

# Research on Integrated Teaching of Mathematical Units from the Perspective of HPM

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**Abstract:** In recent years, unit holistic teaching has been continuously focused on as an effective way to implement core competencies. This teaching method takes a global perspective, organizes teaching content from a unit perspective with systematic thinking, and emphasizes the improvement of students' basic abilities and the development of core competencies. At the same time, teaching based on the history of mathematics is highly valued, HPM (History and Pedagogy of Mathematics) entered the mathematics classroom teaching. HPM teaching can transform science oriented mathematics into education oriented mathematics, thereby maximizing the educational value of the history of mathematics. HPM teaching coincides with unit teaching. This article conducts in-depth research on the overall teaching of mathematical units, sorts out the development of mathematical history, explores the historical background of mathematical knowledge, calculates the evolution process, and effectively integrates mathematical history resources into unit teaching design. The introduction of M-perspective can effectively enrich the content of mathematics teaching, enhance students' interest in learning, deepen their cognitive depth, and help cultivate students' innovative thinking ability in mathematics. Explore the overall teaching implementation strategy of mathematical units, propose corresponding teaching suggestions, and provide reference for mathematics educators.

**Keywords:** HPM; Integrated Teaching of Mathematical Units; History of Mathematics; Mathematics Teaching

## 1. Introduction

Mathematics problems are constantly updated, so teachers' teaching methods should also adapt to the development of the times, and achieve timely rectification and improvement. But at present, many teachers have fallen into the dilemma of mathematics teaching. They have been using traditional teaching methods to impart mathematical knowledge to students aimlessly, without paying attention to their learning situation and effectiveness. Over time, students will not only lose interest in mathematics as a subject, but also develop a sense of boredom and resistance. According to multiple policies issued by our country, in the teaching process, teachers should not only pay attention to students' academic performance, but also focus on cultivating students' core competencies such as values and thinking abilities, in order to promote their comprehensive development[1]. Integrated teaching of mathematical units is a teaching model that emphasizes the connection between subject knowledge, focuses on students' autonomous learning and exploratory learning, and combines HPM (History and Pedagogy of Mathematics) with integrated teaching of mathematical units, which can provide new perspectives and ideas for mathematics education. It can be seen that it is necessary to conduct research on the overall teaching of mathematical units from the perspective of HPM.

## 2. Principles and Methods of Integrated Teaching Design for Mathematical Units from the HPM Perspective

### 2.1 The Relationship Between Mathematical Knowledge

The overall teaching of mathematical units emphasizes the intrinsic connections between mathematical knowledge. When designing

teaching plans, teachers should pay attention to the logical relationships between various knowledge points to ensure the coherence and consistency of teaching content. In order to achieve this principle, teachers need to have a deep understanding of the internal logical system of mathematics and master the relationships between various knowledge points. At the same time, teachers should also focus on guiding students to discover and explore these relationships when designing teaching activities, helping students build a complete knowledge system. For example, when teaching the unit of "Algebra and Equations", teachers can start with the simplest linear equations and gradually introduce content such as quadratic equations and quadratic equations to help students understand the connections and differences between different types of equations. In addition, teachers can also design comprehensive problems that require students to apply multiple mathematical knowledge to solve, in order to strengthen students' understanding of the interrelationships between mathematical knowledge[2,3].

## **2.2 Integrating the History of Mathematics into Mathematics Teaching**

Mathematical knowledge is tedious, complex, and difficult to understand. Therefore, in the process of teaching mathematics, it is difficult for teachers to stimulate students' interest in learning and create a relaxed learning atmosphere. To improve the teaching effectiveness of the classroom, teachers can integrate the history of mathematics into the teaching content to stimulate students' interest in learning and enable them to understand the essence and connotation of mathematical knowledge. For example, when explaining the unit "Development of Calculus", teachers can collect and understand the historical stories behind it, and tell them to students in class to deepen their impression and understanding of mathematical knowledge. At the same time, teachers can also introduce some life stories of mathematicians in class to enhance students' learning enthusiasm and help them better absorb the mathematical knowledge learned in class. To ensure the pertinence and effectiveness of teaching, teachers can make timely adjustments to teaching modes based on students' learning situations, which can

promote the improvement of students' academic performance. In addition, in mathematics classrooms, teachers can also adopt classroom discussions, group activities, and other methods to guide students to communicate, exchange their opinions and ideas, and exercise students' thinking and innovation abilities.

## **2.3 Sorting out the History of Mathematical Concepts**

Effectively tracing the historical development of a mathematical concept and applying it to teaching can help students better understand the history and essence of mathematics. Therefore, before starting teaching, teachers should choose the mathematical concepts they want to organize and collect historical materials related to the mathematical concepts, such as historical literature, books and articles on mathematical history. It should be noted that teachers should ensure the completeness and authenticity of historical materials in order to ensure the effectiveness of subsequent teaching. In the teaching process, teachers should establish a timeline based on the collected data to showcase the development of the mathematical concept[4]. At the same time, in order to deepen students' impression and improve the teaching effect of the classroom, teachers can use multimedia resources such as videos, animations, etc. to present the learned knowledge to students more intuitively, so that students can fully devote themselves to learning. After teaching, teachers should regularly update and supplement the mathematical concepts they have sorted out to reflect the latest developments in mathematical history research.

## **2.4 Situational Teaching**

The overall teaching of mathematical units advocates situational teaching, which guides students to apply mathematical knowledge to solve problems by creating real problem scenarios. To achieve this principle, teachers need to pay attention to practical problems in daily life and combine mathematical knowledge with real-life situations. During the teaching process, teachers can guide students to apply mathematical knowledge to solve practical problems and improve their problem-solving abilities by designing teaching activities such as case analysis and project

research. For example, when teaching the unit of "Statistics and Probability", teachers can introduce some real data to guide students in data analysis and cultivate their data analysis skills. In addition, teachers can also organize students to participate in mathematical modeling competitions and other activities, allowing students to apply their learned mathematical knowledge and improve their problem-solving abilities in the process of solving practical problems.

### **2.5 Combining Exploratory and Practical Approaches**

The overall teaching of mathematical units from the HPM perspective focuses on guiding students to explore independently and discover the inherent laws of mathematical knowledge[5]. Teachers do not simply impart knowledge in teaching, but should design exploratory problem scenarios based on students' actual situations to stimulate their curiosity. For example, when teaching a mathematical concept or theorem, guide students to explore the historical background through researching relevant materials, conducting group discussions, and other methods. Emphasis is placed on the practical application of mathematical knowledge, but there are no limitations to problem-solving paths, allowing students to consolidate and deepen their knowledge understanding through practice. Design projects with practical background problems, allowing students to apply their learned knowledge in problem-solving. Improve students' mathematical application ability and enable them to recognize the value of mathematics in their learning. Organically combining inquiry and practicality, guiding students to discover the inherent laws of mathematical knowledge through practical operations.

### **2.6 Evaluation and Feedback**

Evaluation is an important means of testing teaching effectiveness, HP the evaluation from the perspective of M is not limited to traditional written tests, but focuses on the comprehensive development of students and implements diverse evaluation strategies. In addition to assessing students' mastery of mathematics, attention should also be paid to their understanding and performance in the history, culture, and practical applications of

mathematics. For example, designing open-ended questions that allow students to demonstrate mathematical literacy when solving problems or completing tasks. Comprehensively reflect students' learning outcomes, stimulate their learning motivation and confidence. Feedback must be timely, specific, and targeted. When students encounter difficulties and problems in their studies, teachers provide timely guidance and assistance, allowing students to adjust their learning strategies in a timely manner. Based on student performance feedback, reflect on and improve teaching to meet students' learning needs. Promote effective communication between teachers and students, and create favorable conditions for mutual growth in teaching and learning.

## **3. Case Analysis - Taking Algebra and Equation Units as Examples**

### **3.1 Teaching Objectives**

Enable students to understand the basic concepts of algebra and equations, and master the fundamental methods of solving equations; Developing students' ability to apply algebraic and equation knowledge to solve practical problems; Stimulate students' interest in mathematics and improve their mathematical literacy[6].

### **3.2 Teaching Content**

(1) Algebraic fundamentals: including algebraic expressions, algebraic equations, algebraic operations, etc; (2) Equation solving methods: including substitution elimination method, addition subtraction elimination method, matrix method, etc; (3) Practical problems and equations: including case studies of using equations to solve practical problems.

### **3.3 The Teaching Process**

Mathematical knowledge often has rich background stories and historical origins. Therefore, before the start of teaching, teachers collect a lot of relevant materials and literature based on the course content and teaching objectives, in order to introduce the development process of algebra to students and stimulate their curiosity and exploratory desire. During the teaching process, the teacher designed multiple real-life problem scenarios to guide students in using algebra and equation

knowledge to solve problems. For example, when learning how to solve equations, the teacher set some relatively simple problems for students to solve on their own. The teacher also encouraged students to combine their own life experience to propose practical problems that can be solved using algebra and equations. When solving practical problems, the teacher guided students to engage in cooperative learning and discuss problem-solving solutions together. At the same time, the teacher also designed some problems that require students to explore independently to stimulate their curiosity, improve their learning interest and efficiency. In inquiry based learning, teachers provide some open-ended questions for students to find answers through diverse ways. During the teaching process, teachers evaluate and provide feedback on students' learning progress through classroom questioning and other methods[7]. At the same time, teachers encourage students to reflect on themselves, understand their own learning situation, and identify areas for improvement. Finally, teachers also adopted a formative assessment approach, focusing on students' performance in the learning process, providing timely feedback on their learning situation, and helping students improve their learning methods.

### **3.4 The Teaching Effect**

The teaching effect is achieved through the overall teaching of mathematical units from the perspective of HPM. Students can not only master the basic concepts and methods of algebra and equations, but also apply these knowledge to solve practical problems. In addition, students' interest in learning is stimulated, their mathematical literacy is improved, and at the same time, they enhance their cooperative spirit and exploratory ability in cooperative and inquiry based learning. In teaching evaluation, students' grades and comprehensive qualities have significantly improved, achieving the expected teaching goals.

## **4. Problems and Challenges in the Overall Teaching of Mathematical Units from the Perspective of HPM**

### **4.1 Teachers' Insufficient Understanding of**

### **the History and Culture of Mathematics**

At present, many teachers may have insufficient understanding of the history and culture of mathematics, which makes it difficult to effectively integrate them into teaching. The main reason for this problem is the deficiencies in the teacher education system[8]. In the current process of teacher training, emphasis is often placed on imparting subject knowledge, while neglecting the importance and training of mathematical history and culture. This results in many teachers lacking a deep understanding of this knowledge, making it difficult to effectively integrate mathematical history and culture into teaching. Moreover, at present, many teachers have outdated and decadent ideas, believing that academic performance is the only criterion for measuring students' value, and neglecting the cultivation of students' core competencies. This not only creates enormous academic pressure for students, but also affects their future progress and development.

### **4.2 Limitations of Textbooks and Teaching Resources**

The existing textbooks and teaching resources may not fully meet the overall teaching needs of mathematical units from the HPM perspective. The main reason for this problem is that the development of textbooks and teaching resources lags behind the updating and development of teaching concepts. HP The overall teaching of mathematical units from the perspective of M emphasizes the completeness and relevance of knowledge, as well as its connection with the real world[7]. However, existing textbooks and teaching resources may focus more on imparting subject knowledge and overlook these requirements, which makes it difficult for teachers to effectively implement HPM teaching and affects teaching effectiveness[9]. With the progress and development of society, the rational use of multimedia technology has become a necessary means of teaching for teachers at present. Multimedia technology can provide students and teachers with rich learning resources and massive teaching materials, which can not only meet the learning needs of students, but also meet the teaching needs of teachers. However, in the actual teaching process, many teachers do not use multimedia technology, which not only

fails to broaden students' ways of acquiring knowledge, but also to some extent reduces the teaching effectiveness of teachers.

#### **4.3 Students' Psychological Stress Issues**

The strong abstractness and logicity of mathematics lead to doubled pressure on students. Under the traditional mathematics teaching model, teachers focus on imparting knowledge, strengthening exam taking skills training, and paying little attention to students' psychological feelings. From the perspective of HPM, the overall teaching of mathematical units emphasizes the historical origins and cultural connotations of mathematical knowledge, and reduces students' psychological pressure through vivid and interesting teaching methods. However, in actual teaching, due to the difficulty of mathematics, there are significant differences in students' ability to accept new knowledge, and most students still experience psychological pressure. Students exhibit a sense of fear towards mathematical knowledge and uncontrollable anxiety towards exams. Affects students' learning outcomes and has a negative impact on their physical and mental health.

#### **4.4 The Challenge of Teaching Evaluation**

The overall teaching of mathematical units from the HPM perspective emphasizes the diversity and process of teaching evaluation, which puts higher demands on teachers' teaching evaluation ability. The main reason for this problem is the lack of sufficient training on teaching evaluation methods and strategies in the teacher education system and vocational training[8]. In current teacher training, emphasis is often placed on imparting subject knowledge and training teaching skills, while neglecting training in teaching evaluation. This results in many teachers lacking understanding and practical experience in teaching evaluation, making it difficult to effectively conduct teaching evaluation.

#### **4.5 Teacher Training and Professional Development**

The overall teaching of mathematical units from the HPM perspective has raised higher requirements for teachers' professional competence. However, the existing teacher

training and professional development system may not fully meet the needs of teachers. The main reason for this problem is that the education administrative departments and schools do not attach enough importance to teacher training and professional development, and do not invest enough. In the current education system, emphasis is often placed on the training of teachers' subject knowledge, while neglecting the cultivation of their professional competence and teaching ability. This results in many teachers lacking effective training and support, making it difficult to effectively implement HPM teaching. In addition, many teachers still use traditional teaching methods to teach without paying attention to students' learning needs and interests. Over time, students may not only develop a fear of learning, but also develop resistance.

#### **4.6 Collaboration Between Schools and Families**

Collaboration between schools and families can help establish a good learning environment for mathematics. Families are the first classroom for students' growth, and parents have a profound influence on students' learning attitudes, habits, and methods. By communicating and collaborating with parents, teachers can understand students' learning backgrounds, clarify their learning needs, and provide personalized teaching support for students. Parents integrate mathematical elements into family education and guide students to observe the world with a mathematical perspective. Collaborate closely with parents and guide students to utilize family resources for extracurricular activities. For example, parents can lead their students to visit places such as math museums and science museums, allowing them to experience the charm of mathematics firsthand. In the overall teaching of mathematics units, teachers need to pay attention to students' learning progress and adjust teaching strategies and methods in a timely manner. As teacher assistants, parents assist teachers in monitoring students' learning situations and provide necessary support and assistance. Through close cooperation between families and schools, a new communication mechanism is created to form an educational synergy and jointly promote the comprehensive development of students.



Therefore, cooperation between schools and families plays an important role in the overall teaching research of mathematics units from the perspective of HPM. Establish a good learning environment for mathematics, expand learning resources for teachers, and form a new educational program through parental education channels[10]. To provide students with better quality mathematics education services and cultivate their mathematical literacy. Reshape students' innovation ability from a diversified perspective, make positive contributions to their future social development, and equip them with unique competitiveness.

## **5. Strategies for Improving the Overall Teaching of Mathematical Units from the HPM Perspective**

### **5.1 Strengthening the Teaching of Mathematical History and Mathematical Culture**

Firstly, schools and education departments should attach importance to training and training in this area. Teachers can improve their mathematical history and cultural literacy by participating in professional courses, workshops, seminars, and other forms. For example, mathematics historians and mathematics education experts can be invited to give lectures and training to help teachers better understand the concepts, development, and applications of mathematics. At the same time, teachers can also read relevant books on the history and culture of mathematics to enrich their knowledge reserves. Secondly, in teaching, teachers can integrate the history and culture of mathematics into classroom instruction. By introducing the life stories of mathematicians and revealing the origins and development of mathematical concepts, teachers can stimulate students' interest in mathematics and deepen their understanding of mathematical concepts. For example, when explaining geometry, teachers can introduce the ancient mathematician Euclid's "Elements" and the historical development of geometry to stimulate students' interest in geometry. At the same time, teachers can also organize students to visit mathematical museums, participate in mathematical cultural activities, etc., allowing students to personally experience the charm of mathematics. Finally, schools can collaborate

with experts and publishing houses to develop textbooks and teaching resources suitable for HPM teaching. These textbooks and teaching resources should focus on the completeness and relevance of knowledge, as well as their connection with the real world. For example, project-based teaching modules can be designed to enable students to understand mathematical concepts and application methods by solving real-life problems. At the same time, schools can also organize students to participate in mathematical modeling competitions, mathematical knowledge competitions, and other activities to improve their mathematical application abilities.

### **5.2 Develop Textbooks and Teaching Resources Suitable for HPM Teaching**

Developing textbooks and teaching resources suitable for HPM teaching requires following certain principles and steps to ensure that the textbooks and resources can meet students' learning needs and improve teaching quality. When developing textbooks and teaching resources suitable for HPM teaching, teachers should ensure that the textbooks and teaching resources cover the depth and breadth of mathematical knowledge, including basic concepts, theorems, application examples, as well as the stories and history of mathematicians. These contents should be organized into a coherent whole, so that students can understand the origin and development of mathematical concepts and learn to apply this knowledge to solve practical problems[11]. To cultivate students' critical thinking, textbooks should include open-ended and challenging questions to stimulate students' curiosity and thirst for knowledge. Additionally, teachers can design project-based learning activities to deepen students' understanding and application of mathematical concepts while solving practical problems. In addition, textbooks and teaching resources should be adapted to different cultural backgrounds. Teachers can help students understand the role and status of mathematics in different cultures by designing culturally relevant mathematical problems or activities. At the same time, teachers can also use online platforms such as online courses and discussions to provide students with more learning resources and communication opportunities. Finally, textbooks and teaching

resources should be constantly updated to reflect the latest developments and research results in the field of mathematics. Teachers can learn about the latest developments in the field of mathematics by attending academic conferences and updating textbooks and teaching resources in a timely manner. In addition, teachers can also improve their teaching abilities and levels by communicating with peers and participating in professional training.

### **5.3 Reduce Students' Academic Burden**

Mathematics is an abstract subject, and its theoretical knowledge is obscure and difficult to understand, making learning more complex and tedious. At present, many students face enormous pressure in the learning process. Over time, this not only reduces their learning efficiency but also affects their personal development. Therefore, in the teaching process, teachers should streamline teaching content, highlight key and difficult points, in order to reduce students' learning burden. At the same time, teachers can also enrich classroom teaching content through case analysis and story plots, stimulate students' learning interest, and deepen students' impression and understanding of mathematical knowledge. To meet the learning needs of students, teachers can develop personalized teaching plans based on their learning level and interests. For example, for students who receive knowledge quickly, teachers can expand and extend the teaching content to stimulate their curiosity and curiosity. For students who receive knowledge slowly, teachers can gradually make the knowledge learned in the classroom more detailed and specific. In addition, teachers should also pay attention to students' mental health status and provide timely guidance, which can not only alleviate students' learning pressure but also improve their learning outcomes.

### **5.4 Reasonably Utilize Multimedia Technology**

At present, China has entered the era of informatization. Multimedia technology can transform complex mathematical knowledge into videos or images, helping students understand and remember. It can not only

enhance students' interest in learning, but also enliven the learning atmosphere in the classroom. Therefore, before teaching begins, teachers can select appropriate content and materials for teaching based on teaching needs and student needs, avoiding teaching resources that are too fancy or outdated. In the teaching process, teachers can combine the overall teaching method of the unit with multimedia technology, reasonably use multimedia elements such as pictures and audio, and create a relaxed and pleasant learning environment for students[11]. In addition, teachers can also stimulate students' confidence and improve their enthusiasm through small games, test questions, etc., so that students can fully devote themselves to classroom learning. After teaching, teachers should pay attention to students' feedback and opinions, and communicate and exchange ideas with them in a timely manner, so as to modify the teaching plan in a timely manner and improve the teaching effectiveness of the classroom. In addition, although multimedia technology has many advantages, traditional teaching methods also have their irreplaceable role. When teachers use multimedia technology, they need to combine it with traditional teaching methods, learn from each other's strengths and weaknesses, and make multimedia technology better serve teaching work.

### **5.5 Strengthen Teacher Training and Professional Development**

The teaching level and work ability of teachers are the foundation for improving students' learning efficiency. Therefore, in the teaching process, teachers must master rich mathematical knowledge and diverse teaching methods in order to improve classroom teaching effectiveness and lay a foundation for students' comprehensive development. To improve the teaching ability of teachers, they can participate in professional training organized by education departments, higher education institutions, professional organizations, etc. to understand the latest mathematical education theories and practices. Schools can also provide unified training for teachers, inviting experts and scholars in the field of mathematics to impart relevant theoretical knowledge and teaching methods to teachers, so that teachers can better guide students to understand and apply mathematical

knowledge. After the training is completed, the school should regularly assess the teachers to test the effectiveness of the training. Teachers who pass the assessment should be rewarded and praised by the school, while those who fail the exam should receive secondary training to ensure the effectiveness of mathematics classroom teaching. Finally, teachers can reflect on their teaching practices, summarize experiences and lessons, and continuously improve their teaching abilities through participating in teaching seminars and other activities in daily life. At the same time, teachers can also participate in mathematical education research projects, such as mathematical teaching design and evaluation, to enhance their research abilities and teaching level.

### **5.6 Establish a Collaborative Mechanism Between Schools and Families**

Parents are the first teachers of their children, so they must communicate with the school and teachers in a timely manner to understand their children's classroom learning situation. This way, when they encounter bottlenecks in the learning process, parents can take timely measures to deal with them. At the same time, parents should also pay attention to their children's mental health. At present, students face great academic pressure. According to statistics, more than half of the students in the country have experienced feelings of boredom and anxiety. Moreover, due to the pressure of further education, grades have become the only standard for measuring students' value, which directly leads to many students' mental health problems. As guides on the path of students' lives, both parents and teachers should pay attention to this issue[11]. Teachers should focus on students' learning interests and needs in the teaching process, so as to improve their learning ability. At the same time, parents should give their children some care and understanding, change the mindset that grades are the only way, communicate and interact with their children more, and ask their inner thoughts, which is conducive to their personal development in the future. In addition, schools can regularly organize parent teacher conferences, exchange meetings, and other ways to invite parents to participate and jointly develop their children's education plans. This not only ensures that both parties understand

the students' situation in a timely manner, but also provides a better educational environment for students.

### **6. Conclusion**

In summary, exploring the overall teaching research of mathematical units from the perspective of HPM is of great significance. This teaching method can not only improve students' learning efficiency to a certain extent, meet their learning requirements, but also enhance teachers' teaching ability and level, and enrich the learning content of the classroom. Therefore, in the daily teaching process, teachers should pay attention to the actual situation of students and adopt diverse teaching methods and evaluation methods to improve teaching quality. At the same time, teachers should also pay attention to students' learning needs and adjust teaching strategies in a timely manner according to each student's acceptance level, in order to achieve better teaching results. Through the joint efforts of education, we can contribute to the reform of international mathematics education and lay the foundation for cultivating the next generation of innovative and critical thinking mathematical talents.

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