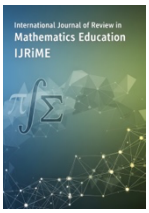

International Journal of Review in Mathematics Education

Department of Mathematics Education, Universitas Muhammadiyah Surakarta, Indonesia
https://journals2.ums.ac.id/ijrime/index

Social Constructivism: Principles and Implications to Mathematics Learning

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DOI: xxxxx
Received: December 30th, 2025. Revised: February 4th, 2026. Accepted: February 12th, 2026
Available Online: February 13th, 2021. Published Regularly: March, 2026

Abstract

This paper examines social constructivism as a learning theory and its implications in mathematics learning. The study followed a conceptual qualitative paradigm. The researcher used secondary data obtained from journal articles, e-books, periodicals and websites. Social constructivism emphasizes active construction of knowledge by learners through interaction with others and the environment. According to the theory, the learner understands the world through experiencing it. Reality is socially constructed and it depends on individual interpretation. In mathematics learning, the theory implies that mathematics tasks make sense to the learners if they solve real life problems. Mathematics learners should not simply memorise concepts, but should critically analyse their own and other people's mathematical perspectives. More marks should be awarded for the thought process than for the final solution to a mathematical task. Mathematics learning should be taken beyond the classroom. Formal mathematics learning can be built atop the knowledge gained by the learners through culturally performed tasks. The mathematics learners should view their teacher as a facilitator, co-learner, co-explorer and co-constructor of knowledge. Teaching strategies that promote collaboration and active participation of learners are desirable. Peer and self assessment help to foster active and interactive mathematics learning.

Keywords: collaborative learning, learning implications, mathematics learning, social constructivism, social interaction.

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1. Introduction

Learning theories inform teaching and learning strategies. They enable teachers to understand how learners acquire, process and retain knowledge. Mathematics teaching and learning is guided mainly by behaviorism, cognitive theory and constructivism. Although the three learning theories perceive mathematics learning in different ways, they complement each other by providing different perspectives on how mathematical knowledge in acquired and applied.

Behaviorism is a psychological perspective of learning proposed by Skinner B.F and Watson J.B. The theory recognizes the existence of observable and measurable behavior, which comes as a response to environmental stimuli (Ulum & Fauzi, 2023). According to the theory, learning results in a change in the learner's observable behavior. Behaviorists assert that cognitions and emotions are not observable but they show themselves through external behaviors

that are observable (Ugli & Zubatkanovna, 2025). The learner learns through interaction with the environment. Reinforcement and punishment are the main drivers of learning that help to keep the learner focused to the learning process.

Some researchers criticize behaviorism, as a theory of learning, for promoting rote learning by suggesting that learners learn through repetition and recall (Saleem, Kausar & Deeba, 2022). The researchers argued that although repetition and recalling are important in mathematics learning, there is need for critical thinking and ability to apply mathematical concepts. Some critics argue that the theory neglects cognitive learning factors and it fails to explain complex human learning behaviors that make people different from animals (Yanagawa & Matsui, 2025).

Unlike behaviorism, cognitive theory focuses on internal mental processes. The main proponents of the cognitive theory are Jean Piaget, David Ausubel and David Kolb. The theory emphasizes on how learners receive, process, store and retrieve knowledge (Kurt, 2023). According to cognitivists, during a learning process, a learner links new knowledge to prior knowledge already existing in his or her cognitive structure (Tennyson & Volk, 2015). Both the new and the existing knowledge should transform so that the learner's cognitive structure receives the new knowledge. Learning takes place only when a learner revises his or her own thinking in light of the new knowledge. For this to take place, the learner should always be active, self-directed and self-driven (Olson & Ramírez, 2020).

Cognitive theory has its own portion of criticisms. Some scholars argue that the theory refer to cognitive concepts that are not directly observable (Alahmad, 2020). Alahmad further argues that the theory underestimates the value of social interaction and environmental factors in learning.

Constructivism is a theory of learning that posits that learners actively construct their own knowledge by reflecting on their experiences as they interact with the environment (Wibowo, Wangid & Firdaus, 2025). The theory has its grounding in the cognitive theory. However, unlike cognitive theory, constructivism claims that knowledge is not transferable from one person to another. It also posits that the learners' interests, perspectives and cultural background influence the learning process.

Constructivism forms the foundation for social constructivism. Social constructivism is a branch of constructivism that acknowledges that learners construct their own knowledge and it emphasizes on the importance of interaction and collaboration in the learning process (Khalid et al., 2025). Over the years, social constructivism has gained attention from various researchers throughout the world. However, some scholars critise the theory for being silent about how learner's abilities, learning styles, genetics and neurodevelopment affect learning. Some argue that the theory lacks actionable strategies that can be used in practice (Pedapati, 2022).

The current study aims to contribute towards addressing the criticism on how the theory comes into practice in the learning process. The study examines the principles of social constructivism and its contributions in mathematics learning. The study reviewed existing literature guided by the following research questions.

- What are the main principles of social constructivism?
- How does social constructivism theory impact mathematics learning?

2. The Background of Constructivism as the Grounding for Social Constructivism

Social constructivism is a brain child of the constructivism theory, therefore before examining social constructivism, there is need to examine the background of constructivism. Table 1 gives the names of the most influential theorists whose ideas gave birth to constructivism.

Table 1. Theorists whose ideas contributed towards constructivism.

Theorist	Period	Main ideas contributing to the constructivism theory
John Dewey	1859-1952	Experiential learning • Learning should solve real life problems.
Maria Montessori	1870-1952	Child-centered learning • Learning should be self-directed and hands-on.
Jean Piaget	1896-1980	Assimilation, accommodation and stages of cognitive development • Learners build their own knowledge from existing knowledge through interaction with the environment.
Lev Vygotsky	1896-1934	Social interaction, scaffolding, zone of proximal development (ZPD), and more knowledgeable other (MKO) • Learners learn through interaction with others. • The MKOs give assistance to the learners whenever they need it.
Jerome Bruner	1915-2016	Discovery learning and spiral curriculum • New ideas are built from existing knowledge hence the curriculum should be sequential from simple to complex and from known to unknown. • People learn about the world by experiencing it and reflecting on it.

Table 2. The three categories of the constructivism theory.

Category	Main proponent	Principles	How the proponents view reality.
Cognitive constructivism	Jean Piaget	• A learner is an active problem solver. • The learners construct knowledge through mental processes like attention, perception and memory. • Learners construct their own understanding of reality.	• Reality is objective. • Reality exists independently of the learner.
Radical constructivism	Ernst Von Glasersfeld	• Learners construct new knowledge on the foundation of existing knowledge. • The knowledge constructed is always incomplete. • Reality is subject to individual interpretation of one's own experiences	• Reality depends on individual interpretation of own experience.
Social constructivism	Lev Vygotsky	• Learning is a collaborative process. • Learners develop knowledge through interacting with theirs in their respective cultures and societies. • There is no one truth.	• Reality is socially constructed. • Reality is subject to individual interpretation.

According to Olorode and Jimoh (2016), constructivism theory came as an improvement on the cognitive theory. Olorode and Jimoh state that constructivism has three categories: cognitive constructivism, radical constructivism and social constructivism. Table 2 gives a brief description of the three categories of constructivism.

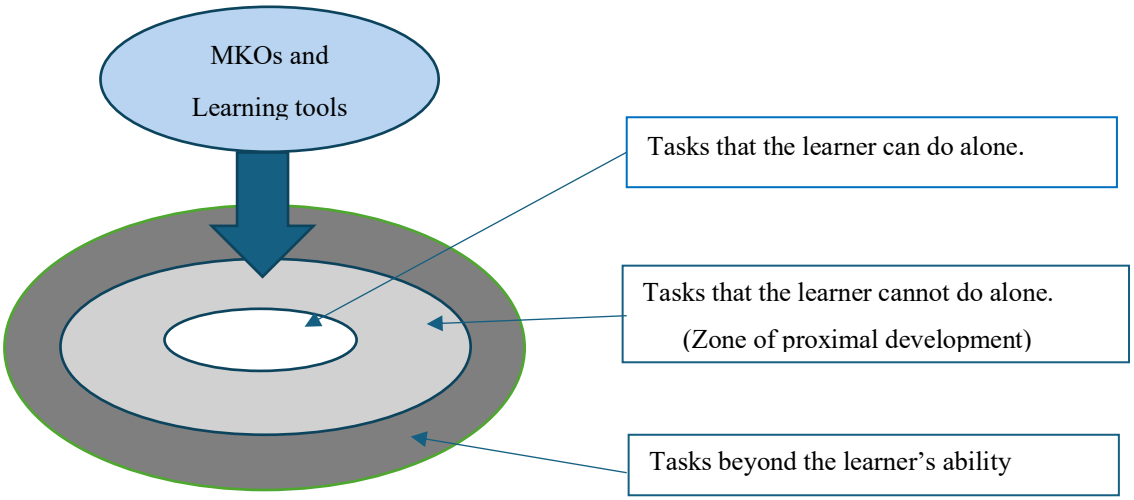

Figure 1. Illustration of the relationship among the zone of proximal development, MKO, and learning tools.

3. Method/Approach

The study followed a conceptual qualitative paradigm. The researcher used secondary data obtained from e-books, websites, periodicals and journal articles. Data obtained from literature produced by the main proponents of social constructivism like Levy Vygotsky formed the basis of the study. Work from other scholars relating to social constructivism in the context of mathematics learning was also utilized. For scholars other than the main proponents of social constructivism, the researcher considered literature spanning from 2015 to 2025. The period was considered long enough to provide ample data. To ensure credibility of the current study, only peer reviewed articles based on both empirical and theoretical studies were considered.

In the study, the researcher analysed the principles of social constructivism and how they impact on the mathematics teacher, learners, learning strategies, assessment strategies and learning environment. The data were analysed under the following themes: interactive and collaborative learning, learner engagement in mathematics learning, cultural context in mathematics and the role of the mathematics teacher.

4. Result and Discussion

4.1 The Principles of Social Constructivism

The principles of social constructivism are centered on the zone of proximal development (ZPD), scaffolding, more knowledgeable other (MKO), use of language, social interaction and collaborative learning.

4.1.1 Zone of proximal development, more knowledgeable other and scaffolding

The zone of proximal development is the distance between the actual cognitive development level and the potential cognitive development level (Vygotsky, 1978, 2021). The cognitive development level is the level at which the learner can learn on his or her own. The potential cognitive development level is the level that the learner can achieve under the guidance of others. Social constructivists suggest that the best time to teach the learner is when the learner reaches the zone of proximal development (Vygotsky, 1978, 2021). The reason is that during this period the learner is eager to acquire new knowledge, but he or she cannot acquire the knowledge without assistance from a person with better knowledge than him or her. The person with better knowledge than the learner is called the more knowledgeable other (MKO). The assistance that the MKO gives to the learner is called the scaffolding. Figure 1 shows an illustration of the relationship among the zone of proximal development, MKO and learning tools.

However, Da Silva (2024) argued that social constructivism does not explain if the zones of proximal development of different individuals are comparable or whether the size of an individual learner's zone of proximal development changes with time.

4.1.2 Use of language in learning

According to Vygotsky in Newman (2018), language is a vital tool through which learners share knowledge, get meaning of their experiences and construct new knowledge. Language facilitates interaction between the learner and the environment, including other people in the community (Rahmatirad, 2022). It is the conduit for cultural transmission (Muhammed, 2024). It serves two purposes; as a means of transmitting information and as a tool for intellectual adaptation.

Vygotsky (1978) mentioned three types of language; social speech, private speech, and silent or inner speech. Social speech is language used for external communication with others. It is a medium of knowledge sharing between or among individuals. Private speech is when one speaks aloud to oneself. It is directed to oneself and it has an intellectual function. It assists the learners to reflect on their experiences, think critically and find solutions for tasks ahead of them. It happens when one tries to remember something or when one deeply thinks of a possible solution to a problem. It serves as a transition point between social speech and silent inner speech. During private speech external dialogues with others are converted into internalized speech or silent thought (Pedapati, 2022). Silent or inner speech involves the movement of speech articulators like the lips and the tongue without producing audible sound. It represents self-regulation of behaviour. This type of speech often happens when reading, planning, recalling, reflecting, making decisions and solving problems. It helps the learner's mind to comprehend and remember concepts.

4.1.3 Knowledge as a sociocultural construct

Social constructivism posits that individual learners construct knowledge as they interact with the MKOs like parents, peers and teachers (Rytila, 2021). Knowledge construction and cognitive development are socially mediated processes that are determined by social interactions and the cultural environments in which the individuals live. Through interaction, learners acquire cultural values, beliefs and problem solving strategies. The learner's culture plays a pivotal role in how the learner views and understands the world around him or her. Cultural tools like language, symbols, signs and artifacts enhance the learner's cognitive development. The cultural tools are passed on through generations. As a result, knowledge differs with individuals, cultures and contexts. Different cultures have different views of useful knowledge.

4.1.4 Collaborative and active learning

In order to effectively construct new knowledge, a learner should be actively involved in the learning process. In other words, according to social constructivism theory, knowledge is not transferable. The learner should work with others in order to adopt socially shared experiences and problem solving strategies (Zhou, 2024). Collaborative learning is advisable. As the learners work together, they encounter some problems which they discuss and try to solve (Matusov, 2015). Sometimes learners work with people with better knowledge than them. This form of collaboration is called guided participation (Mangwiro & Machaba, 2022). The group of individuals working together to work out a solution for a problem is called a community of practice (Anton et al., 2025). A community of practice can also be a group of individuals with special expertise in a culturally significant task.

4.1.5 Learning tools and mediated learning

Mediation in learning refers to the use of tools to facilitate learning. According to social constructivism theory learning is mediated by instrumental and psychological learning tools. Instrumental learning tools are cultural artefacts that include machines, information systems, measuring instruments and others. Psychological learning tools include language, symbols,

signs, problem solving skills and theories (Holzman, 2018). Psychological learning tools facilitate psychological processes like thinking, reflecting, remembering and others (Eun, 2016). They facilitate the construction of beliefs, values, perspectives and views in the learners.

4.2 Implications of Social Constructivism to Mathematics Learning

Social constructivism theory has far-reaching implications to mathematics teaching and learning. This section discusses the implications of the theory to the mathematics teacher, the learner, the learning environment and the learning process.

The concept of the zone of proximal development suggests that mathematics tasks can be grouped into three categories ;(1) tasks that a learner can accomplish on his or her own, (2) tasks that the learner can accomplish only with assistance from an MKO and (3) tasks that the learner cannot accomplish even with assistance from the MKO. The general implication is that a learner can operate within certain limits. Therefore whenever a mathematics teacher intends to teach a particular concept, it is important to identify the three categories related to the concept. The learner's ability and level of performance should determine the tasks and the type of assistance to be provided. For those tasks that the learner needs assistance, the teacher should provide the needed assistance at the right time and right level. Mathematics teachers can also make use of resource persons like statisticians, economists and other experts as MKOs to assist the learners. The experts should provide scaffolding to the learners in their respective areas of expertise. Once the learner gets the knowhow, the scaffolding is withdrawn and the learner works on his or her own. In mathematics learning, scaffolding can be given in the form of demonstrations, explanations, illustrations or discussions. However, the mathematics teacher should determine when to give assistance and when to withdraw it. Too much support cause over reliance and little support cause confusion and overloading. As mentioned earlier in this section, the type and nature of assistance depends on individual learner's abilities and progress in knowledge construction since learners have different zones of proximal development which are influenced by different social, physical, cognitive and psychological factors.

The tasks that the learners cannot accomplish even with assistance should not be introduced to the learners prematurely. Mathematics teachers should avoid overwhelming the students or forcing them to achieve (Aljohani, 2017). Aljohani suggests building a firm basis through collaboration before introducing tasks beyond the zone of proximal development. Prerequisite concepts should be understood by the learners prior to introduction of higher order tasks. The concepts taught should be related and properly sequenced (Van Hover & Hicks, 2017). For instance, it is proper to teach gradient of a straight line before introducing differentiation. The reason is that before understanding gradient, differentiation can be outside the learner's zone of proximal development but once the learner grasps gradient, differentiation becomes accomplishable.

Social constructivism emphasizes on the need for collaborative work (Mohammed & Kinyo, 2020). In mathematics learning collaboration is important. There are two forms of collaboration in mathematics learning: learner to learner collaboration and learner to expert collaboration. A conducive environment for the two forms of collaboration to take place should be created. Peer collaboration or learner to learner collaboration can be facilitated through provision of group tasks. Small groups with heterogeneous students are preferable. Small groups reduce uneven participation and keep all the members active. Heterogeneity of the groups allow those with better knowledge to provide assistance to those struggling to comprehend. Social constructivism suggests shared responsibility among group members and calls for members to respect each other's views. The theory posits that there is no one truth. However, the teacher should monitor the students' interactions in order to avoid spreading of misconceptions. The teacher should also facilitate learner to expert collaboration or guided participation outside the classroom through homework or out-of-school tasks.

According to social constructivism, interaction is key in the learning process. In mathematics learning, learners should always be given an opportunity to interact. They should interact with other people or with the environment around them. Interaction between the teacher and the students should be constructive, with both the teacher and the students having opportunities to ask questions (Kussmaul & Pirmann, 2021). Kussmaul and Pirmann state that in order to make sense of new knowledge, the learners need to ask, investigate, and evaluate the new knowledge. The students should investigate and interact with the environment around them too. A social constructivist mathematics teacher asks open ended questions that are thought provoking so that the learners reflect, analyze, predict, and hypothesis. The teacher needs to respect and value the learners' perspectives, thoughts, and experiences irrespective of them being correct or incorrect. The learners' perspectives, thoughts and experiences can determine the content to be taught and the teaching or learning strategy.

The fact that reality depends on interpretation by individuals has its implications in mathematics learning. It implies that learning can be affected by individual learner's social background and prior experiences. Therefore, mathematics concepts should be built atop what the learners already know from their society. Mathematics questions and examples should relate to the students' everyday life for them to show social relevance. Tasks that solve real life problems make sense to the students. They make mathematics learning useful and applicable to real life, hence worth learning. Culturally performed tasks like preparing a meal, sorting clothes, erecting a boundary fence and others that students do at home also assist in learning mathematics concepts. For instance, preparing a meal teaches proportion, and erecting boundary fence teaches perimeter. The teacher should take advantage of the knowledge gained by the learners through the culturally performed tasks when introducing mathematics concepts.

Instrumental and psychological learning tools assist in mathematics learning. Instrumental mathematics learning tools include measuring instruments (protractors, rulers, scales and others), e-learning tools (internet, smart phones, laptops and others), calculating tools (calculators, statistical tables and others) and other artifacts. Psychological mathematics learning tools include language, symbols, rules, theories, axioms and others. Social constructivism puts much emphasis on the use of language as a key factor for knowledge comprehension. Therefore mathematics teachers should mind their language of instruction. They should ensure that it is well understood by the learners. It helps them to receive instruction clearly and share their thoughts and ideas effectively. Learners understand mathematical symbols, operations, rules, algorithms, formulae and theories if they understand the language of instruction.

Another important implication of the social constructivism theory is that the learner should be an active participant in the learning process. Active participation in learning builds self-trust, self-efficacy and confidence in the learners (Knapp, 2019). It makes the learners resourceful. According to the theory, rote learning has no place in mathematics learning. Social constructivism reduces the teacher's role to that of a facilitator and not a source of knowledge. The learners should view their teacher as a learning partner who provides assistance, dialogues with them and gives feedback on their progress. In order to keep the students active, teaching strategies should encourage students to apply their knowledge rather than memorizing other people's ideas, conceptions and definitions (Saleem, Kausar & Deeba, 2022). They should challenge their own and others' perspectives. For instance, instead of memorizing a theorem, students should find why the theorem is true. The following teaching methods keep mathematics students active and they encourage them to think critically; research projects, brainstorming, guided discovery, surveys and simulations.

Social constructivism posits that students construct knowledge from prior experience. This makes practical or hands-on tasks important when learning mathematics concepts. Such tasks give the necessary experience that help learners to comprehend concepts easily. Introducing a concept by involving learners in practical tasks facilitates effective learning. Learners are more

likely to recall knowledge constructed through active involvement in practical activities (Saleem, Kausar & Deeba, 2022). For instance, learners comprehend and recall the concept of mass easily when they carry out activities like carrying objects of different mass, measuring mass and comparing the mass of different objects.

From a social constructivism point of view, performance evaluation should not be based on memorizing mathematical facts. Test items should test critical thinking, problem solving, authentic reflection and application of knowledge to real life situations. Learners' autonomy and initiatives should be rated too. Evidence of critical and deep thinking as well as connection between previous and new knowledge should be rewarded. Marks should be given for the thought process and not for the final answer. The assessor should look for both cognitive growth and mastery of concepts. When assessing cognitive growth, the assessment should not be a one-time process. It should be in the form of occasional exercises. Learners should be allowed to assess and manage their own progress. They should keep samples of their work, learning logs or periodicals that help them to track their progress. Peer assessment can also be utilised. Peer assessment is a form of collaborative learning. Students can assess their peers during presentations, simulations, demonstrations and exhibitions.

5. Conclusion

Social constructivism states that learning takes place when a learner actively interacts with others and with the environment. The theory suggests that learners understand the world when they work jointly and share experiences. The cultural and historical contexts in which learning takes place influence the learning process. In one's life, knowledge construction is an on-going process that requires one to continuously reflect on experience and refine already acquired knowledge in order to keep pace with the dynamic cultural contexts. In the learning process, the learner reaches a stage where he or she needs assistance from people with better knowledge. Instrumental and psychological learning tools help the learner to construct knowledge.

In mathematics teaching and learning, the principles of social constructivism have important implications. The theory implies that, to the learners, the mathematics teacher is a facilitator, co-learner, co-explorer, and co-constructor of knowledge. The theory also implies that the teacher should know when to give assistance and when to withdraw it. Among other activities, the teacher assists the learners by demonstrating how to solve problems, giving explanations of hard-to-understand concepts, and giving tips on how to work out problems. The learners should be encouraged to work together to find solutions to problems. Heterogeneous groups are preferable as they enable learners to help each other. The learners should also interact with adults or experts. Teaching strategies that promote collaboration, like demonstrations, projects, discussions and others are advisable. Mathematics tasks should be culturally relevant to the students. Assessment of students' progress in mathematics learning should focus mainly on real time critical thinking, analytic problem solving, and application of the learnt concepts in solving real life problems. The thought process should be evaluated and immediate feedback should be given to the learners to guide them accordingly in their knowledge construction process. Mathematics learners should be discouraged from memorizing concepts rather they should derive the concepts from already existing knowledge.

Acknowledgments

The researcher expresses sincere gratitude to previous researchers whose work was used to carry out the current study.

Declarations

Author Contribution	:	Author 1: Conceptualization, Writing - Original Draft, Formal analysis and Methodology.
Funding Statement	:	The study did not receive any funding from external sources.
Conflict of Interest	:	The author declares no conflict of interest.
Additional Information	:	No additional information is available for this paper.
AI Declaration Statement	:	The researcher did not use any AI tools during the study.

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