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## APPLYING CONSTRUCTIVIST THEORY IN TEACHING MATHEMATICS AT GRADE 2

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### ABSTRACT

Constructivism theory emphasizes the active role of students in the learning process to create knowledge for themselves. This initiative is reflected in the fact that students are placed in situations where they find it necessary, capable, and need to solve the given problem. Through problem-solving, students create knowledge for themselves. In this paper, we present the concept of constructivist-based teaching and types of constructivism; analyze the role of constructivist-based in teaching Math, and propose some design principles and processes of lesson design according to constructivist theory.

**KEYWORDS:** Constructivism theory, constructivism- based learning, Mathematics, Grade 2, primary school.

### 1. INTRODUCTION

The orientation of the Vietnam General Education program since the year 2018 is to apply methods of positive and active learning activities in teaching subjects and other educational activities in schools. There, teachers work as organizers, guide learning activities for students, and create a friendly learning environment and problem situations to encourage students to participate actively in learning activities. Besides, learners practice, self-discovery of their own abilities and aspirations, practice habits and self-study ability, and promote their potential and accumulated knowledge and skills for development. Therefore, in teaching Mathematics in primary schools, teachers must create opportunities and organize learning activities for students to experience, discover - create, and apply knowledge and skills in real life. The role of Mathematics is a tool subject because it has two purposes: A tool for learning other subjects and a tool for solving real-life problems. Math in Grade 2 is more convenient than in 1st grade because students have initially acquired the study habits formed in Grade 1. However, students' thinking is still specific and intuitive. Therefore, in order for students to be excited and active in learning, teachers still need to invest their efforts and enthusiasm to be able to design a path of discovery and knowledge creation. The teacher is the person who will convert the knowledge of mathematical science into the knowledge of mathematics subject in the school. Teachers transfer the scientific method of mathematical perception to the method of teaching

mathematics in schools. To do this, constructivism is an effective approach for students to construct new knowledge based on known knowledge or experience.

## **2. RESULTS**

### **2.1. Constructivism theory**

#### **2.1.1. Concept of Constructivism theory**

John Dewey (1958) - an American philosopher, psychologist, and educator, emphasized: Students' intellectual development from experience is more important than from what is taught. Knowledge and ideas emerge only from a situation when learners must try to go beyond experiences that are meaningful and important to them. These situations must occur in social settings, where students can analyze standards together and create a community of others who build knowledge together.

Jean Piaget (1896-1983) was a famous Swiss psychologist. He is known as a pioneer of constructivist theory. According to Piaget J. (2001): Learning is the process by which individuals form their own knowledge. It is the process by which the individual organizes the act of exploring, and discovering the outside world, and reorganizing them in the form of cognitive schemas.

According to Bruner (1990): Learners create their own knowledge by directing ideas and approaches based on existing knowledge and experiences, applying them to new situations, and forming a whole that unifies the newly acquired knowledge with the existing knowledge in the brain.

According to Brandt (1997): Constructivist theory is a teaching theory based on the study of the human learning process and on the view that each individual constructs his own knowledge, not merely receiving knowledge from others.

In 2002, M. Briner wrote: "Students construct their own knowledge by applying ideas and approaches based on prior knowledge and experience, applying them to new and relevant situations into a unified whole between newly acquired knowledge and existing knowledge in the mind".

In general, the above perspectives have in common that is emphasizing the active role of learners in the learning process and how learners acquire knowledge for themselves. Although they highly appreciate the role of the individual, researchers also appreciate the role of society and group, in the process of students' knowledge construction.

Along with the deepening awareness of people, knowledge is constantly being renewed. In each specific problem and situation, humanity requires processing and re-creating knowledge to fit new specific problems and situations. Each person starts on the basis of his own experience to build and form new knowledge and determine the meaning of knowledge for himself. Because each person's experience background is different, the knowledge that is formed is surely also different.

So, knowledge is only a rationalization of the individual's experience, and it cannot exist independently of specific external conditions. In addition, the texture of knowledge is not arbitrary. In the process of forming knowledge, people always receive the influence of contemporary socio-cultural factors and need to cooperate and exchange with others to constantly adjust and modify their knowledge. In this way, they can fully understand the outside world.

From the above research results, we believe that: Constructivist teaching is an approach to teaching in which students actively create new knowledge and skills for themselves based on existing life experience or knowledge.

### **2.1.1. Types of constructivism in teaching**

Starting from the nature of constructivist theory, many researchers have divided constructivism in teaching into basic construction and social construction.

- Basic constructivism: Basic constructivism holds that knowledge is constructed to understand and interpret the world rather than being a "copy" of the real world. According to the basic constructivist point of view, the authenticity of things is unknowable. An individual's knowledge is what he envisions. So, we cannot penetrate other people's knowledge. This concept is different from the previous concept of knowledge that considers theories, laws, ... science already existing and independent of humans.

- Social construction: The father of Social Constructivism is the Russian psychologist Lev Vygotsky, whose hypothesis is that "knowledge must be understood as something that is activated in social interactions (and necessarily context-dependent), through interaction, debate, and exchange in the community"

According to Robert E. Slavin (1995), social construction is a theory that emphasizes the role of culture, social conditions, and their impact on the knowledge construction of human society. Social construction considers the individual in close relation to the social fields.

The knowledge that learners reconstruct is a part of the knowledge community of scientists. This is a social product, recognized in the scientific community. The criterion for assessing knowledge is to be socially acceptable. Social constructivism also notes that any understanding we have is placed in a social context. Our thoughts must be expressed in language and other common symbols. So, it can be said that knowledge construction is social even when it is an individual's think.

In teaching, cooperative teaching, communication between students and teachers should be encouraged.

In this process, the role of the teacher as guiding and helping is necessary. According to Vygotsky, learning can only be done through person-to-person interaction. Learning is a two-stage process: One stage is a cooperative, collective, and social activity; one is a stage of personal activity, an intrinsic and transformative process.

Basic Constructivism focuses on the process of creating knowledge of separate individuals, emphasizing the individual's role, and the active initiative of the individual. Meanwhile, Social Constructivism focuses on social contexts of learning, emphasizing social interaction and the exploitation of social conditions in the production of knowledge.

## **2.2 The Role of constructivist theory in Teaching Mathematics**

Constructivist theory always considers students being a central and active role throughout the teaching process. For students, the constructivist theory has the followings roles in teaching Mathematics:

- Constructivist theory helps students have an active and positive attitude in discovering and controlling new knowledge. Students also actively mobilize and apply old knowledge and skills in the process of finding new knowledge.
- Constructivist theory helps students to be active and proactive in the process of discussing and exchanging information with their friends and teachers, participating in many open learning activities such as: Joining learning forums on the internet, discussing in groups, doing a project...
- Constructivist theory helps students actively express their views and difficulties in new learning situations.
- Constructivist theory helps students to self-adjust their old knowledge after acquiring new knowledge through solving learning situations.

Teachers have very important roles in the process of teaching according to constructivist theory as follows:

In the constructivist classroom, teachers must seek the students' existing understanding, knowledge, skills, and experiences. Teachers pay attention to what students say, think, and evaluate their ideas. Teachers ask motivating questions, research, debate, and explore new knowledge.

The teacher has the role of an understanding person, an active listener, a coordinator, and a moderator to make students in the classroom cooperate with each other to discover knowledge. While listening to a student's presentation, the teacher must adjust the classroom organization strategy.

Learning is an interactive process with many different relationships. There are two important relationships which are communication and exchange between students and students, between students and teachers. In that process, students can give their views, and questions, or give solutions, and ways to prove a certain problem. That is the most suitable time for teachers to give advice, exchange, and

open-ended questions, deepening the issues which are raised by the students. This will help them get answers to their questions by themselves. It is also the process of creating new knowledge.

### **2.3. Principles of designing teaching activities according to constructivist theory**

#### *2.3.1. The design of teaching activities must be consistent with the requirements of the math curriculum at Grade 2*

The content development and design of teaching activities need to comply with the requirements of the Math program in general and the 2nd grade Math program in particular in Vietnam. Moreover, when designing teaching activities, it must be based on the requirements of the lesson to be designed, because the requirement to achieve the lesson is the goal that students must achieve after each lesson. Each teaching activity needs to be clearly defined, complete with objectives, content, and methods of teaching as a basis for building questions to assess students' cognitive level, measure students' ability, and is the basis for teachers to evaluate students.

#### *2.3.2. The design of teaching activities must be suitable for the lesson's content and the type of lesson*

Teachers carefully study the content of lessons and types of lessons to design problem situations, creating opportunities for students to explore, discover and apply knowledge. The design of activities must ensure the systematic and logical in the previous lesson, must be put in relation to the next part, the next lesson, and at the same time must be reasonable, create cognitive excitement, and stimulate creative exploration of students.

#### *2.3.3. The design of teaching activities must apply teaching methods to stimulate students' learning activities*

Each activity designed must clearly show the role of the teacher as well as that of the students. Students' activities must be centered. Teachers only give orientation and suggestions so that students can self-discover knowledge in appropriate ways to participate in activities to solve learning tasks.

#### *2.3.4. The design of teaching activities must be appropriate to the student's abilities and levels, and the psycho-physiological characteristics of students in Grade 2.*

Teachers must pay attention to the psychological factors of the individual as well as the group of students. The number of activities in each lesson must be appropriate to the student's level to have enough time to organize research, discovery, and application of knowledge. The activities are designed to attract attention, stimulate the general activities of the whole class, promote the ability to explore, discover and acquire new knowledge and should ensure equal participation of students in learning activities.

Activities must be suitable, and create conditions for students to work independently, in pairs, or in groups. Activities also help students to self-assess, evaluate each other, and combine both the teacher's assessment and the student's assessment.

The activity must ensure adequate difficulty in the process of acquiring knowledge. However, the activity is not too simple. Because if the activity is too easy, or too simple, it will lose the effect of the activity because what students already know or easily deduce will not create cognitive needs in them. In case the activity is too difficult or too complicated, students will not be able to do it, leading to boredom, loss of interest, and easy abandonment.

#### *2.3.5. Make sure to focus on learners' activities*

Learners must become active, self-aware, proactive, and creative person to create knowledge. Designing constructivist Math lessons in Grade 2 is the process of generating ideas and predicting the way primary school students find and discover knowledge, focusing mainly on what learners need to do and how to conduct such activities to gradually discover new awareness. In many primary schools in Viet Nam, the current math lesson design mainly focuses on teaching activities, what the teacher needs to do, and how to convey the entire content of the lesson to the learners. That process is mainly to transfer textbook content to students and help students remember and reproduce information from the provided material.

In contrast, the design of Math constructivist lessons in Grade 2 needs a high intellectual investment for teachers to visualize the students' new knowledge-building path, along with that, primary school students need to be supported with other conditions such as learning media, learning materials, instructions, and interactions. Teachers need to anticipate both success and failure, the difficulties that students face; Then, teachers make plans to help and support their students. Therefore, the design of Math lessons in Grade 2 needs to ensure flexibility and mobility, so that it can change and adjust flexible teaching options with specific teaching situations.

#### *2.3.6. Ensure students will be learned in diverse interactions*

Establish diverse teacher-student and student-student interactions, encourage students to exchange, debate, evaluate, and share opinions and experiences, and promote a spirit of cooperation and teamwork skills. Students interact in a multi-dimensional way during class time: Interact with teachers, with classmates, with learning media, and with learning content. That interaction is the root of the change of values in the learners, the driving force for the learners' inner quality development. During that interaction, students reveal and affirm their own values; discover the signs and the nature of things and phenomena, and turn them into their own understanding. At the same time, students reveal their own limitations and shortcomings so that teachers and classmates can promptly support and help. Therefore, teachers need to create a friendly learning environment where students feel comfortable (not forced, encouraged to exchange, debate, and express personal views, interests, and self-esteem), a really exciting and fun learning atmosphere.

### *2.3. The process of designing teaching activities according to constructivist theory*

Step 1. Analyze the curriculum and learners: Teachers need to carefully study the content of the Math curriculum, and understand the knowledge circuit and requirements of the program and textbooks.



From there, determine the outcome of knowledge and skills, the most basic requirements of the lesson, and determine the requirements in terms of quality and capacity (expected output). Emphasis on mathematical competence implies not only knowledge, skills, and techniques, but also motivations, attitudes, interests, and beliefs in learning mathematics. To have mathematical competence, students must practice, review and experience in learning Math. In addition, teachers need to base themselves on the cognitive and psychological characteristics of primary school students to build appropriate and feasible lesson objectives.

Step 2. Determine the requirements to be achieved: This is the step where the teacher determines the goal to be achieved in the lesson in terms of knowledge, capacity, and qualities. From there, the teacher determines the requirements students have to gain when finishing the lesson. These are the predictions about the learning outcomes of the learners. Learners can understand, do, and have value after conducting the lesson. This needs to be described quantitatively in the form of quantifiable cognitive, behavioral, and attitudes descriptive phrases.

Step 3. Brainstorm teaching ideas for the unit: The teacher identifies the types of student learning activities required to achieve the intended learning outcomes. From there, teachers come up with as many ideas for activities as possible. Corresponding to each idea, the teacher sketches the conditions, means, learning materials as well as the accompanying learning environment. Determine the student's ability to meet cognitive tasks, including identifying the knowledge, skills, qualities, and competencies that the student already has and should have; anticipate difficulties, situations that may arise, and solutions.

Step 4. Select ideas and design lesson plans. On the basis of considering and choosing a plan to organize learning and teaching activities, teachers select and design appropriate means, learning materials as well as a learning environment. Teachers also pay attention to helping primary school students to have symbols of "events taking place", to create concrete, vivid, and clear images supporting primary school students' awareness and their activities in the classroom, in specific space and time. It is necessary to adhere to the following principles: the plan maximizes the positivity of learning, creates attractiveness and excitement for primary school students; ensures the feasibility and suitability of the teacher's capacity.

Step 5. Organize lessons according to constructivist theory.

When teaching Mathematics, it is necessary to practice for children the habit of solving problems from many different faces. In the process of teaching, teachers need to train students to solve problems in many different ways. This will help students have flexible thinking, able to see a problem from different angles in each new learning situation.

The constructivist theory holds that students' minds are never empty. Even when faced with a completely new concept, students have more or fewer symbols and implicit forms of action related to

this new concept. Some symbols available in the student's mind will be a favorable premise for the creation of new knowledge. But there are also symbols that create obstacles and that is also one of the important causes of students' mistakes.

### 3. CONCLUSION

For teachers, teaching according to a constructivist strategy is not a type of informed and given teaching. Learners have to positively and actively explore, discover and solve learning problems. In that process, learners must make efforts to find, receive, solve, and evaluate creativity to develop their own fundamental competencies and achieve the desired learning outcomes. In designing and conducting lessons according to constructivist theory, teaching and learning activities are active, the teaching program has the function of encouraging, guiding, and focusing on learners' activities. Teachers need to create a learning environment according to the ideology of applying constructivist theory, ensuring space, time, and equipment for learning, especially problem situations for students to actively participate in the teaching and learning process.

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