



## CONSTRUCTIVISM FROM PHILOSOPHY TO MATHEMATICS LEARNING

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### **Abstract**

*Constructivism, especially philosophy, understands that knowledge is the result of construction in a personal human being. Develop knowledge through social interaction with other human beings, phenomena, experiences, and environments. Knowledge is considered correct if it has significance for troubleshooting. Learning in a constructionist view offers to develop concepts and perceptions of the student itself. In the classroom process, teachers take on the role of moderators and facilitators. A constructivist teacher must understand the characteristics of a student's mistakes because the increase in knowledge is through mistakes and mistakes. Teachers should see mistakes as a source of information about the student's scheme of characteristics and thinking. There are four principles of constructivism in mathematical learning. First, the psychological structure must be before the occupation of the amount. Second, the structure of background knowledge (schemata) must be developed before teaching formal mathematics symbols. Third, students should have the opportunity to find and form their mathematical relationships, not to expose adult thinking. Fourth, teachers should create an atmosphere of thinking in the classroom.*

**Keywords:** Constructivism, Philosophy, mathematics learning

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### **INTRODUCTION**

Today constructivism is considered a new view in education even though constructivism is a view in philosophy. The philosophy of constructivism assumes that knowledge results from human constructs through interactions with objects, phenomena, experiences and their environment. Constructivism dots from the assumption that knowledge grows and develops from the human mind through constructing, not through transfer. Constructivism as one of the paradigms in learning theory has influenced mathematics learning a lot, especially towards the learning approach delivered by teachers and the position and role in the mathematical learning process. In this article will be elaborated on the philosophy of constructivism, the relationship of constructivism with the theory of learning, the nature of children according to the view of the theory of learning constructivism, the nature of the approach of constructivism, the nature of learning according to the theory of learning constructivism, and the implications of constructivism on mathematical learning.

Constructivism is a philosophy that considers knowledge to be the result of human construction. Humans construct knowledge through interactions with objects, phenomena, experiences and environments. A knowledge is considered correct when it can be helpful to face and solve appropriate problems. According to constructivism, knowledge cannot be transferred from one person to another, but must be interpreted by each person. Knowledge is not something that is finished but is a process that develops continuously.

Matthews distinguished two great traditions from constructivism, namely psychological constructivism and sociological constructivism. Psychological construction rejects the development

of child psychology in building their knowledge, while the social constructivism of knowledge is built more based on society. Psychological constructivism is divided into personal and social constructivism, while sociological constructivism stands alone.

#### 1. Constructivism of personal psychology

Psychological constructivism begins with Piaget's work on how a child builds his cognitive knowledge. Genetic epistemology uses psychology as the basis for explaining the formation and development of one's knowledge. In Piaget's theory of knowledge, psychology plays a vital role in analysis. According to him, in the lower levels of cognitive development (motor sensory and pre-operational), the influence of the social environment is better understood by the child as the object observed by the child.

#### 2. Constructivism of social psychology

One of the constructivism figures of social psychology is Vigotsky. According to Vigotsky, learning is a development of understanding. In the process of learning there is a spontaneous development of understanding towards a more scientific. Inspired by Vigotsky's work, socioculturalism emphasizes cultural and social practices in a learning environment. According to socioculturalists, understanding is always influenced by one's participation in existing social and cultural practices. They apply individual participation in the practice of culturally organized activities, e.g. in interactions within the classroom.

Constructivism is contextual. Students always form knowledge in specific situations and contexts. The current interpretation of Vigotsky's ideas is that students are supposed to be given complex, challenging and realistic tasks and then given sufficient assistance in completing the task. This is expected to be a capability to complete such complex tasks.

#### 3. Sociological constructivism

Sociological constructivism holds that knowledge is the result of social discovery and at the same time as a factor in social change. Sociological constructivism emphasizes that scientific knowledge is social construction and not individual construction. They tend to take the functions and roles of society for granted in the formation of human knowledge.

About mathematics, social constructivist philosophy considers mathematical truths not absolute and identifies mathematics as the result of humans' problemsolving and problemposing. In mathematics learning, with socio-constructivism students interact with teachers, and based on everyday experience, develop strategies to respond to a given problem. Wheatley proposes two main principles in learning with the theory of constructivism learning. First, knowledge cannot be passively gained, but actively by the cognitive structure of students. Second, the function of cognition is adaptive and helps organizing through the actual experience that the child has.

The description above emphasizes how important the involvement of children actively in the process of attribution of several ideas and the construction of science through their environment. Hudoyo specifically stated that learning is more accessible for a person to learn something based

on what others already know. Therefore, to learn a new material, the past learning experience of a person will influence the occurrence of the learning process.

In addition to the emphasis and certain stages that need to be considered in the theory of constructivism learning, Hanbury presents several aspects about learning, namely: (1) students construct knowledge by integrating their ideas, (2) learning becomes more meaningful because students understand, (3) student strategies are more valuable, and (4) students have the opportunity to discuss and exchanged experiences and science with his friend.

Constructive learning is learning created by the teacher by holding that the teacher does not transfer knowledge to his students, but rather students acquire knowledge based on reasoning, so that students understand what he learns. Constructivism considers that knowledge cannot be transmitted directly by the teacher into the student's mind, but rather this process of change requires the active construction of the student. To construct new meanings, students must have experience conducting observing, guessing, doing and trying activities.

The structure of these students' initial concept or initial knowledge is personal, making it difficult to change, and can hinder the understanding of further learning. Therefore, it is necessary to take really in learning so that students can utilize their initial knowledge towards the correct concept.

## **METHOD**

To answer the question above, the method used is the study of the library, namely. In this case, the author tries to study some available literature to explain the problem so that the issues in this paper can quickly be answered. As stated by Sujarweni (2014: 57), by using the research method of literature study, the author can quickly solve the problem to be researched.

## **RESULTS AND DISCUSSION**

The theory of constructivism is a theory that gives freedom to humans who want to learn or seek their needs with the ability to find their wants or needs with the help of facilitation of others, so that this theory provides activeness to humans to learn to find their competencies, knowledge, or technology and other things needed to develop himself. Learning outcomes depend on the experience and perspective used in personal interpretation. On the contrary, the function of the mind interprets events, objects, perspectives used, so that the meaning of learning outcomes is individualistic. Failure and success are seen as different interpretations that are worth respecting and successful learning is primarily determined by students' freedom to make arrangements from within the student. The purpose of learning is to learn how to learn.

To support the quality of learning, learning resources need primary data, manipulative materials, emphasising reasoning processes in conclusion making. Systematic evaluation emphasizes actively drafting meaning, integrative skills in real problems, exploring the emergence of divergent answers and double solving.

Learning is a process by which students produce knowledge. Students develop knowledge, build meaning making, and construct ideas. The theory of constructivism emphasizes that learning is meaning making or building meaning, while teaching is scaffolding or facilitating. Therefore, the scenario of a learning and learning activity that only stops at the stage where students collect data and obtain information from outside, namely teachers, resource persons, books, laboratories and the environment into the student's memory alone, is not enough, because students are still at the level of consuming knowledge. It therefore needs steps that demonstrate the actions of students constructing ideas to produce knowledge.

One of the most well-known theories or views related to constructivism learning is piaget's theory of mental development. This theory is also commonly called the theory of intellectual development or the theory of cognitive development. The theory of learning is related to the readiness of the child to learn, which is packaged in the stage of intellectual development from birth to adulthood. Each stage of intellectual development in question is equipped with specific characteristics in constructing science. Foreexample, at the sensory stage of the child's motor thinking through movement or deed.

Furthermore, Piaget known as the first constructivist asserts that such knowledge is built into the child's mind through assimilation and accommodation of 10. Assimilation is the absorption of new information in the mind. Meanwhile, accommodation is reordering the structure of the mind due to the presence of new information, so that the information has a place. Another sense of accommodation is the mental process that includes establishing a new scheme that matches a new scheme or modifying an existing one to match that stimulus.

Piaget further suggests that knowledge is not passively obtained by a person, but rather by action. In fact, a child's cognitive development depends on how far they actively manipulate and interact with their environment. Meanwhile, cognitive development itself is an ongoing process of unbalanced state and state of balance.

The child's view from more recent constructivistic circles developed from piaget's theory of cognitive learning states that science is built into a child's mind with assimilation activities and accommodation according to his schematic. Learning is an active process to develop schematics so that related knowledge is like a cobweb and not just arranged hierarchically. From the above understanding, it can be understood that learning is an activity that takes place interactively between internal factors in the learner and external or environmental factors, thus giving birth to changes in behavior.

In contrast to Piaget-style cognitive constructivism, the social constructivism developed by Vigotsky is that learning for children is done in interaction with both social and physical environments. Discovery or discovery in learning is easier to obtain in the socio-cultural context of a person.

The implications of the theory of constructivism learning in children's education are as follows: (1) the purpose of education according to the theory of learning constructivism is to produce individuals or children who can think to solve every problem faced, (2) the curriculum is designed in such a way that there is a situation that allows students can construct knowledge and skills. In addition, problem solving exercises are often done through group learning by analyzing problems in daily life and (3) students are expected always to be active and able to find a suitable way of learning for themselves. Teachers serve as mediators, fascists, and friends who make situations conducive to the construction of knowledge in students.

When people are going to do something, then that person should set a goal to achieve. To achieve the goal, one chooses the right approach so that the optimal, successful, and appropriate results are obtained.

Likewise, teachers are educators who are tasked with providing a certain amount of knowledge to students in school. Therefore it takes an experienced teacher, and able to socialize to the learning environment. Each teacher has their personality according to their life background. This fact is recognized as an aspect that cannot be ruled out as a framework of teaching success to lead students to become knowledgeable and knowledgeable and personable people.

In school learning activities, the general pattern of teaching activities is very decisive for achieving the teaching objectives set by the curriculum and the achievement of learning indicators. As Vienna Sanjaya argues that: "the general pattern of teaching is the process of conveying and instilling science". In conveying and instilling science is required approach in teaching, because with the approach of teaching the learning process will be more effective. The teaching approach in principle is the ways that teachers can achieve their teaching goals as best they can. Furthermore, he argues the following: "the approach is the starting point or our point of view towards the learning process." The term approach refers to the view of the occurrence of a process that is still very common in nature. Therefore the learning strategies and methods used can be sourced or depending on a particular approach.

Based on the above excerpts, it can be known that in conveying the topics of teacher lessons as educators require an appropriate teaching approach in order for teaching objectives to be achieved effectively. Roy Killen as quoted by Wina Sanjaya noted that: "there are two approaches in learning, namely teacher-centred approaches and student-centred approaches."

Teacher-centered approach decreases direct instruction strategies, deductive learning or expository learning. In this strategy the role of the teacher is very decisive in either the selection of content or subject matter. While the student-centered learning approach decreases inductive learning strategies, namely student-centered learning. A student-centered approach is very effectively used for math subjects. Because with that approach a student does not become passive, but can develop his or her potential and develop his knowledge. Remembering the words: "mathematics is a science obtained by reasoned." 18

From the above quote, mathematics emphasizes activity more in the world (ratio). Another opinion says: "Mathematics is what we do everyday with regard to patterns, sequences, structures, or forms and relationships between them." This opinion assumes to us that mathematics is a natural science, meaning that mathematics is taken from our daily lives modeled into mathematical models. Therefore teachers in providing math materials in schools should use a teaching approach that corresponds to the above opinion, in addition to mathematics is the science of reason, mathematics is also close to the activities that we do everyday.

Learning will not achieve its maximum goals if the learning steps are ignored. Similarly, the application of constructivism approach has several steps. The steps of mathematics learning with constructivism approach include the following:

1. Search and use students' questions and ideas to guide the lesson and the entire teaching unit
2. Let students express their ideas
3. Develop leadership, cooperation, information search, and student activities as a result of the learning process
4. Using students' thoughts, experiences, and interests to direct the learning process
5. Developing alternative use of information sources both in the form of written materials and materials from experts
6. Try to get students to present the causes of an event and situation and encourage students to predict the consequences
7. Look for students' ideas before the teacher presents their opinions or before students learn ideas contained in textbooks or other sources
8. Get students challenged with their conceptions and ideas
9. Provide sufficient time to reflect and analyze, respect, and use all the ideas that all students are focusing on
10. Encourage students to do their analysis, gather objective evidence to support ideas and reformulate ideas according to the new knowledge they learn
11. Using problems identified by students according to their interests and the impact they have
12. Using local resources (humans or objects) as sources of information that can be used in troubleshooting
13. Engage students in finding workable answers in solving problems that exist in actual circumstances
14. Expanding learning around lesson hours, classrooms and school environments
15. Focusing on the impact of science on each student
16. Emphasizing career awareness primarily related to science and technology.

As has been stated that according to the theory of constructivism learning, knowledge cannot be transferred from the teacher's mind to the student's mind. That is, that the student must be mentally active in building his or her knowledge structure based on their cognitive maturity. In other

words, students are not expected to be small bottles ready to be filled with various sciences according to the teacher's will.

In connection with the above, three emphasises can be put forward in the learning constructivism theory as follows. First, the active role of students in constructing knowledge meaningfully. Second, the importance of making a connection between ideas in construction is meaningful. Third, associate between the idea and the new information received.

The above understanding emphasizes how important the involvement of children actively in the process of attribution of some ideas and the construction of science through their environment. Even specifically Hudoyo said that one would be easier to learn something if learning was based on what others already know. Therefore, to learn a new material, the past learning experience of a person will influence the occurrence of the learning process.

In addition to the emphasis and certain stages that need to be considered in the theory of constructivism learning, Hanbury presents some aspects with learning, namely (1) students construct knowledge by integrating the ideas they have, (2) learning becomes more meaningful because students understand, (3) student strategies are more valuable, and (4) students have the opportunity to discuss and exchanged experiences and science with his friend.

From some of the above views, it can be concluded that learning that refers to the theory of constructivism learning focuses more on the success of students in organizing their experiences. It is not the student's obedience in reflection of what the teacher has commanded and done. In other words, students take precedence over constructing their knowledge through assimilation and accommodation

## **CONCLUSION**

A constructive learning approach will allow teachers to choose the appropriate learning rules and students can determine the time needed to acquire a concept or knowledge. Teachers can also make their own assessments and assess their understanding of a field of knowledge that can be improved again.

Constructive learning based on several new views on science and how it was obtained. The formation of new knowledge is born from the combination of learning first. This learning encourages students to be creators of their solutions and test using new hypotheses and ideas.

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