Research on the Essence and Main Characteristics of Mathematics Constructivism Learning Based on Number Sense Cultivation

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Abstract: Constructivism education thought has attracted extensive attention in recent years. Its teaching view, student view and learning view have provided many valuable references for the reform of modern education. Influenced by Piaget genetic epistemology, constructivism learning theory has gradually formed and developed, which has had a profound impact on the teaching of various disciplines, especially mathematics teaching. Teachers should not only help students master mathematics knowledge, but also improve their logical thinking ability and cultivate their sense of numbers. Based on the cultivation of the sense of numbers, this paper discusses the essence of the theory's mathematical constructivism learning, the constructivist learning view and the characteristics embodied in the mathematical teaching under the guidance of the theory.

1. Introduction

Constructivism has been a hot topic in the international mathematics education field since the 1980s. Because it emphasizes the inner thinking construction activities of the cognitive subject and better reveals the process and essence of mathematics learning, it has increasingly become an important educational theory guiding the current quality education and innovative education [1]. Human's understanding of logic, mathematics and physics is the product of continuous construction. From the initial pattern, the structure is constructed, which plays an intermediary role in understanding. The structure is continuously constructed, from relatively simple structure to more complex structure, which is realized and completed by force activities. At the same time, the abstract understanding of logarithm is the most basic content. Through effective learning, students' sense of numbers can be continuously improved, and at the same time, students can learn to reason and draw inferences from one instance to another [2]. Cognitive psychologists also pay more and more attention to education as a field of psychological application and a source of research problems. In recent years, the vast number of mathematics educators in our country have devoted themselves to the research of innovative mathematics teaching and have achieved fruitful results, forming many new generation of teaching modes and teaching methods suitable for the construction concept, making quality education and innovative education flourish. Constructivism teaching has also developed into an important teaching theory. A full understanding of constructivism learning and teaching theory is of great significance for promoting mathematics teaching reform and improving mathematics teaching quality.

2. The Essence of Mathematics Constructivism Learning

The essence of mathematics constructivism learning is that the subject constructs the meaning of the object psychologically through the thinking structure of the object. The so-called "thinking structure" means that the subject obtains the meaning of the new knowledge in the process of connecting the new knowledge with various factors in various aspects. Cognition is a continuous construction. The so-called construction refers to the occurrence and transformation of the structure. Only by putting the human cognitive structure into the continuous construction process and studying

the occurrence and transformation of the cognitive structure dynamically can the epistemological problem be solved [3]. Knowledge is not internally represented by symbol system, but exists subjectively by psychological image or psychological mode. Knowledge is not an accurate representation of reality, but an explanation and assumption [4]. In addition, it is necessary to establish links with various related experiences and related knowledge in the cognitive structure. This thinking activity of establishing multiple links constructs the network framework of the relationship between new knowledge and various factors, thus finally obtaining the meaning of new knowledge. It refers to the original rational function inherent in all mankind, which considers that structure is the unconscious function of the human mind projected onto the object and is a sort and arrangement of the structural potential of the human brain to the outside world. It requires students to actively and actively organize basic knowledge systematically, deeply understand and flexibly apply it, so as to keep their original cognitive structure stable and clear and become the basis for acquiring new knowledge in the future. In the process of assimilation and adaptation, students are required to actively and actively carry out a series of organizational processing, selection, transformation and reorganization of new knowledge.

"Construction" is also the process of establishing and constructing the cognitive structure of new knowledge. "Establishment" generally refers to the construction from scratch. "Construction" refers to the adjustment, integration or reorganization of existing materials, structures and frameworks. Soil's learning of new knowledge includes both the establishment and construction. The role of teachers is to create a learning environment for students so that students can establish a new mathematical cognitive structure through expression, communication, comparison, criticism, reflection and improvement in the learning environment. Any pattern that can be stored or referred to other patterns is a symbol that can be processed by an information processing system. In short, cognitive psychology of information processing holds that knowledge is a symbol system of internal representation, and learning is a process of transforming external symbol representation into internal representation. Assimilation is the process in which an individual assimilates objects into the schema of a human subject. Conformity is that the schema of the subject cannot assimilate objects, thus causing qualitative changes in the schema and promoting the adjustment or innovation of the schema. Balance refers to the balance between assimilation and adaptation. The most obvious and fundamental feature of quality education and innovation education is to highlight the initiative, autonomy and creativity of students. Therefore, it is consistent with constructivism, which emphasizes that teaching should be student-centered, become the active constructor of knowledge meaning, and promote the all-round development of human beings.

3. Basic Characteristics of Teaching Process of Mathematical Constructivism

The teaching concept of mathematics constructivism emphasizes "student-centered" teaching, emphasizes students' positive initiative, pays attention to students' existing life experience and knowledge background, and pays attention to students' self-guided learning and self-regulated learning. It is a process in which the subject produces personal experience due to his own intellectual participation in the independent activities with the object as the object. The meaning of the object is established in this process. Although individuals have given certain external forms of knowledge through language symbols, and even these propositions have been generally accepted, this does not mean that learners will have the same understanding of these propositions. So as to enable students to actively participate in the mathematics teaching process, making the mathematics teaching process more colorful and full of vitality. Therefore, the teaching process of mathematics constructivism teaching concept has the following basic characteristics.

3.1 Subject participation

The learning activity of new mathematics knowledge is a process in which the subject establishes and develops the mathematical cognitive structure in his own mind, and it is also a process in which mathematics activities and experiences are internalized. The completion of such a process is entirely

the independent behavior of the subject, which can only be realized through the active participation of the subject. When the construction of a new mathematical knowledge is completed, its linguistic representation is only an external form that can be expressed, in addition to which there are non-linguistic representations that cannot be expressed in external forms. However, non-linguistic representations are closely related to linguistic representations and give strong support to linguistic representations. Constructivists believe that individuals can understand symbolic systems to obtain psychological structures or psychological meanings, and can internalize symbolic systems, but this internalized symbolic system is impossible to understand other symbolic systems. It is necessary to ask questions with the help of situations and find out the mathematical models that exist in them, so as to develop a good sense of numbers. That is to say, the construction of mathematical knowledge is a double coding of language and non-language. We usually only pay more attention to language coding and ignore non-language coding. In fact, in the construction activities of mathematics, non-language coding is often carried out first, and then language coding is carried out. In fact, from the perspective of teaching content, students can participate in every link of teaching as long as it is carefully designed. Find out the method to solve the problem, extract the mathematical concepts contained in it, and obtain mathematical results such as mathematical formulas or properties. In case of problems, in addition to discussing with other students, you can also communicate with teachers.

3.2 Autonomous choice

On the one hand, teaching should provide the basis for students to construct and understand, and at the same time, it should leave students broad space for construction so that they can adopt appropriate strategies for specific situations. In the active activity of the object, the subject obtains not only linguistic representation, but also plot representation and action representation. Language representation is the abstraction and generalization of experience in the activity, plot representation is the visual image or other image in the activity, and action representation is the direct experience obtained in the action. Knowledge is not passively accepted by individuals through feeling or communication, but is actively constructed by cognitive subjects. Construction is realized through the interaction of old and new experiences [1]. Moreover, knowledge or meaning is not simply determined by external information, and external information itself has no meaning. Sense of number belongs to an advanced mental skill, which can not be formed and cultivated by teachers simply through knowledge explanation, but requires students to return mathematical knowledge to life, digest knowledge continuously through life practice, and gradually internalize sense of number into their own skills [5]. In learning, learners' autonomy and initiative are encouraged. It holds that learning is the result of thinking structure, and students' learning is the result of combining new information with known information. If students can actively construct their own understanding, they can learn better. This link must leave enough time and space for students to take part in activities, give students the right to question independently, respect students' awareness of independent exploration, and teach students the method of independent knowledge. If there is only language code but no non-language code, then understanding is incomplete. Therefore, if the content of mathematics learning is only transmitted to students in the form of language, the personal experience will be incomplete due to the lack of non-language representation.

3.3 Situational learning

Constructivist teaching view holds that learning should take place in a situation similar to the real situation. The teaching goal is to solve the problems encountered by students in real life. The learning content should choose authentic tasks and cannot be treated simply [6]. This process of internalization, or in the form of assimilation, brings the object into the existing cognitive structure, causing changes in the amount of the original cognitive structure; Or change the existing cognitive structure in the form of adaptation so as to be consistent with the objects that do not adapt to oneself, thus making the original cognitive structure undergo qualitative changes. Learning is a process of construction. This is the constructionist's understanding of the nature of the learning process. This understanding completely conforms to Piaget's two-way construction theory, namely assimilation

within and assimilation outside. Show the exploration process similar to the actual problem solving in class, provide the prototype of problem solving, and guide students to carry out exploration activities. Because the essence of mathematics construction learning activity is thinking structure, it indicates that this is a creative process. Although it is the nature of rediscovery and recreation, it is still the first time that the learner discovers and invents himself. Therefore, the subject must have a high level of intellectual participation before this creative process can be realized.

3.4 Inquiry activity

Constructive learning is usually strong in inquiry, and inquiry learning plays an important role. Students must have a process of understanding or digesting the new knowledge taught by teachers. According to constructivism, the "understanding" or "digesting" here is also to incorporate what teachers say into their proper cognitive structure. This process of integration must be based on their existing knowledge and experience to make their own explanation of what teachers say. In this process, due to the conflict, adjustment and change of the old and new knowledge, the existing psychology has been transformed and reorganized. In this process, a series of physical and reflexive abstractions exist and operate. Although we have proposed for a long time that teachers should take the lead and students should be the main body in classroom teaching, we still think that this is reasonable, but students are still not the main body in classroom teaching. Therefore, mathematics teaching should design the typical materials in the teaching materials into inquiry activities for students to rediscover and recreate, providing a relevant cognitive framework for students to construct their understanding of knowledge. At this time, what the students have learned is not what the teachers have taught, but has gone through the thinking structure of the main body. It can be seen that this kind of "understanding" or "digestion" actually has a strong "creative nature" and cannot be realized without the high level of intellectual participation of the main body.

3.5 Cooperation and exchange

The cooperative communication under the viewpoint of mathematical constructivism revolves around mathematical problems. Through mutual communication and communication, mutual argument and discussion, teachers and students, students and students cooperate to complete certain tasks and jointly solve problems. Constructivism holds that the first thing to do is to construct the meaning of the problem, that is, to activate and extract knowledge and experience related to the problem from memory, to distinguish the existing state, target state, existing state and target state of the problem, and what actions can be taken to narrow the difference. Therefore, if teachers want to cultivate students' sense of numbers, they should let students learn to transform abstract mathematical concepts into concrete understanding, and then gradually induce students to produce sense of numbers from concrete to abstract. Of course, constructivist learning still has other characteristics, such as accumulation, diagnosis, reflection, situation and problem orientation [7]. The issues involved in cooperation and communication are preferably those that can stimulate thinking, "structurally unsound" issues, confusing issues, and open and exploratory issues. Although we do not agree that in mathematics teaching, every mathematical concept and mathematical result can be obtained through students' exploration and discovery, in fact this is unlikely, but it should be of positive significance for students to have the opportunity to explore and discover mathematics [8].

3.6 Open teaching

Constructivism emphasizes the creation of a learning environment with multiple sources of information and multiple viewpoints, encourages learners to acquire diverse viewpoints, and analyzes and synthesizes these viewpoints to form an integrated higher-level viewpoint. For students at the stage of cognitive development, this kind of activity is initially mainly manifested as external activities. Due to the intellectual participation of the main body itself, the external activity process is internalized into the psychological activity process within the main body, from which the main body's personal experience is generated. Constructivist teaching attaches great importance to the importance of the students' existing direct experience to their learning. It believes that teaching cannot ignore the

students' rich perceptual experience and cognitive ability and put new knowledge into the outside, but should take "the students' existing knowledge and experience as the growing point of new knowledge. The biggest characteristic of teaching openness is the teaching of open problems. The teaching of open questions can provide more opportunities to encourage students not only to read and write, but also to speak and listen. An important symbol of activity autonomy is the subject's intellectual participation. The higher the subject's intellectual participation, the stronger the autonomy of the activity. Under the autonomous activity, the personal experience resulting from their own intellectual participation is the cornerstone of the psychological significance of new knowledge, and eventually sublimates into the psychological significance of new knowledge.

4. Summary

In a word, constructivist mathematics teaching has a feeling of returning students' mathematics learning to its true colors, flashing the light of Dewey, Vygotsky, Bruner and Piaget's theories, and fully showing the thoughts of naturalistic education and open education. In teaching, teachers' reflection includes two aspects: first, to assist students in reflection. Specifically, guide students: first, reflect on their own thinking process; The second is to reflect on the knowledge involved in learning activities; Cultivating students' good sense of numbers is of great significance to the improvement of students' mathematical literacy. Therefore, in teaching, teachers should combine the actual content of the curriculum, carefully design the situation for students to cultivate the sense of numbers, and provide a good environment for students to develop the sense of numbers. Secondly, teachers reflect on themselves, that is, adjust teaching behavior according to students' learning situation, and reflect on the whole teaching process and results. It is worthy of our in-depth research on constructivism theory and its influence on mathematics education, which may enlighten our reform of mathematics education.

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