related to issues in the student's environment.

Implications of Constructivist Learning Theory in Mathematics Learning

The main focus of learning mathematics is to empower students to think in constructing mathematical knowledge that has been discovered by experts, not implementing procedural knowledge that has been discovered by previous mathematicians. In other words, from a constructivist perspective, Koehler and Grouws (MKPBM, T, 2001) state that learning has been seen as a continuum between negotiation and imposition at the ends. Someone who views that learning is a transmission, the process of knowing will follow the

imposition model. Meanwhile, those who believe that teaching is a process that facilitates construction will follow the negotiation model.

Imposition and negotiation are two different and equally important things. Where the imposition process is useful for teachers in communicating simple symbols in mathematics while negotiation is useful for teachers in communicating mathematics as a concept. Next, in the implementation stage of constructivist mathematics learning, we must understand the aspects of mathematics learning that are based on constructivist theory. In this regard, Hanbury (1996) suggests a number of aspects related to mathematics learning, namely (1) students construct mathematical knowledge by integrating the ideas they have, (2) mathematics becomes more meaningful because students understand, (3) students' strategies more valued, and (4) students have the opportunity to discuss and exchange experiences and knowledge with their friends (Xie, C., et al, 2018).

Based on these aspects, as much as possible, the implementation of constructivism in mathematics learning must start from basic education for children. Driver and Bell (Kusuma, J. W, 2021) propose the following characteristics: (1) students are not seen as passive but have goals, (2) learning considers the process of student involvement as optimally as possible, (3) knowledge is not something that comes from outside but constructed personally, (4) learning is not the transmission of knowledge, but involves managing classroom situations, (5) the curriculum is not just learned, but a set of lessons, materials and resources.

Thus, in order for a new experience to be related to knowledge that he already has, the learning process must start from knowledge that already exists in the student's mind (already has a cognitive framework) or is easy for students to grasp (it is easy to build a cognitive framework). However, most importantly and fundamentally, the main task of a teacher is to be a facilitator so that the learning process in the classroom can easily help students to form (construct) new knowledge into their cognitive framework. (Grady, M., et al, 2012). The lesson above shows that learning begins by posing a problem where mathematical ideas are expected to emerge from the problem, followed by students discussing how to solve the existing problem, followed by finding their own (guided reinvention) mathematical knowledge.

CONCLUSION

Constructivism is an approach that views students as active individuals constructing their own knowledge by experiencing and working on it, in the

process of entering the real world continuously, so that facts and skills are learned holistically and a process of connecting new knowledge and skills into new knowledge and knowledge occurs. previously possessed skills. Mathematics learning characterized by constructivism emphasizes building one's own understanding actively, creatively and productively based on previous knowledge and experience. Knowledge is not a series of facts, concepts and rules that can simply be given and ready to be put into practice, but humans must first construct this knowledge and provide meaning through experience. The teacher's task in applying constructivism to mathematics learning is not only to transmit ideas to students, but also to change the conceptions they have to develop them, therefore teachers need to pay attention to students' initial conceptions before learning begins, this aims to make it easier for students in the process. processing new knowledge that will be received.

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