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Study on the Mathematical Simulation Teaching in China

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Abstract

Simulation teaching, as a new teaching method to cultivate teachers' professional talents, is more and more applied in the field of mathematics education, which plays an important role in guiding students to combine teaching theory with practice. In this paper, the literature research method is used to the study, the author summarized and sorted out the previous research on mathematical simulation teaching, and drew the following conclusions: (1) At present, domestic studies mainly focus on the meaning and purpose of simulation teaching, the implementation status of simulation teaching, the analysis of simulation teaching effect and the problems and countermeasures of simulation teaching. Although the number of previous studies is small, the basic study problems have been involved, there is a certain foundation. (2) There are some deficiencies in previous studies. For example, the previous study methods and study content need to be further expanded. (3) There are some gaps in the research of this subject, such as the lack of a unified, scientific evaluation model to highlight the implementation of simulation teaching effect and significance; We should also explore some measures to improve the implementation of mathematical simulation teaching in addition to teaching professional skills, such as strengthening the study of theoretical knowledge of simulation teaching, starting from educational institutions and departments to explore measures that are conducive to expanding the implementation scope of simulation teaching and improving efficiency. Therefore, future research must adopt more scientific research methods, further expand the scope of research and explore suggestions to improve the efficiency of mathematical simulation teaching in many aspects to make the future research more in-depth and comprehensive.

Keywords

Mathematics, Simulation Teaching, Teaching Skills

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1. Introduction

To comprehensively improve the comprehensive quality of teachers and cultivate high-quality and professional primary and secondary school teachers, the ministry of education began to implement the training plan for outstanding teachers in 2014 [1, 2]. At present, the new curriculum reform of mathematics education makes society more and more demanding for mathematics education professionals [3, 4]. The development of the whole field of mathematics education and students' mathematical abilities is closely related to the professional abilities and teaching skills of mathematics teachers [5]. Consequently, we must do a good job in the education of pre-service teachers [6]. As a new form of teaching and research activities, the simulation teaching method is helpful to improve teachers' professional skills and evaluate teachers objectively [7]. Therefore, in the face of the new mathematics curriculum reform and strengthening the professional development of mathematics teachers, it is urgent to study mathematical simulation teaching. In recent years, the form of simulation teaching began to enter the field of normal education, and some related research appeared [8, 9, 10]. However, the number of simulation teaching research for mathematics is very small, and there is no general research on

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mathematical simulation teaching. To find out the current situation of the research on mathematical simulation teaching, the deficiencies of studies, and the blank points that have not been involved, this paper intends to make a comprehensive summary of the previous research. This study can not only provide ideas and directions for the implementation and improvement of mathematical simulation teaching but also help researchers master the characteristics and status quo of current research, point out its shortcomings and blank points to promote the further research of scholars.

The main research questions of this paper are as follows: (1) what aspects are included in the current research on mathematical simulation teaching? (2) What are the deficiencies and gaps in the current research on mathematical simulation teaching?

2. Methods

2.1. Source of Data

All the documents in this paper are from the CNKI database. CNKI is a large-scale full-text database covering and disseminating various forms of literature and materials in China, such as journals, doctoral dissertations, conference minutes, newspapers, patents, yearbooks, and so on. It is the most authoritative literature retrieval tool for national academic journals, which contains all the contents of Chinese journals, including various disciplines. Therefore, based on the integrity of its literature collection and huge academic influence in China, this paper selected this database to ensure the integrity of references and the reliability of the study.

2.2. Data Collection

To avoid the situation of literature omission, five different keywords of "simulation teaching", "simulation teaching", "mathematical simulation teaching", “simulation class” and "mathematical simulation teaching" are input respectively in the process of consulting data. However, after browsing the entry results, we found that there are different levels of research on simulation teaching in China, involving medicine, electronic technology, education, and other fields. Although a large number of papers have been searched, the research on mathematical simulation teaching is very few. For all the retrieved data, the study used the following criteria for screening: (1) Only the domestic Chinese literature is selected; (2) the simulation teaching of mathematics is taken as the research object. When we first browse the search results, we can find that there are very few materials about the simulation teaching of mathematics. After screening, only seven papers meet the research standards. It is found that the earliest study on mathematical simulation teaching was published in 1996, which shows that the research started late.

2.3. Data Collation

Since there are only seven studies in the literature, we used the method of taking notes to sort out the contents of each aspect involved in the four papers. After sorting out the notes, the current domestic studies on mathematical simulation teaching mainly focus on the meaning and purpose of simulation teaching, the implementation status of simulation teaching, the effect analysis of simulation teaching, and the problems and countermeasures of simulation teaching.

3. Results

According to the summary and analysis of the existing studies, the author thinks that the current domestic studies mainly focus on the meaning and purpose of simulation teaching, the implementation status of simulation teaching, the analysis of simulation teaching effect, and the problems and countermeasures of simulation teaching.

3.1. Connotation and Significance of Simulation Teaching

As for the meaning and connotation of simulation teaching, Huang thinks that simulation class must be simulated, which should be similar to a real class. Its feature is a simulation, and its essence is class [12]. Feng and others pointed out that the practice of simulated classroom teaching is a kind of classroom teaching form in which students, under the guidance of teachers and guided by mathematics teaching theory, give full play to their creativity, design their class teaching scheme for middle school mathematics, and simulate one of the teaching design schemes in middle school mathematics to carry out teaching practice in the classroom [13]. Huang and others proposed that simulation teaching is to consciously create a situation similar to the middle school classroom and guide students to imitate the role of teachers in class. It is carried out around the goal of cultivating qualified middle school mathematics teachers and guided by "learning transfer theory" [14]. Sun thinks that simulation teaching is a form of teaching and research activities [7].

As for the significance of simulation teaching, Feng and others defined the implementation purpose of simulation teaching based on the teaching objectives of the course of "mathematics curriculum theory", that is, to enable students to use the mathematics education and teaching theory they have learned to creatively design mathematics classroom teaching, and form certain mathematical teaching skills and preliminary mathematical teaching ability through teaching practice training [13]. Huang and others put forward the implementation purpose of mathematical simulation teaching from two aspects of theory and practice. Theoretically speaking, it is to explore the practical teaching mode of

pedagogy and mathematics classroom teaching method; From a practical point of view, it is to enable students to have a deeper understanding of the theory of education and teaching in the practice of classroom simulation teaching, cultivate and train some basic skills of "learning mathematics teaching in junior high school" to promote the transformation of students to the role of qualified junior high school mathematics teachers [14]. Sun believes that simulation teaching can not only help novice teachers improve their professional skills, but also make an objective and fair evaluation of teachers, which is an effective way to realize teachers' professional development [7]. Huang believes that the practical purpose of simulation teaching is to let students understand the theory of education and teaching in the practice of classroom simulation teaching, and train some basic skills of "learning how to teach middle school mathematics". The theoretical purpose is to explore the classroom practical teaching mode of pedagogy and mathematics subject teaching method [15].

From the above discussion on the connotation and significance of mathematical simulation teaching, we can see that at present, it is generally recognized that mathematical simulation teaching is regarded as a kind of classroom teaching form. Students simulate mathematics classroom practice under the guidance of teachers to make full use of mathematics education and teaching theory, cultivate qualified mathematics teachers, and promote teachers' teaching ability and professional skills development as the goal. Previous studies on its meaning and significance have a certain degree of rigor and integrity, which undoubtedly laid a solid theoretical foundation for further related research.

3.2. The Implementation of Simulation Teaching

After reading and sorting out the literature, it is found that simulation teaching is not only implemented in student groups but also applied in professional development activities or competitions of in-service mathematics teachers. According to the basic skills competition of junior middle school mathematics teachers held in Hangzhou, Huang thinks about the misunderstanding and countermeasures of simulation teaching. This activity is divided into four items: chalk writing, impromptu speech, teaching design and courseware making, and classroom teaching. Among them, classroom teaching adopts the form of simulated class to show teaching design and teaching courseware [12]. Simulation teaching is a segment with the most problems in the whole process, which shows that some teachers can not grasp the essence of simulation class and the implementation effect is not ideal. Feng and others discussed the whole development process of mathematics simulation classroom teaching practice, including the preliminary preparation stage, the classroom teaching scheme design stage and the simulation classroom teaching implementation stage [13]. In the early preparation stage, the teaching objectives and needs are defined, and the students are arranged in groups, and the ideological mobilization and teaching space are solved. The implementation stage is the core of the whole practice process, which is organized by three team leaders under the guidance of teachers, and consists of three links: simulation teaching, lesson presentation and evaluation [13]. Huang discussed the two basic structures of mathematical simulation teaching, which are classroom link simulation teaching and classroom whole process simulation teaching. In the whole process simulation teaching, modern audio-visual means are fully used to leave real and effective materials for the evaluation after implementation [14]. Using the idea of micro-teaching, Zhang adopted the mode of "group preparation-individual teaching-collective discussion after class-lecturers' reflection after class-preparing lesson again" to promote the professional skills development of pre-service teachers [6]. With the method of action research, Sun formulated the improvement strategies for the undergraduate students majoring in mathematics normal education and the masters of subject teaching (mathematics) [7]. Huang discussed the classroom structure of mathematical simulation teaching, which mainly includes three parts: link simulation, classroom link simulation teaching, and classroom whole process simulation teaching [15].

From the above-mentioned implementation status of mathematical simulation teaching, the implementation objects and organizers of simulation teaching are not unique. For the implementation of the whole simulation teaching, because of different researchers, different research purposes, there are different ideas and implementation process. And from some previous studies, we can directly or indirectly see the problems in the implementation process, so there may be some mistakes in the scientific implementation process.

3.3. Analysis of the Effect of Simulation Teaching

Feng and others believe that the practice of mathematical simulation classroom fully arouses the enthusiasm of students' autonomous learning, effectively promotes the mutual learning among students, creates opportunities for the combination of theory and practice, deepens students' understanding of mathematics teaching theory, provides a platform for training teaching skills, and promotes the initial formation of students' mathematics teaching ability [13]. Huang believes that simulation teaching has initially cultivated and trained students' classroom language expression skills and correct teaching state; it has initially cultivated and trained students' preparation skills in analyzing and processing mathematical textbooks and compiling

mathematical teaching plans; it has also initially taught students the skills of organizing mathematics classroom teaching and using teaching methods [14]. Huang believes that the effectiveness of this teaching model is reflected in three aspects: first, it has cultivated and trained students' classroom language expression skills and correct teaching state; second, it has cultivated and trained students' lesson preparation skills in analyzing and processing teaching materials and compiling mathematical teaching plans; third, it has taught students the skills of organizing mathematics classroom teaching and using teaching methods [15].

From the above summary of the implementation effect of mathematical simulation classroom practice, mathematical simulation teaching has greatly trained students' mathematics teaching professional skills in language expression, lesson preparation, teaching material processing and other aspects, which shows that to a certain extent, it has achieved the expected goal and purpose of mathematical simulation teaching, and has a certain effect on the development of students' professional skills. It also lays a certain foundation for students' teaching ideas and professional ability.

3.4. Problems and Countermeasures of Simulation Teaching

Huang pointed out six misunderstandings in the teaching of mathematical simulation, mainly including two aspects: the inaccurate understanding of the connotation of simulation teaching and the deficiency in the implementation process. In the aspect of connotation grasp, there is mainly teachers' confusion about the form of simulated teaching and the dislocation of teachers' role; in the process of practice, teachers' teaching efficiency is not high, lack of passion, misunderstanding of teaching materials and over idealization of students' status. The author also puts forward corresponding countermeasures for each kind of misunderstanding [12]. In the research, Sun pointed out the problems existing in the simulation teaching of undergraduate and masters of mathematics. For the undergraduates majoring in mathematics, they mainly have some problems, such as incomprehensible understanding of teaching materials, inappropriate allocation of time, unsound basic teaching skills and lack of teaching tact; For masters of subject teaching (mathematics), they mainly have some problems, such as unreasonable blackboard writing design, untidy handwriting, teaching design is not innovative, not detailed and so on [7].

On the suggestions to improve the implementation of mathematical simulation teaching, Huang pointed out that it is necessary to carefully design the teaching content, highlight the key and difficult points, learn to deduce the process, pay attention to knowledge generation, fully preset the classroom, and give appropriate space for blank space [12]. Huang made full use of audio-visual teaching methods in the whole process of simulated teaching. He allowed students to observe the videos of national super grade teachers and their teaching respectively. According to the video content, they made comments and analyzed the problems in the teaching process. After receiving further feedback, students could have greater improvement [14]. According to different research objects of undergraduates and postgraduates, Sun has formulated corresponding promotion strategies. For the undergraduate students majoring in mathematics, it is necessary to promote the selection and application of teaching methods, improve the design and innovation of teaching process, and change the teaching intonation with more rhythm and appeal; For the master students of subject teaching (mathematics), it is pointed out that they should practice more in their spare time, deal with the problems of improper details, learn more excellent teaching design, introduce different teaching methods and guidance methods, and design a unique mathematics classroom [7]. Wu thought that studying the textbook carefully is the first task of preparing lessons. In the process of simulation class display, we should pay attention to "targeted", and pay attention to the penetration of research routines and the conception of blackboard writing [16].

From the above problems and countermeasures of mathematical simulation teaching, the existing problems proposed in the current research results are mainly divided into the students' insufficient understanding and learning of the theoretical knowledge of simulation teaching (including connotation and implementation purpose), as well as the problems of professional skills exposed by students in the teaching process. In terms of improvement measures, the previous studies mostly focus on how to teach a good mathematics course, which is to improve students' teaching skills and ability.

4. Discussion

From the above about the meaning and purpose of mathematical simulation teaching, although the number of related research is not many so far, there is a high degree of consensus on the understanding and implementation of the concept connotation of simulation teaching. At present, mathematics simulation teaching is generally regarded as a kind of classroom teaching form in which students carry out mathematics teaching practice under the guidance of teachers. As for its significance, previous researchers generally believe that it can make a breakthrough and innovation in the training mode of mathematics normal students, and play an important role in the future professional teaching skills and professional development of students. This higher level of consensus also laid a solid foundation for further research in the future.

From the current situation of the implementation of mathematical simulation teaching, although the number of references is only seven, it can be seen that the current education field still needs to strengthen the importance of simulation teaching, and the implementation scope needs to be further expanded to achieve the good effect of simulation teaching. Secondly, from the research of this teaching activity form, we can see that simulation teaching has a certain effect, but also exposed a lot of problems.

From the analysis of the effect and the existing problems of the above mentioned mathematical simulation teaching, we can see that the implementation effect of the mathematical simulation teaching has not reached the ideal state. Although it has received relatively significant results, there are also many problems. The implementation effect is mainly from the two aspects of students' teaching professional skills and the exploration of new teaching mode, and the exposed problems involve students' inaccurate grasp of theoretical knowledge of simulation teaching and weak grasp of basic teaching skills and professional skills. It can be seen from the above improvement measures of mathematical simulation teaching that the current research mainly discusses teaching means, teaching skills, teaching content and other aspects, which belong to the major category of teaching professional skills. It can be seen from the above that although the number of previous studies is small, the basic research problems have been involved, and there are a certain research foundation and depth.

However, from the above summary, we can also see that there are some deficiencies in previous studies. The first is about the research methods of predecessors. Most of them adopt qualitative research methods (action research, interview, and so on) and theoretical speculation, but few studies adopt quantitative research methods, which reduces the persuasiveness and credibility of the research to a certain extent. Besides, in terms of research content, from the number of previous studies, we can see that the research is far from enough depth, and there is still a lot of room for expansion in the research issues involved, not to mention the blank spots not involved in previous studies.

The number of previous studies is too small, which also shows that there will be some blank spots in the research of this subject. For example, as for the evaluation mechanism of simulation teaching, most of the previous studies were conducted by teachers and students themselves, and there was no unified and scientific evaluation model to show the effect and significance of simulation teaching; Another example is to explore some effective measures to expand the scope of the implementation of mathematical simulation teaching, so that more students can obtain teaching experience and skills, and improve their teaching professional ability; Finally, we should also explore measures and suggestions to improve the implementation of mathematical simulation teaching in addition to teaching professional skills, such as strengthening the learning of theoretical knowledge of simulation teaching, starting from educational institutions and departments to explore the suggestions conducive to expanding the implementation scope of simulation teaching and improving efficiency.

5. Conclusions and Suggestions

It is of great value to review and summarize the strategy research on promoting students' positive transfer of mathematics. Through reviewing, combing, and analyzing the previous studies, this study found that:

At present, domestic studies mainly focus on the meaning and purpose of simulation teaching, the implementation status of simulation teaching, the analysis of simulation teaching effect, and the problems and countermeasures of simulation teaching. Although the number of previous studies is small, the basic study problems have been involved, there is a certain research foundation and depth.

There are some deficiencies in previous studies. For example, the previous research methods and research content need to be further expanded.

There are some gaps in the research of this subject. For example, there is lack of a unified, scientific evaluation model to highlight the implementation of simulation teaching effect and significance; Besides, we should discuss some effective measures to expand the implementation scope of mathematical simulation teaching and improve students' teaching professional ability; Finally, we should also explore measures and suggestions to improve the implementation of mathematical simulation teaching in addition to teaching professional skills.

Therefore, future research must adopt more diversified and scientific research methods based on the existing research theories, expand the research scope and space of mathematical simulation teaching, and further explore relevant research; It is necessary to explore the measures and suggestions to enhance the teaching effect of mathematical simulation from a broader perspective and aspects to make the research more comprehensive, systematic and in-depth.

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