

# Constructive Learning Approach in Mathematics Education: Challenges and Possibilities

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## Abstract

*A constructive learning and instruction approach has been proposed as an alternative and latest scientific model, which is implicit in all behaviorist and some cognitive approaches to education. The major concern of this study is to analyze the theoretical views and challenges of the constructive learning approach in the mathematics classroom. This research is qualitative and does not use any primary data. The findings of the research are based on in-depth study and analysis of various articles, researches, books, and conference papers presented at various conferences published nationally and internationally as secondary data. The constructive learning approach encourages students to learn the information themselves, it helps students explore the knowledge themselves, it seeks to make students more aware, it develops more powerful thinking teaching and classroom environment, and it improves the students' performance in various fields. Whereas the traditional learning approach has always been teacher-centered learning.*

## Keywords:

Construction, child-centered, critical thinking, problem-solving, perception

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## Introduction

The real-life education, teaching, and learning initiative are conscious to improve and balance links between education and daily activities (Stevens, 2000). This means mathematics is supposed to be taught and learned in and between different learning contexts, such as the school, workplace, and everywhere. The action is expected to have an impact on the learners' attitudes towards their learning and on the use they make of mathematics (Lakoff & Núñez, 2000). Also, mathematics is the best platform to develop individual intellectual proficiency in making logical reasoning, visualization, abstract thought, and analysis (Watson & Mason, 2006). They explore that various learning approaches have been adopted in this platform with the direct involvement of the learners for meaningful teaching and learning of these subjective concepts. According to Zain et al.

(2012), the constructive learning approach is student-centered which will be in the form of students-students and students teachers processes in constructing the mathematical knowledge. Similarly, learners are actively contributing in the process of constructing their understanding while teachers facilitate them to construct their knowledge (Díaz, 2017). The constructive learning approach will help students to understand better since they construct their understanding through activities done in the classroom (Samsudin et al., 2016).

Various approaches to mathematics classroom teaching have been practiced in the world. All kinds of approaches prioritize making learning effective by emphasizing different aspects of the learners. This research specifically analyzes the constructive learning approach. The main purpose of this research is to analyze the theoretical

views of the constructive learning approach and the challenges of implementing it in the mathematics classroom. To achieve the stated objective, this research is conducted to find out the answers to the following research questions:

- 1) How does mathematical knowledge develop in learners through a constructive learning approach?
- 2) How does the constructive learning approach is different than other traditional approaches?
- 3) What are the challenges to implementing a constructive learning approach in the mathematics classroom?

### Literature Review

This section reviews and analyzes the literature on three different themes based on research questions. As the basis of this research data is a secondary source, national and international level articles, books, and conference papers presented at various conferences have been analyzed on various themes.

### Constructive Learning Approach

Constructivist concepts are also found in several works including ideas of theorists *Dewey*, *Piaget*, *Vygotsky*, *Candy*, *Merizow*, *Boud*, etc. (Suhendi, 2018). However, constructivism as a theory was officially recognized in the early 1990s. It should be noted that mathematics education is more influenced by *Piaget*, *Vygotsky*, and *von Glasersfeld's* ideas (Vintere, 2018). He focused the greatest influence on the constructivist approach in mathematics education comes from *Piaget*, *Vygotsky*, and *Glasersfeld* who characterize constructivism as a cognitive position and also admit that social interaction and knowledge is a self-organized cognitive process.

Most of the other traditional mathematics instruction approaches and curricula are based on the transmission or absorption view of teaching and learning mathematics (Clements & Battista, 2009). In such types of approaches, students passively absorb mathematical structures, assumptions, and rules invented by others and recorded in text or known by authoritative adults. Supporting this argument, Xie et al. (2018) believe that teaching consists of transmitting sets of facts, skills, and concepts to students. On the other hand, Bognar et al. (2016) stated that the constructive learning approach opposes this view. They explore the basic tenets of the constructive learning approach are:

- 1) Knowledge is actively created or invented by the learners.
- 2) Learners create new mathematical knowledge by reflecting on their physical and mental actions.
- 3) The interpretation of the true reality is shaped by individual experience and social interactions.
- 4) Mathematical ideas, assumptions, and truths are cooperatively established by the members of a culture. Therefore, the constructive classroom is seen as a culture in which learners are involved. This means the social discourse involving explanation, negotiation, sharing, and evaluation.

### Constructive and Other Traditional Learning Approaches

The process of teaching and learning is to give priority to share knowledge and understanding to enable students to apply the concepts, principles, and mathematical processes (Sriraman & English, 2005). The emphasis on the development of student thinking in mathematics is built and developed through the process of teaching and learning in the classroom based on the

following principles of problem-solving; communication, reasoning, connections, making the representation, and use of technology in mathematics. Supporting this argument, Vintere (2018) stated that the impact of the constructivist approach on the development of mathematical competencies in the context of sustainable development can be seen from different aspects including critical thinking, problem-solving approach, analytical skills as well as confidence, respect for others, etiquettes and social skills among learners.

On the other hand, the traditional teaching process is indeed a repetitive activity where teachers feed students with the information that they needed rather than encourage students to construct their thinking (Fast & Hankes, 2010). Also, they believe that traditional classroom students rely heavily on textbooks, workbooks, and they have to follow the fixed curriculum that can be tedious. Moreover, Grady et al. (2012) claim that the traditional approach is based upon teacher presentation and explanation of basic topics, rather than allowing students to develop their knowledge. This may turn the lesson into a theoretical, boring, and ineffective process. Also, Fast & Hankes, (2010) stated that the traditional approach has always been teacher-centered learning has strongly stated that this approach is a process where students have been given all information needed and Students did not construct their knowledge. According to Brooks & Brooks, (1999), the differences between constructive learning approach and another traditional approach as follow:

<b>Traditional Classrooms</b>	<b>Constructivist Classrooms</b>
The curriculum is presented part to whole, with emphasis on basic skills	The curriculum is presented whole to part with emphasis on big concepts

Strict adherence to a fixed curriculum is highly valued	Pursuit of student questioning is highly valued
Curricular activities rely heavily on textbooks and workbooks	Curricular activities rely heavily on primary sources of data and manipulative materials
Students are viewed as “blank slates” onto which information is etched by the teacher	Students are viewed as thinkers with emerging theories about the world
Teachers generally behave in a didactic manner, disseminating information to students	Teachers generally behave interactively, mediating the environment for students
The teacher seeks the correct answer to validate students learning	The teacher seeks the student’s point of view to understand the student’s present conceptions for use in subsequent lessons
Assessment of student learning is viewed as separate from teaching and occurs almost entirely through testing	Assessment of students learning is interwoven with teaching and occurs through teacher observations of students at work and student exhibitions and portfolios
Students primarily work alone	Students primarily work in the group

Source: Cited from Brooks and Brooks, 1999, p.17

## **Challenges of Constructive Learning Approach**

It is believed that mathematical knowledge is constructed actively by learners in the process of adapting to their environment they however differ in their view of knowledge and reality (Samsudin et al., 2016). In the same regard Radford L. (2008), points out that empiricist constructivists locate knowledge in an external environment and see it existing independent of the child's cognitive activity, yet radicals believe knowledge does not exist independently of the knower. Radicals also see learning as a problem-solving process in which learners attempt to overcome obstacles and contradictions that arise when they engage in purposeful activity. Furthermore, Ndlovu M. (2013), points out that confusion about what constructivism does and does not mean has engendered some myths that have diluted and polluted it. On the other hand, Pon N. (2001), believed that teaching is more than communication in a constructive approach and lacks clarity about the meaning of construction. Although students are happy to solve problems based on real-life examples, there is a risk that the course will not be completed within a certain time frame (Anwar & Rahmawati, 2017). The learning process taught through the use of constructivist methods in the classroom is found to be more critical than the students in the traditional classroom, even though the students have a deeper understanding of the subject matter (Corte, 2004). Furthermore, several studies indicate that constructivist teaching is beneficial to developing students' perceptions of learning, in terms of independence in learning, coherence of concepts, and cognitive engagement (Clements & Battista, 2009; Vintere, 2018). However, the outcomes of promoting the students' cognitive commitment in one aspect

may result in the students being more critical in another.

## **Methodology**

This research is qualitative and does not use any primary data. This research is not done between a particular place and a certain population. It is based on document analysis and interpreted the result according to reviewing the literature. The findings of the research are based on in-depth study and analysis of various articles, researches, books, and conference papers presented at various conferences published nationally and internationally as secondary data.

## **Conclusion**

As there is no primary data in this research, the analysis of secondary data has already been done in the literature review section. So, the finding and discussion have been included in the conclusion section. Teachers play a vital role in the teaching and learning process so that students can understand and apply that in solving a mathematics problem. Therefore, constructivism can be implemented in mathematics classrooms. The constructivism approach is an opposite technique that has been executed in traditional classrooms. In this approach, students have to use their thought in problem-solving. This will eliminate the traditional methods where students ought to find their information instead of teachers who need to provide everything in the learning process. Constructivism is about self-regulated learning and student-centered approaches have been seen to play an essential role in this process. Research conducted shows that constructivism improves the students' performance in various fields. Through the constructivism approach, student's attitudes can be built and the process of attitude development is formed through their life experiences. Students' understanding can be increased by strategies

and learning approaches.

There are some challenges in the constructive learning approach in the mathematical classroom. In this approach, the students' view of knowledge and reality can be different, knowledge does not exist independently of the knower, lack of clarity about the meaning of constructivism, students being more critical than other approaches, lack of group working habits of some students, and lack of accommodating weaker students.

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