

Research on the Construction of Case Library for the Study of Middle School Mathematics Curriculum and Textbooks Based on the New Curriculum Reform

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Abstract: The construction of the case library for the Master of Education curriculum in China is relatively small, and there are no reports on the construction of the case library for "Research on Middle School Mathematics Curriculum and Textbooks". In order to improve the quality of education master's training, it is urgent to improve the construction of the case library. Based on the principles of "authenticity, typicality, pertinence, and comprehensiveness", high-quality teaching cases have been developed for the teaching content of middle school mathematics algebra, geometry, statistics and probability, calculus, and other chapters. This will enable the Education Master's Association to analyze and design middle school mathematics courses and textbooks, and master the necessary educational teaching practice and research abilities for engaging in middle school mathematics education and teaching research.

Keywords: Case library; New curriculum reform; Research on Middle School Mathematics Curriculum and Textbooks

1. Introduction

When cultivating professional graduate students, the case teaching method can enable students to apply the theoretical knowledge they have learned to practical analysis and problem-solving through discussion and communication in the classroom, thereby enhancing their understanding of theoretical knowledge, gaining experience in problem-solving, and enhancing their practical skills. It is recognized by teachers and students for its rich knowledge, authenticity, situational nature, and practicality. In the "Education Master's Degree Training Program in the Field of Subject Teaching (Mathematics) at Jinan University", the curriculum of "subject teaching (mathematics)" is clearly defined, emphasizing the principle of "student-centered and student-centered", emphasizing the unity of theory and practice, and adopting a diversified teaching method combining classroom teaching, case teaching, group cooperative learning, micro teaching, simulation teaching, etc.

In case teaching, cases are a valuable teaching resource. With the rapid development of the Internet and the continuous development of computer technology, the case base, as a convenient and rich way, is increasingly loved by teachers and students. Therefore, building a high-quality shared case base can better meet the needs of teachers and students. Therefore, in order to improve the quality of education master's education teaching, it is necessary to vigorously promote the construction of case libraries in education master's courses in universities across the country.

"Research on Middle School Mathematics Curriculum and Textbooks" is an important course offered by our college for education master's degree students in the field of subject teaching (mathematics). This course closely follows the requirements of middle school mathematics curriculum standards and textbook content analysis, highlights the integrity of middle school mathematics knowledge modules, focuses on the connection of middle school and high school mathematics knowledge mainlines, and expands international perspectives. The teaching content mainly includes the analysis of compulsory education and ordinary high school mathematics curriculum standards, middle school mathematics algebra content, geometry content, statistics and probability, calculus and other content analysis, as well as research-based learning, middle school mathematics curriculum reform and development trends, fully reflecting the concept of the new mathematics curriculum standards. The teaching content reflects the forefront of mathematics education theory, which helps education masters

to understand the current situation and hot topics of mathematics education reform, and is conducive to cultivating mathematics teachers in primary and secondary schools with strong practical and research abilities in education and teaching. Through case analysis in the classroom, teachers have gained valuable experience and mastered certain teaching techniques in the learning process of Master of Education. Therefore, building a case library for "Research on Middle School Mathematics Curriculum and Textbooks" is not only a practical need, but also an inevitable requirement for sustainable development.

2. The significance of case library construction

2.1 Theoretical significance

This study provides a plan and approach for constructing a case library, which is of great significance for further improving the theoretical construction of the case library for "Research on Middle School Mathematics Curriculum and Textbooks". It can effectively compensate for the shortcomings in current research in this field and provide more reference and reference for subsequent research.

2.2 Practical significance

This study provides experience guidance for the case collection, case organization, and effective promotion of the case library of "Research on Middle School Mathematics Curriculum and Textbooks" at Jinan University and other universities, as well as experience reference for the co construction and sharing of other course case libraries in China.

3. Overview of Case Library Construction at Home and Abroad

In 1870, Harvard Law School in the United States first adopted case-based teaching, which has a development history of more than 150 years and has a great influence internationally^[1]. Case teaching in foreign countries started earlier and has accumulated a large number of teaching cases. For example, Harvard University has established over 8000 case libraries. Foreign universities continuously update the case library from the perspectives of long-term research by teachers, scientific research achievements, and corporate practices.

In the early 1980s, Chinese universities began to conduct research on case teaching and conducted beneficial explorations on it. Currently, case teaching has gradually been integrated with the teaching of domestic universities, which has to some extent improved the quality and effectiveness of teaching. Compared with the emerging teaching case libraries internationally, the construction of domestic case libraries is relatively lagging behind. As an emerging research field, the construction of teaching case libraries is currently in the exploratory stage, and there is still a lack of understanding of basic issues such as teaching case libraries and their construction in China^[2].

The construction of the case library for education master's courses in our country is even more insufficient. There are no reports on the construction of the case library for "Research on Middle School Mathematics Curriculum and Textbooks". In order to improve the quality of education master's training, it is urgent to improve the construction of the case library.

There are three sources of cases in the current teaching of "Research on Middle School Mathematics Curriculum and Textbooks": first, the China Professional Degree Case Center, which can provide mathematics education related cases. Although these cases are of high quality, they are limited in quantity and cannot meet the practical teaching needs. The second is the cases published in journals and books, but these cases were not considered to be related to real-life student learning and teaching in the early stages of writing, and there are certain differences between them and actual teaching. If used for teaching, a lot of modifications are needed. The third is the practical teaching process and teaching design, but these cases lack typicality, lack educational value, and are not closely related to educational theory. Therefore, it is urgent to collect case materials and write high-quality cases to make up for the current lack of high-quality teaching cases in teaching.

4. Related work and policy guarantees that have been carried out in the early stage

We analyzed the current situation and existing problems of the case teaching of "Research on Middle School Mathematics Curriculum and Textbooks", and explored the design principles and content framework of the teaching case of "Research on Middle School Mathematics Curriculum and Textbooks" based on the new development of mathematics education reform. In classroom teaching, based on the research hotspots and latest developments in mathematics education, some class hours were taught using case teaching method, achieving good teaching results. Moreover, we have completed the construction of a teaching case library for Educational Statistics based on SPSS, accumulating rich experience for the research of this project. Building a case library to comprehensively and deeply carry out case teaching will greatly improve the learning enthusiasm and educational research level of Master of Education.

To ensure the smooth progress of the construction project of the teaching case library for the Master of Education's "Research on Middle School Mathematics Curriculum and Textbooks", the school and college will take various measures and means to ensure the smooth implementation of the construction project.

In order to actively encourage and promote the construction of high-quality and high-quality graduate courses, and to improve the quality control system of graduate education, the university has successively issued the "Interim Measures for the Management of Graduate Education Innovation Plan Projects at Jinan University", "Implementation Measures for Graduate Course Construction at Jinan University", "Regulations on the Management of Graduate Course Teaching at Jinan University", "Several Opinions of Jinan University on Further Improving the Quality of Graduate Education ", and "Opinions of Jinan University on Improving and Strengthening Graduate Course Construction ". The Interim Measures for the Management of Graduate Course Examinations at Jinan University strengthen various aspects of graduate teaching and management, ensuring the quality of graduate teaching at our university.

In order to support the integration of online and offline teaching reform in teaching work, the school has established a "Research Classroom" course platform to support teachers in classifying and managing electronic teaching resources and managing the learning process of graduate students. Graduate students can carry out online course selection, group discussions, preview and review of teaching materials, providing a resource platform and technical services for the reform of graduate education in our school.

The college attaches great importance to the implementation of the teaching case library construction project for the Master of Education's "Research on Middle School Mathematics Curriculum and Textbooks". It fully recognizes the importance of this project construction for the cultivation of subject teaching (mathematics) education master's degree and even the development of mathematics discipline. It strengthens organizational leadership, strengthens overall coordination, and provides strong organizational leadership guarantees for achieving project construction goals, forming a work situation of attention, concern, and support.

5. The characteristics and innovation of case libraries

5.1 Authenticity

Teaching cases must reflect the actual situation in the field of education truthfully to stimulate the learning interest of the Master of Education. When designing, it is necessary to select and handle based on the actual problems in teaching, teaching objectives, and key difficulties.

5.2 Typicality

The selection of teaching cases should start from reality, pay attention to typicality and representativeness, and fully utilize the latest achievements in mathematics education research hotspots and theoretical frontiers to solve typical problems in "Research on Middle School Mathematics Curriculum and Textbooks".

By analyzing and exploring typical cases in the research of middle school mathematics curriculum and textbooks, Master of Education can learn the knowledge and methods of applying mathematical education theory to analyze and solve practical problems in the process of mathematics teaching.

5.3 Pertinence

The design of teaching cases should revolve around breakthroughs in basic knowledge points. In the process of designing teaching cases, it is important to closely focus on a clear teaching objective, rather than using cases solely for the sake of the case. The designed teaching cases are specifically designed for the research field of middle school mathematics curriculum and textbooks, and should reflect the professional characteristics of the subject.

5.4 Comprehensiveness

Teaching cases are different from previous examples in teaching. Teaching cases have richer content, a wider range of knowledge, and a more complex and comprehensive process of analysis and solution. This requires Master of Education to proficiently combine the new curriculum standards with specific teaching cases on the basis of understanding, grasping, and implementing the new curriculum standards and trends in mathematics education reform and development. In addition, master's students in education must also possess strong mathematical literacy and strong computer application skills.

6. Example of Case Library Case Content

This project is based on the principles of "authenticity, typicality, pertinence and comprehensiveness", and aims to construct more than 10 high-quality teaching cases for the teaching content of middle school mathematics algebra, geometry, statistics and probability, calculus, and other content analysis. This will enable the Master of Education to analyze and design middle school mathematics courses and textbooks, and master the necessary educational teaching practice and research abilities for engaging in middle school mathematics education and teaching research. Students can engage in in-depth discussions on cases through group collaboration, collect information, design teaching materials, form teaching design analysis reports or papers, and present their results in the form of defense, in order to achieve integration and flexible application of teaching content. The application of case library in this course will help Master of Education master master practical and highly professional teaching design skills to conduct teaching research, and provide assistance for Master of Education master to further deepen their study of mathematics education reform research, mathematical thinking and methods research, middle school mathematics teaching design and implementation research, and other courses.

The case content mainly combines the latest development and research hotspots of mathematics education. In the context of the new curriculum reform, teaching design research is carried out for various theme contents of middle school mathematics, including the introduction of mathematics education theory, teaching strategies, teaching design principles, teaching design (textbook analysis, learning situation analysis, teaching objectives, teaching key and difficult points, teaching methods and means, teaching process design, teaching process), teaching design analysis, etc. For example:

Case 1: A case study on the topic of functions

As the main thread of middle school mathematics, the concept of function is one of the most important core concepts in middle school mathematics. Functions play an extremely important role in middle school mathematics textbooks. The PBL (Problem Based Learning) model aims to cultivate students' awareness of independent thinking, communication and cooperation, and improve their comprehensive quality through problems. This is in line with the requirements of the new curriculum reform and is also a hot topic in the current education field. Through the study of the case "Research on Teaching Design of Secondary Functions in Middle School Based on PBL Mode", the Master of Education will master the teaching design of secondary functions based on PBL mode, and learn how to design goals, problems, evaluations, and teaching steps in middle school mathematics teaching based on PBL mode. Research on teaching design based on the PBL model for function themes can help education masters understand how to effectively design and implement PBL teaching methods to promote student learning and development^[3].

Case 2: Cases on Probability and Statistics Themes

"Course ideological and political education" is a hot educational term that has emerged in recent years. High school mathematics is a basic learning course for young people in China, and combining course ideological and political education with high school mathematics teaching is a clever solution to achieve the fundamental task of cultivating morality. The teaching focus of probability and statistics is

to guide students' learning with real problem scenarios and integrate them with information technology, which provides a starting point for introducing ideological and political elements into the teaching of this topic. Compared with other teaching contents, probability and statistics are more suitable for teaching ideological and political courses^[4]. Taking probability and statistics as an example, combined with high school mathematics curriculum standards^[5], textbooks, and other relevant materials, this study explores high school mathematics teaching strategies from the perspective of curriculum ideology and politics, and conducts research on high school mathematics teaching design from the perspective of curriculum ideology and politics. Through the study of the case "Research on High School Mathematics Teaching Design from the Perspective of Curriculum Ideology and Politics - Taking Probability and Statistics as an Example", it can help Education Masters explore materials containing ideological and political elements in teaching, focus on how to design high school mathematics teaching from the perspective of "Curriculum Ideology and Politics", truly cultivate talents for the country and society, and implement moral education.

7. Conclusion

In the context of the new curriculum reform, the organic integration of research hotspots and case teaching methods in the field of mathematics education into the teaching of "Research on Middle School Mathematics Curriculum and Textbooks" is a new trend in the teaching reform of "Research on Middle School Mathematics Curriculum and Textbooks". Therefore, the research on the case library of middle school mathematics teaching design based on the research of mathematics education reform will undoubtedly improve the current situation of relatively few teaching cases in the field of subject teaching (mathematics) in China, enhance the teaching effectiveness of "Research on Middle School Mathematics Curriculum and Textbooks" and related courses (such as "Research on Mathematics Education Reform"), and promote the improvement of teaching level and research ability of education master's degree.

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A Study on the Reform of Educational Statistics Program Based on Case Study Teaching. (JDYY2114)

Teaching Cases of Secondary School Mathematics Curriculum and Textbook Research Based on the New Curriculum Reform. (YJPAL202304)

References

- [1] Ruohong Sun, Xinyi Yang. Action research on using case teaching to cultivate the research ability of subject teaching (English) education master's degree: Taking the course of foreign language education research methods as an example [J]. *Journal of Liaoning Economic and Management Cadre College*, 2024, (01): 109-112.
- [2] Yichao Ren, Chunyan Zhao, Jinye Wang. Preliminary exploration of the construction of a teaching case library for master's degree students in fishery development [J]. *Scientific Consulting (Science and Technology Management)*, 2023, (10): 127-129.
- [3] Rongzu Zeng. Research on Teaching Design of Secondary School Quadratic Functions Based on PBL Mode [D] Taiyuan Normal University, 2023.
- [4] Xueying Yang. Research on High School Mathematics Teaching Design from the Perspective of Curriculum Ideology and Politics [D]. Mudanjiang Normal University, 2023.
- [5] Ministry of Education of the People's Republic of China. Curriculum Standards for Mathematics in Ordinary High Schools (2017 Edition) [S]. Beijing: People's Education Press, 2018.