

Comparative Study of Mathematics Teaching Methods at Home and Abroad

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Abstract—Teaching methods are the intermediaries and bridges between teachers, students and teaching contents. They are the means and methods used in the dynamic process of putting the established teaching contents into practice. Whether teaching is successful or not is directly related to the selection of teaching methods, which greatly affects teaching efficiency and teaching effect. This paper compares the research and development of Chinese and foreign mathematics teaching methods by introducing the connotation and basic theory of mathematics teaching methods, and finds out their similarities and differences. It enlightens the reform and development of mathematics teaching methods in our country and makes our mathematics education speed up the reform of mathematics teaching methods while preserving its own advantages.

Keywords—Teaching methods; Mathematics teaching methods; Sino-foreign comparison; Reform

I. INTRODUCTION

Teaching method is one of the important factors that constitute teaching activities. "Method includes people's attitude, intention (technology) and procedure (operation)." [1] Combining with the characteristics of teaching, the connotation of teaching methods includes: (1) Teaching methods are restricted and guided by certain teaching purposes and teaching ideas, which are helpful to achieve the purpose. (2) Teaching methods embody the internal relationship among the elements of teaching activities, especially the relationship among teachers, students and contents. (3) The teaching method consists of a series of actions, which are manifested in the observable and explicit behavior of teachers and students.

Mathematics teaching method can be regarded as an interrelated activity way for teachers and students to achieve the goal of mathematics teaching, and it is an important means for students to learn mathematics knowledge, increase their skills and develop their abilities. It includes teachers' working methods and students' learning methods. It is a dynamic system under the guidance of philosophy and educational thought. Herbart, the idealist theorist, emphasized that

"students must maintain a passive state towards teachers", negated the students' subjective status, and vigorously carried out the theory of "external shaping". Dewey, the idealist empiricist, advocated that "education activities should be child-centered", negated the leading role of teachers, and vigorously carried out the "endogenous theory". Both of them oppose the leading role of teachers and the initiative of students, negate the unity of teaching and learning, and ignore the objective law of teaching. Marxist philosophy affirms the dual functions of external and internal causes, and points out that teaching is a dynamic process in which teachers are the dominant factor, students are the main body, textbooks are the main line, according to specific teaching laws and scientific teaching methods, so that students can fully develop.

II. RESEARCH ON MATHEMATICS TEACHING METHODS ABROAD

Foreign research on teaching methods is relatively early, and the research results are quite rich. In ancient society, the purpose of teaching activities was to preserve the experience accumulated by ancestors. The appropriate method was to pass it on from mouth to ear by the elders and to imitate, practice and remember by the younger. The early Greek and Roman schools mostly adopted this teaching method.

In the early Western ancient times, Socrates, an ancient Greek thinker, also proposed the "midwifery" - the earliest heuristic teaching method. He emphasized that education is a process of constantly eliciting and developing children's potential wisdom from the inside to the outside, not a process of injecting, training and shaping from the outside to the inside; the main purpose of teaching is not to simply impart knowledge, but to seek the correct knowledge that can be accepted by students; teachers are also a learner, exploring with students. Knowledge, not the prophet of knowledge and problems.

Next, more valuable teaching ideas appeared in modern times. Great changes have taken place in the values of education in modern western countries. The teaching methods

have changed from sensory realism to emotional teaching, and then to physical teaching and activity teaching. For example, during this period, Czech educator Comenius advocated the intuitive teaching method and the use of senses to develop intelligence; later German educator Didaway advocated the intuitive teaching, which stimulated students' intellectual life through a series of intuitive rules; Swiss democratic educator Pestalozzi carried out the experiment of intuitive physical teaching method. German educator Froeber believes that the main form of children's activities is games, using games to teach students to self-activity and self-development; German Herbart put forward the "five-stage teaching method", which divides the teaching process into clear, associative and self-development. Systematic and methodological stages, after the expansion of Ziller and Rein, have drawn up five stages, namely preparation, prompting, association, summary and application [2,3]. It has pointed out the mechanism of concept transformation and connection for teachers' teaching at that time, and rationalized the teaching steps.

The development of modern teaching methods in the West has produced many new teaching methods. At the end of the 19th century, the progressive education movement appeared in the United States. Barnard, Horace Manparker and others introduced and promoted the achievements of the advanced teaching reform in Guangxi. As a result, American educators carried out a reform in the field of teaching methods. They opposed the traditional teaching methods currently used in the United States and advocated freedom, activities and performance. New teaching methods emerged, such as de Crowley's teaching method, Morrison's unit teaching method, Dewey's activity teaching method and Klebtra's design teaching method, which affirmed the dominant position of children, respected their needs, learned in interesting activities and developed their practical ability, reflecting the new comprehensive teaching methods [4].

In the early 1960s, the United States carried out another campaign to promote equal educational opportunities. At that time, Bruner's representative educational thought was "discovery learning", which was reflected in his book "The Educational Process". He believed that students should choose the subject structure to understand and classify the curriculum into two types: linear and spiral. Zhang should adopt the method of discovery to teach, cultivate students' interest in learning content, and develop students' thinking ability [5].

More influential to the world are the educators of the Soviet Union, such as the famous educator and psychologist Zankov, who put forward his idea of teaching and development in psychologist Vygotsky's idea of "the zone of recent development". He believed that teaching should make all the students in the class develop generally, with special emphasis on the worst learning. The development of life. He believed that for the backward students, more efforts were needed to develop their intelligence and abilities than other students. Supplementary lessons and a large number of exercises were indispensable means. In general practice, however, the possibility of providing real intellectual activity for the worst learning is minimal.

The foreign mathematics teaching methods are summarized in the popular mathematics teaching methods abroad published by Shanghai Education.

(1) Discovery-centered teaching method. Since the beginning of the 20th century, foreign educators have realized that the ultimate goal of teaching is not for the discipline itself, but to teach students how to think through the teaching of the discipline. They advocated that students should be helped to become discoverers of laws and pioneers of knowledge, and put forward that mathematics teaching should focus on discovery behavior. In the process of discovery-centered teaching, teachers are only the organizers of the discovery process and provide guidance and help to students with students as the main body. What British and American educators call "inquiry and discovery" is the representative of this kind of teaching method.

(2) Empirical life-centered teaching method. In order to improve the efficiency of mathematics teaching, the teaching in western countries has gradually shifted from mechanical and rigid methods to respecting students' learning experience and fully integrating the real life with the real scene. This kind of teaching method is springing up in Britain and America. It emphasizes organizing teaching for the purpose of developing students' personality, focusing on students' cognitive structure and the practical application of knowledge. For example, the "Applied Mathematics" in English primary and secondary school mathematics education pays great attention to solving practical problems and daily life problems, including raising questions, designing tasks, making plans, collecting information, selecting mathematics, applying strategies, obtaining conclusions, testing and interpreting results, etc., rather than being limited to books. "Problem" and rigid solution process.

(3) Systematic learning-centered teaching method. The greatest feature of mathematics textbooks and teaching in primary and secondary schools in the former Soviet Union is to pay attention to the logical systematicness and rigor of mathematical knowledge system and to the quality of teaching, which is different from the experience-based life-centered mathematical education in Britain and the United States. Similarly, in Japan, there has been a period of emphasis on systematic learning, not only to enable students to understand knowledge systematically in form, but also to develop students' logical thinking, so that students can think systematically in terms of thinking. In addition, the "procedural teaching method" which was formed and developed by American educator Skinner in the 20th century also comes from the systematic educational thought of mathematics.

(4) Problem-solving-centered teaching method. Since the end of 1970s, the "problem-solving-centered" mathematics teaching method has formed a new wave in the world. In 1980, the National Institute of Mathematics Teachers in the United States published the Action Agenda, which pointed out that "problem solving should be the core of mathematics in primary and secondary schools in the 1980s", and put forward 10 basic skills: the ability to solve problems; the ability to apply mathematics to daily life; and the ability to perceive the

rationality of results; (4) the ability of approximate estimation; _the ability of reasonable calculation; the ability of geometric structure; _the ability of measurement; the ability of reading, explaining, making charts and block diagrams; the ability of using mathematics for prediction; the ability of using computers. [5] Since 1980, "problem solving" has become the most popular research topic in mathematics education. Many textbooks aim at problem solving, which is unprecedented until today.

III. RESEARCH ON MATHEMATICS TEACHING METHOD IN CHINA

The related research of mathematics teaching methods in China is more about the classification and introduction of mathematics teaching methods.

"Research on Mathematics Classroom Teaching in Junior High School" edited by Li Qiulai introduces the traditional maths classroom teaching methods (explanation method, conversation method, reading guidance method, guidance homework method, demonstration method of teaching aids) and modern maths teaching methods in junior high school (guidance discovery method, procedure teaching method, self-study guidance method, unit teaching method, trial guidance-effect). Return teaching method and research method.

The Course of Mathematics Teaching in Middle Schools, edited by the Department of Mathematics, Capital Normal University, introduces Professor Li Bingde, an expert in teaching theory in China. According to the external form of teaching methods and the characteristics of students' cognitive activities under this form, the commonly used teaching methods in primary and secondary schools are divided into five categories: the method of transmitting information mainly by language (lecture). Law, conversation, discussion and reading guidance; direct perception as the main method; practical training as the main method (practice); guiding exploration as the main method; appreciation activities as the main method.

In the article "The Reform and Experiments of Mathematics Teaching Method in Middle Schools in the Development of Modern Mathematics Teaching Method in China", Dai Qin considered that the development of Mathematics Teaching Method in Middle Schools in China has gone through four stages: from the founding of the People's Republic to the pre-Cultural Revolution, the period of "ten years of turmoil", the period from 1977 to the mid-1980s, and the middle and late 1980s. The teaching methods are divided into self-study and guidance, guidance and inquiry, communication and discussion and activities. However, the main teaching methods in each stage are not elaborated. In addition, Xu Dan and Fu Helen's "Recognition of the Reform of Mathematics Teaching Methods in China in the Past 30 Years" comprehensively analyzed the achievements of the reform of mathematics teaching methods in middle schools in China since the 1980s, and pointed out that the research on mathematics teaching methods in middle schools in China started in the 20th century by mathematics educators and researchers. In the early 1950s, Kelov's classroom teaching mode was introduced into China's educational circles during

this period. First, it was "deep and thorough", and then gradually it was "intensive and practical" [6]. Up to the end of 1970s when the college entrance examination was resumed, the reform of education and teaching was carried out in an all-round way, and the reform of teaching methods aimed at improving the quality of teaching was put forward. In particular, the Standing Council of the Mathematics Teaching Professional Committee of the Chinese Teaching Society issued the call of "actively carrying out teaching research and further improving the quality of mathematics teaching" in 1982. The advocacy of the experiment of teaching method reform actively leads mathematics teachers and theoretical workers to explore and summarize the large-scale reform of teaching method of mathematics on the basis of inheriting the "heuristic" teaching method with Chinese characteristics and drawing lessons from many advanced educational ideas abroad. Fruits are springing up like bamboo shoots after a rain. However, a large number of achievements of teaching method reform have not been popularized, many of them have been busy for a while, and some of them seem to go around and back to their original place.

IV. COMPARISON OF MATHEMATICS TEACHING METHODS BETWEEN CHINA AND FOREIGN COUNTRIES

A. *Similarities of Mathematics Teaching Methods between China and Foreign Countries*

From the existing research results, foreign research is earlier than domestic research, and the research results are more abundant than China. Comparatively, the similarities between Chinese and foreign mathematics teaching methods in middle schools are as follows:

(1) The teaching procedures are basically the same. For example, in the middle school mathematics teaching in many countries, the new teaching is basically based on the teacher asking questions. Students preview with questions or read and study by themselves, then understand what they have learned under the teacher's explanation and summary, and consolidate what they have learned with classroom exercises and homework after class.

(2) Teaching method is a basic teaching method widely used in middle school mathematics teaching in various countries. Whether in China or in other countries, mathematics teachers are mainly teaching methods to transfer mathematics knowledge to students, in some cases will be supplemented by other teaching methods.

(3) Heuristic teaching is widely emphasized. At home and abroad, Dupu has carried out various degrees of teaching methods reform, including, of course, the reform of middle school mathematics teaching methods. Through the reform, more and more attention has been paid to the cultivation of ability and the improvement of students' comprehensive quality in mathematics teaching in various countries, especially to the application of heuristic teaching ideas in mathematics teaching.

B. Differences in Mathematics Teaching Methods between China and Foreign Countries

(1) Different attention is paid to the development of ability and personality. Foreign countries attach great importance to the cultivation of students' personality, which has better trained students' self-study ability. Teaching attaches great importance to teaching students in accordance with their aptitude, which can meet the learning needs of different students. In our country, we pay more attention to the mastery of the basic knowledge of the subject, but lack of attention to the individual differences of students.

(2) Teachers and students have different roles and relationships in the teaching process. In our country, teaching is usually teacher-centered, in the process of teaching, we often adopt the teaching method of indoctrination. Foreign teachers attach great importance to the cultivation of students' interest in learning. If students can not understand a certain mathematical knowledge, teachers will create a specific teaching atmosphere, which will infect students, so that they can actively explore knowledge and understand knowledge.

(3) There are differences between the cultivation of students' mathematics consciousness and the thought of Applied Mathematics education. In foreign countries, mathematics teaching pays attention to the connection with life, introduces the familiar cases to mathematics teaching as far as possible, attaches great importance to applied mathematics education, and cultivates students' mathematics consciousness. For a long time, our country has focused on imparting book knowledge. This new curriculum reform requires the cultivation of students' practical and innovative abilities. Mathematics teaching is gradually strengthening the cultivation of students' mathematical awareness and application.

V. INSPIRATION

Through the comparison of mathematics teaching methods between China and foreign countries, the trend of International Mathematics Education Development in recent years and the current situation of mathematics education development in China, according to the requirements of quality education, the reform of mathematics teaching methods in our country should pay attention to students' independent inquiry, emphasize the adaptability of teaching and highlight the emotionality of teaching. It is embodied in:

(1) Pay attention to the communication between teachers and students, improve the relationship between teachers and students, strengthen the comprehensive understanding of students, and mobilize students' enthusiasm for learning;

(2) Pay attention to the cultivation of students' knowledge and skills, processes and methods, emotional attitudes and values, so that students can develop in an all-round way;

(3) Emphasizing the role of emotion in teaching and the influence of non-intellectual factors on teaching;

(4) Pay attention to the whole process of the occurrence, exploration, discovery, argumentation and application of mathematical problems, from the injection teaching method to the heuristic teaching method;

(5) Teaching methods should effectively use modern educational technology;

(6) Reform the examination system, break the theory of "only going to school" and lighten the burden on students. It is necessary to change the unreasonable situation that examinations are superior to teaching and that examinations are "batons of command", so that examinations can become the means of testing teaching and play the role of assistant teaching.

VI. CONCLUSION

There is no definite method of teaching, but there is a proper method of teaching. The stone of other mountains can attack the jade. Absorbing the excellent teaching methods of other countries, combining Chinese and Western, removing the dregs, extracting the essence, removing the false and retaining the true, the reform of mathematics teaching methods will be effective, and the new curriculum reform of basic education will be implemented.

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