International Journal of Humanities and Social Science Research
ISSN: 2455-2070; Impact Factor: RJIF 5.22
www.socialsciencejournal.in
Volume 3; Issue 7; July 2017; Page No. 52-54

The study on promoting students to understand mathematics concept with advance organizers

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Abstract
According to the characteristics of mathematics poor students we put forward the design strategy and the application method of advance organizers in mathematical teaching, the aim is to promote them to understand mathematics concepts better.

Keywords: mathematics poor students, mathematics concept, advance organizers

1. Introduction

Mathematics poor students is an unignorable group, since in modern society, mathematics has become an indispensable tool to help people live, work and study. Mathematics also is an important aspect to cultivate well-rounded persons that the curriculum standard emphasized. When the mathematics poor students step into society or start a new study, the fears for mathematics will undoubtedly not only bring pressure to them, but also burden the society. Therefore, it is a concerned problem for education workers to transform the mathematics poor students. In fact the causes of mathematics poor students are complex, and the ways of transformation have been numerous. The article will put forward a strategy about advance organizers in order to improve the the effect of poor students on understanding mathematics concept.

2. The concept of poor students and mathematics poor students

Learning difficulties also be called learning disabilities. American Kirk thought poor students referred to those children who had one or several psychological procedural obstacles in understanding and using verbal and written language. The obstacles included imperfect performance in listening, speaking, reading, thinking, counting. But the obstacles did not include audio-visual defects, motion defects, mental retardation, disabilities and poor economic and cultural environment (Pi, 1997) [1]. Simply, poor students refer to these students whose senses and intelligence are normal but learning results are far from teaching objects.

Mathematics learning difficulties (or mathematics learning disabilities) refer to students' backwardness in mathematics learning because of the defect of mathematics ability, namely the phenomenon that poor students obviously lag behind students of the same age or grade. Mathematics learning disabilities is a subtype of learning disability, which is a learning disability in mathematics. Mathematics learning disabilities is mainly manifested on computational errors, arithmetic disorders, difficulty in reading and writing, poor problem-solving ability, spatial organizational obstacles, especially problem-solving ability (Xu, 2003) [2]. Therefore, mathematics poor students can be simply defined as the students who have normal senses and intelligence but have some difficulties in mathematics learning and need special coaching and helping to achieve the requirements of mathematics curriculum standard.

3. The learning of mathematics concept

Mathematics concept is a thinking form reflecting essential attributes of things in quantity relationships of quantity and situation of space, which is an abstraction after excluding the specific material contents of objects and what it reflected is the inherent properties of objects in numbers and shapes. Mathematics concept is often learned through concept formation and concept assimilation. The process of concept formation is the one that according to identifying various stimulation modes (it can be experience of students or typical examples of teachers), students differentiate their properties, determine their key ability, differentiate new concept from existing concepts and summarize concept in language. With the increasing of students' age and the improvement of cognitive level, the concept assimilation has gradually become the main form of getting concept. The basic learning stage is: (1) revealing the essential properties of the concept, giving the definition names and symbols; (2)classifying concepts, discussing various special cases that concepts contain, highlighting the essential features of the concept; (3)connecting new concepts with relevant concepts in existing cognitive structures, incorporating new concepts into existing conceptual systems, assimilating new concepts; (4) using positive examples and negative examples to help students differentiate new concepts from existing cognitive structures; (5) incorporating new concepts into the corresponding conceptual systems to make up a whole (Cao, 2006) [3].

In the long teaching practice, junior high school mathematics education workers put forward the following teaching mode in mathematics concept: (1)introducing the background of the concept, guiding students to discover essential properties of the concept; (2)revealing the essential properties of the concept by giving the definition; (3) establishing the relationship between concepts and concepts, forming a conceptual system; (4) consolidating concepts; (5) applying of concepts; (6) understanding the conceptual learning process. Comparing with the mode of concept assimilation, it could be seen this mode focused on the context of concepts, the system of concepts and the understanding of conceptual learning process. The mode is more consistent with cognitive regularity of students.

4. Difficulties and strategy in mathematics concept learning.

The reasons of mathematics poor students are complex, and

views are not unified. In terms of internal causes, the characteristics of existing cognitive structures are more discussed. While in terms of external causes, the guidance of teachers is more discussed. Students' understanding of mathematics concepts is influenced by some factors such as cognitive structure, the property of conceptual learning materials, the ability of abstract and summary. Ausubel thought what we needed to pay attention to were the following three variables in the students' cognitive structure, it was the key to make students have meaningful learning: (1) whether the concepts which are in the cognitive structure and able to connect the new material are available; (2) the degree of differentiation between existing concepts and the new concepts; (3) whether the concept as fixed point function in cognitive structure is stable and clear (Shi, 2001) [4].

In recent years, with the rapid development of the mathematics learning disabilities children's compensation education, people developed a series of effective intervention plans. Among them, cognitive orientation intervention is based on neurology of identifying and dealing with math problems, especially disorder in the process, namely cognitive orientation intervention is based on students' mathematics cognitive obstacles. Poor students have some defects in the process of understanding mathematics knowledge, transforming knowledge and associating cognitive structures. These defects affect their processing about mathematics knowledge. The key part of translating teaching of teachers into effective learning of students is establishing relationship between external knowledge and existing knowledge and translating mathematics instruction into students' cognitive instruction(Xu,2005) [5]. Ausubel's advance organizers is a strategy that influences learners' cognitive structure from the outside and helps students to establish relationship between external knowledge and existing knowledge. The aim of the strategy is to help poor students understand mathematics concepts and make meaningful learning.

The purpose of advance organizers strategy is to build relationship between what students already know and what they need to know to help students make meaning learning and form cognitive structure. Ausubel thinks the most effective strategy for promoting learning and prevention of interference is taking advantage of associated, inclusive, the most clear and the most stable guiding material. The guiding material is called organizers. Because these organizers are often used before teaching to help students build psychological trends of meaning learning, they also be called advance organizers. Later, the concept was further developed: the organizers could be used either before teaching or after teaching and the level of abstraction, generality and perturbation can be higher or lower than the learning material (Shi, 2001) [4].

The difficulty of understanding mathematics concept is the abstraction of the mathematics concept itself. The abstraction makes poor students feel difficult to find the substantive connection between old knowledge and new knowledge. Using appropriate advance organizers can help students grasp the conceptual logical relationship. For example, advance organizers that have concrete image can reduce the abstraction of the mathematics concept itself. While advance organizers that have strong generality can help students assimilate new concepts easier.

5. The design of the advance organizers

The key using the strategy effectively to promote the understanding of mathematics concepts is the design of the advance organizers (Lu, 2000) [6]. According to the definition of advance organizers, the form of advance materials can be a law, a concept or a general text, which is higher than the new learning material in the general level. The form of advance materials can also be a concrete model, an illustrative diagram, a life phenomenon, which is lower than the new learning material in the general level. No matter what form of organizers, its type can be divided two categories: declarative organizers and comparative organizers. If cognitive structures lack the knowledge to assimilate new concepts, declarative organizers can help students embed suitable upper concepts. If students have a vague concept, it will be more ambiguous in the face of a similar new concept. At this moment, comparative organizers can increase the clarity and consolidation of the original concepts.

Before students learned concepts of linear inequality of one unknown and quadratic equation with one unknown, teachers firstly guided students to recall the concept of linear equation with one unknown. The strategy not only reduces the difficulty in learning the new concept but also consolidates the original concept. It is a method that teachers unconsciously use in teaching. Similarly, if students can firstly recall the formula of a function when they summarize the formula of the quadratic function, they will obtain the same effect. These strategies actually use as comparative organizers.

Here are a few cases

Case 1

Teachers firstly told a story about drawing Yang tao when students touched the concept of three view.

Teachers asked students to draw Yang Tao he laid it on the table in the art class. A student finished it carefully. But other students laughed at him because he draw a star. The teacher went to his position and look at the Yang tao. Then the teachers also let other students look at the Yang tao in that student's position. Finally students understood that Yang tao seemed like a star in that position.

According to this interesting and educational story, students would deeply feel that they might saw different pictures when they looked at an object from different angles. That will improve students' understanding of three views and enthusiasm to observe carefully. Here, the story was used as declarative organizers.

Case 2

Students often have difficulty in understanding the concept of irrational number. Irrational number is introduced by letting students experience discovery process in the textbook. However, if irrational number is introduced by its real discovery process, students will have a clearer understanding about the invention and expansion of numbers. Then students will have enough cognitive readiness and enthusiasm to study irrational number. Therefore the mathematics history can be used as advance organizers to study irrational number:

Pythagorean School is a school represented by the Greek philosopher, mathematician and astronomer Pythagoras. The

school thinks “everything has its numbers”, namely” all phenomena in the universe can be attributed to integers or the ratio of integers” or all phenomena can be described by rational number. 5th century BC, Hipparchus, a member of Pythagorean School, discovered the length of square diagonals that the square's side is one could not be represented by integers or the ratio of integers. The discovery broke Pythagorean religion and caused panic among its believers. As a result, Hipparchus was thrown into the sea. But the truth still exists even he died. Posterity accepted his discovery and proved it. These numbers were called irrational number. They exist objectively and can describe the objective world like rational number.

6. The application of advance organizers

Advance organizers are usually used before the teaching of new knowledge because of its "antecedent" meaning. Can we put it behind the new knowledge? Foreign studies have shown that advance organizers can be used after teaching (Zhang, 1999) [7]. Some studies show that it is best to use advance organizers again after teaching. That will let students know the beginning and end of the new knowledge to help students better understand and grasp concepts (Zhang, 2005) [8]. As case 1, students have a certain understanding of the concept of three views and can draw three views of simple geometry. Then teachers let students try to draw two other views as one of the views of the star. Students' spatial imagination ability will be further stimulated and the understanding of the three views will be more profound.

The learning of mathematics concepts is a prerequisite for students to learn mathematics. Poor students often encounter all kinds of problems in the learning of abstract concept because of the lack of good cognitive structures and weak generalization ability. Therefore, the proper use of the advance organizers can influence their existing cognitive structure, reduce the difficulty of the concept learning, promote the understanding of the concept, eventually achieve meaningful learning.

7. References

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