The Research on the Professional Development of Middle School Mathematics Teachers Based on Core Quality

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ABSTRACT

The core quality of the discipline and the core quality of students is the new direction of Chinese education reform. However, the development of the core quality of the discipline and the cultivation of students' core quality are inseparable from the effective guidance of teachers. Therefore, it is important for teachers to obtain corresponding professional development. Based on the needs of social development, this paper started from the connotation of core quality and the professional development of middle school teachers, and discussed the consciousness, knowledge and ability of middle school mathematics teachers in detail.

Keywords: *Core quality, Middle school mathematics, Teacher's professional development.*

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1. INTRODUCTION

In 2014, the Ministry of Education of the People's Republic of China proposed that they would research the core quality system for students in each school stage, and clarified the necessary character and key ability of students to meet the demands of lifelong development and social development. Then, what is core quality? In order to cultivate students' core qualities, what qualities and abilities should the middle school mathematics teachers possess? The exploration of these problems is of great significance to the realization of the core quality goal of middle school mathematics (Ministry of Education of the People's Republic of China, 2014).

2. CORE QUALITY AND CORE QUALITY OF MATHEMATICS

2.1. The Connotation of Core Quality

For the connotation of core quality, there is no unified definition in the world. In 1997, the organization for economic and cooperative development (OECD) first proposed that core quality was an important quality, which covered multiple areas of life and promoted a successful life. The EU (European Union) pointed out that core quality was a collection of knowledge, skills and attitudes that were transferable and multifunctional, and these qualities were necessary for each person to develop themselves, to integrate into society and to be competent. The United Nations educational, scientific and cultural organization (UNESCO) proposed that the essential qualities of citizens in the 21st century include learning to learn, to work, to live together, to survive and to change. The United States believed that core quality included life and career skills, learning and innovation skills, information, media and technology skills (Wu, 2017).

There is also no uniform definition of core quality in China. Professor Zhong Qiquan pointed out that the core quality referred to the students' ability to solve problems through school education (Zhong, 2015). Professor Lin Chongde thought that core quality was the necessary character and key ability of students to adapt to lifelong development and social development (Lin, 2016). In September 2016, the Ministry of Education promulgated *the core literacy of Chinese students' developments*, and it put forward a new framework and requirements for cultivating students' core qualities that the core quality was the comprehensive performance of students' knowledge, skills, emotion, attitude and values, which took the training personnel development in an all-round way as a core, and was divided into cultural foundation, independent development and social participation. It was the six qualities of humanistic background, scientific spirit, learning, healthy life, responsibility and practice innovation (Wu, 2017).

Combined with domestic and foreign scholars points of view, the core qualities that students should have were not only basic knowledge, also not only emotional attitudes, but also students' thinking, judgment and personality. Core quality was a comprehensive quality, including knowledge, skills, attitude, etc., which has both explicit behavior and inherent quality, and it further explained what kind of people our country education wanted to cultivate.

2.2. The Connotation of Core Quality of Mathematics

For the connotation of core quality of mathematics, the Program for International Student Assessment (PISA) emphasized the learning and application of mathematical knowledge. They pointed out that mathematics quality was the ability of individuals to form, use and interpret mathematics in various situations. It could be seen that PISA defined the core quality as mathematical knowledge and ignored the cultivation of students' emotion and character (Xie, 2008).

There is no clear definition of the mathematics core quality in China. Compulsory mathematics curriculum standards (2011) (standard for short) clearly putted forward ten core quality: number sense, symbol sense, space

concept, geometry, the concept of data analysis, arithmetic ability, reasoning ability, model thinking, awareness of application and innovation (Ma, 2015). The Professor Shi Ningzhong thought that the essence of mathematics core quality was mathematical characteristics that a person should have after he has passed the mathematical education. In general, it can be summed up that one saw, thought and expressed the world in a mathematical way (Shi *et al.*, 2017). The Professor Li Xingyun defined the mathematics core quality as the most basic and growth related mathematics quality which was formed by individuals in the practice of mathematical learning. In other words, in various social life situations, individuals actively used mathematical knowledge and mathematical thinking to analyze and solve various problems, and realize the continuous development of themselves and society with the application value of mathematics (Li, 2016). These mathematics core qualities include mathematical knowledge and ability, emotional attitude and values. The Professor Ma Yunpeng putted forward that the mathematics core quality is the comprehensive ability that the mathematics learner should achieve in the field of learning mathematics (Ma, 2015). He emphasized that the mathematics core quality should be basic and comprehensive. The mathematics core quality should be covered by the core quality, plus the characteristics of the mathematics itself. In other words, the mathematics core quality should not only emphasize mathematical knowledge, but also cultivate students' ability and attitude.

The author made clear which quality is the most key and indispensable thought analyzing the mathematics core quality that middle school students should have, with the characteristics of mathematics based on the overall framework of core q proposed by the ministry of education. Finally, the author thought that middle school teachers should cultivate students' mathematical communication ability, data analysis ability, mathematical operation ability, mathematical reasoning ability, mathematical modeling ability and spatial imagination ability. They also guided students to establish correct attitudes and values.

3. ANALYSIS OF PROFESSIONAL DEVELOPMENT OF MIDDLE SCHOOL TEACHERS BASED ON THE MATHEMATICS CORE QUALITY

3.1. Teachers' Professional Development

Foreign scholars have diverse understandings about teachers' professional development. Perry,P. thought that the teachers' professional development means the growth of teachers in professional life. It included the enhancement of confidence, the improvement of skills, continuous updating and deepening of the subject knowledge (Jiang, 2004). Hoyle,E. pointed out that teachers' Professional Development is the process of the teachers master the necessary knowledge and skills of their profession practice at every stage in their teaching-occupation (Zhang, 2008). Evans defined teachers' professional development as the development of teachers' attitude and function. The development of attitude includes intellectual development and motive development. The development of function includes procedural development and productive development (Lu and Zhong, 2006). Hargreaves,A. thought that teachers' professional development should not only include the knowledge and skills, but also morality, politics and emotion (Wu, 2008).

Some scholars in China believed that teachers' professional development is the process of teacher professional growth or continuous updating, evolution and enrichment of teacher's internal professional structure (Ye, 2001). More specific explanation was teacher must be continuous learning and research, continuous development of the connotation of the professional, reach the professional mellowest state gradually in the whole process of pre-service teacher training, teaching and in-service education (Li, 2013). Taiwan scholar Luo Shuiqing thought that teachers' professional development is the course of the activities and learning for teachers in order to improve their professional standards and professional performance (Luo, 1999).

Combined with domestic and foreign scholars' views, teachers' professional development can be understood as the process of improving their professional consciousness, accepting new knowledge and improving their professional competence. In this process, teachers can increase professional skills, professional autonomy, and professional development awareness by constantly reflecting, exploring and constructing new knowledge. Finally they reach the professional maturity level. Teachers' professional development focuses on the development of teachers' healthy personality and teachers' practical wisdom, and throughout the career of teachers.

3.2. The Professional Consciousness of Middle School Mathematics Teacher Based on the Mathematics Core Quality

3.2.1. Setting Up Self-Development Consciousness and Reflective Consciousness

Teachers' self-development consciousness and reflective consciousness is the key to improve their professional ability. Teachers' professional development, if only because of external pressure, must be negative, difficult to achieve effective results. Only by actively realizing and transcending the self, the professional development has the real power and vitality. Therefore, teachers must have self-development consciousness. In addition, reflective teaching is an important link for teachers to promote self-development. Through teaching reflection, teachers can find their shortcomings and problems in all aspects of teaching, and then improve themselves and improve their teaching ability and level. Some teachers have written monograph and books by summarizing, refining their own experience. This has important implications. For example, Wei Shusheng's the Work of the Head Teacher and Sukkomlinsky's A Hundred Pieces of Advice to Teachers.

3.2.2. Strengthen the Awareness of Students' Development

The teacher's morality was the teacher's soul, which was always regarded as the most important teacher quality, and the focus on the development of students was the core element of teacher morality. The foreign educator Fuller had put forward *the focus on stage theory*, who argued that a new teacher to become a professional teacher should go through three stages, including pay close attention to the survival stage, the teaching situation stage and the students' stage. It could be seen that the focus on students as the highest level of professional development of teachers played a crucial role in the cultivation of the core quality of teachers (Li *et al*., 2013).

3.2.3. Setting Up A Reasonable Problem Consciousness

Problem consciousness refers to people's psychological state of doubt, confusion, anxiety and exploration when dealing with some difficult practical problems and theoretical problems. For middle school students, this kind of psychology drives them to think positively. Therefore, in the middle school math class, teachers should consciously throw questions, so that students can focus on analyzing and solving problems. However, many scholars believed that the phenomenon of *classroom filled with questions* was present in the classroom, which made the low quality problems filled the classroom and the students could not grasp the key points, leading to inefficient classrooms. Therefore, the teacher should have the appropriate problem consciousness, eliminate the unreasonable phenomenon of *classroom filled with questions*, and carefully prepare the question (Bo, 2017).

3.3. The Professional Knowledge of Middle School Mathematics Teacher Based on the Mathematics Core Quality

The professional knowledge of middle school mathematics teachers influences the choice of teaching content in the teaching design. The level of professional knowledge of mathematics teachers influences the teaching method

chosen by teachers in teaching design. Therefore, it influences the cultivation of students' core qualities. So, in order to achieve the training goal of core quality, middle school teachers should pay attention to the further understanding and accumulation of relevant knowledge and continuously improve their professional quality. This knowledge includes three aspects as follows.

3.3.1. Understanding the Basic Knowledge of Culture

Cultivating students' core quality requires teachers to set up problem situations in designing teaching activities to stimulate students' interest. These problems should not only be the problems of pure mathematics or "artificial", but also include many realistic problems. In addition, the analysis and solution of the problem will also involve comprehensive knowledge, which requires teachers to have extensive knowledge and acquire the latest knowledge in science, technology and culture. Teaching activities sometimes use multimedia technology, which requires teachers to understand the basic knowledge of information technology.

3.3.2. Mastering and Thoroughly Understanding Mathematics Subject Knowledge

Firstly, to cultivate students' mathematics core quality, teachers should first have these abilities, comprehensively understand the mathematical knowledge system, basic ideas and methods, and master the basic knowledge and basic skills of mathematics. In the meanwhile, teachers also understand the connection between mathematics and other disciplines. Secondly, cultivating students' mathematics core quality emphasizes the comprehensive influence on students from knowledge, skills and emotion. This requires teachers not only to have a thorough understanding of declarative knowledge, but also to master procedural knowledge, and to analyze the skills and emotions to be conveyed by knowledge (Li, 2016).

3.3.3. Enhancing The Knowledge of Related Subjects

Related subjects include mathematics pedagogy, education psychology and so on. In order to improve their professional quality, middle school teachers need to be familiar with the basic principles and methods of education, which requires teachers to enhance their study in mathematics education. Middle school teachers need to understand students' the rule and characteristics of physical and mental development, outlook on the world, life and values, the way of thinking and acting, this requires teachers to be familiar with the knowledge of education psychology. Most of the time in math teaching, the teacher teaches the students the knowledge, set questions to lead the students to think questions, and to learn knowledge step by step. This requires middle school teachers to appropriately increase their language knowledge and improve their expressive ability.

3.4. The Professional Ability of Middle School Mathematics Teacher Based on The Mathematics Core Quality

Middle school mathematics teachers should first identify which mathematics core qualities should be cultivated. At the same time, teachers should also have a deep understanding of students' mathematics core quality, and combine core quality and mathematics core quality effectively to design a high level of mathematics teaching activities. As mentioned above, the author thought that cultivating students' mathematics core quality is to cultivate students' mathematical communication ability, data analysis ability, mathematical operation ability, mathematical reasoning ability, mathematical modeling ability and spatial imagination ability and guide students to establish correct attitudes and values. At the same time, combined with the connotation of teacher professional development,

the author thought that the professional development of middle school mathematics teachers should have the following abilities.

3.4.1. Designing Reasonable Teaching Activities

The formation of students' mathematics core quality is acquired, which takes place in the process of thinking. Teachers should encourage students to think and communicate, and design teaching activities that can lead students to think actively. Firstly, the teacher should make a change from the thought, and cannot teach only one lesson or one knowledge point. They should connect the relevant knowledge points and carry out a whole design, while focusing on the knowledge points, think about the mathematical essence and the mathematical thought.

Secondly, the situation and problems in teaching design should be diverse, familiar, relevant and comprehensive. The formation of mathematics core quality requires a specific environment, so the appropriate situation is conducive to students' thinking, absorption, understanding and insight, which is more conducive to the cultivation of students' mathematics core quality. Teaching activities designed by teachers should guide students to analyze and solve the problem in mathematical thinking, help students understand the mathematical essence and promote the formation of students' mathematics core quality in the process of solving math problems.

3.4.2. Using Reasonable Teaching Methods

The cultivation of students' mathematics core quality is inseparable from thinking. Middle school teachers should incorporate heuristic thoughts into teaching methods. In other words, in the process of mathematics teaching, according to the mathematical teaching task and the objective law of learning, from the reality of the students, teachers use diverse ways to mobilize the students' initiative and enthusiasm and prompt them to study mathematics lively. The use of heuristic teaching in class is conducive to the cultivation of students' mathematical reasoning ability. Let students experience activities in person, which is conducive to the cultivation of students' data analysis ability. At the same time, it is necessary to introduce relevant mathematics history in math class. This can arouse students' enthusiasm for learning mathematics and guide students to set up correct values. In math class, the middle school teachers should make students explore mathematical knowledge independently, and make each student explore, discover more through observation, experiment, guess, validation and reasoning. At the same time, teachers should adopt the way of group cooperation, so that students can make progress together.

3.4.3. Constructing Reasonable Practical Courses

The formation of students' mathematics core quality is associated with course. Based on the existing experience of mathematics activity, students participate in the relevant mathematical tasks, and reflect the mathematical knowledge, skills and attitude in solving practical problem. Thus, in the process of the activities of the experience and thinking gradually form mathematics core qualities. In order to cultivate students' core quality of mathematics, it is ineffectual for teachers to teach only some explicit and regular courses, and some practical classes are needed to help students reflect on the experience, which will not only improve students' basic knowledge and basic skills, but also improve students' mathematical thinking ability and help them to set up correct values of emotional attitude.

Combining mathematics curriculum with practice activity, students learn relevant theoretical knowledge through observation or hands-on practice, and reflect on what they have learned in their communication with classmates and teachers. It is helpful for them to cultivate mathematical communication ability and mathematical analysis ability in the process of combining theory with practice. At the same time, the group cooperation and other

practical ways are conducive to the students' enjoyment of cooperation and to guide students to establish correct emotional values.

3.4.4. Mastering Reasonable Evaluation Techniques

The core quality of Chinese students' development has given the performance of 18 major specific students' core qualities. Middle school math teachers should establish academic quality standards based on core quality. In the daily teaching, middle school teachers should combine the core quality of mathematics and their corresponding evaluation criteria to improve and optimize the existing indicators of student assessment. At the same time, the teacher should make clear the degree that students should achieve after completing the mathematics learning content, which could effectively promote the implementation of core quality.

Teachers should be patient with the evaluation of students' core qualities, because such evaluation is a long process and should pay attention to the real situation. In the process of cultivating students' core quality of mathematics, teachers should step by step and train students' ability to analyze and solve problems from a mathematical point of view. Thus, students can better understand the abstract of the mathematical world. At the same time, teachers should conduct follow-up evaluation to help students form a good non-intellectual quality and achieve the goal of educating people based on the core quality of mathematics.

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