Research on Teaching Reform of "Higher Mathematics" under the Background of Big Data

Xia Lan

Jilin Communications Polytechnic, Changchun, Jilin, China

Keywords: Big data; Higher mathematics; Reform in teaching

Abstract: In the context of computer information technology, the acquisition of information and data has become more rapid and convenient, and is very suitable for the field of education. At present, with the development of modern information technology and the continuous progress of educational system reform, the issue of higher mathematics education reform in China has also been put on the agenda. The reform of higher mathematics teaching in the context of big data can not only enrich teaching content, improve teaching models and methods, but also build more interesting and vivid mathematics classes, further improving teaching effectiveness. Therefore, based on the background of big data, this article analyzes the strategies for "Higher Mathematics" teaching reform, and fully utilizes the advantages of information technology.

1. Introduction

The curriculum reform of higher mathematics is a long-term and sustained basic process, which should be guided by the new requirements of social and market quality and ability, and cultivate talents with innovative spirit and adapt to social development. To face the changes in the environment, mathematics teachers should keep up with the pace of the development of computer science, adhere to the idea of "integrating knowledge, ability, and quality", effectively combine diverse teaching methods, and constantly explore feasible methods and strategies for problems that may arise at any time in the mathematics teaching process and affect students' learning.

2. Problems in "Advanced Mathematics" Teaching under the Background of Big Data

2.1. Backward Teaching Concepts

Under the influence of exam oriented education, teachers' explanations occupy most of the time in mathematics classrooms, and students can only passively learn knowledge, while their thinking abilities cannot be effectively developed and exercised. For example, in traditional classrooms, teachers will explain mathematical knowledge according to teaching courseware, analyze concept definitions and application methods for students, and then use example analysis to guide students to deeply understand mathematical knowledge. Finally, arrange a large number of exercises to let students master the key mathematical knowledge during the problem solving process. In this process, students lack the time for independent thinking and analysis, and can only follow the rhythm of the teacher step by step. Even if some knowledge points are not understood, they will passively ignore them.

2.2. Theoretical Teaching Content

Most textbooks fail to adapt to the new social needs, pursuing rigorous logic and complete systems, emphasizing theory over practice, stripping away the practical significance of concepts and principles, which is not conducive to the connection with subsequent courses, resulting in an embarrassing situation for students who "cannot use even if they learn". Especially today, with the massive increase in big data and the rapid development of information technology and its terminal products, it is not possible to effectively integrate information technology and its terminal products with the content of college mathematics teaching in mathematics textbooks and teaching

  DOI: 10.25236/ichamhe.2023.020

construction. Teachers' application of information technology is not deep enough, they have not fully utilized the advantages of information technology in curriculum teaching, and they have not built a more effective platform for teacher-student interaction. Due to the lack of high-quality information based teaching resources, the improvement of the teaching quality of higher mathematics courses has been slow.

2.3. Single Teaching Method

Nowadays, the basic teaching methods of higher mathematics are too single, and too much emphasis is placed on the proof of mathematical theorems, making mathematical knowledge more abstract. There is still a certain gap between them and the basic problems in real life. In the specific process of teaching, mathematics teachers overemphasize the overall logic and rigor of their mathematics, and the teaching method is basically indoctrinated. For a long time, it has been teacher-centered and teaching oriented, and students are still in a relatively passive position in the mathematics teaching classroom.

2.4. Monotonous Assessment Nethods

In order to test the learning effectiveness of students, examinations are usually conducted. At present, the assessment method of "Higher Mathematics" courses is mainly based on the integration of usual scores and final scores. The usual performance includes attendance, homework, classroom performance, exams, mid-term exams, etc. The main assessment content is the students' mastery of basic concepts, theorems, formulas, properties, calculation methods, and other knowledge. This assessment method has little interest in students, is not serious at ordinary times, does not focus on the persistence required for learning "Higher Mathematics", and does not train the ability to solve practical problems through mathematical methods, even if the results are good at ordinary times. In terms of final scores, most of them are assessed using a written test paper, which is more comprehensive and more difficult than usual. By reviewing and reciting, students can also achieve good results, but they do not grasp the essence of "Higher Mathematics". Once encountering difficult problems, they are prone to develop a psychological fear and rejection.

3. Teaching Reform Strategies for "Advanced Mathematics" in the Context of Big Data

3.1. Innovativing Teaching Concepts

In "Higher Mathematicss" teaching, teachers are the basic conditions for classroom activities. In order to meet the requirements of the era of big data, teachers should abandon outdated teaching concepts and have a sense of strategic development. Teachers can use the convenience and intelligence of big data to conduct online seminars or exchange meetings to communicate teaching concepts, so that teachers can reasonably understand the content of mathematics teaching and lay the foundation for selecting appropriate teaching methods. Clarifying teaching objectives is a prerequisite for conducting "Higher Mathematics" teaching. Teachers can only focus on teaching according to the requirements of each specialty. Some majors have higher theoretical requirements, and can explain more concepts and related proof questions. Others have requirements for computing ability, and can provide more training in hands-on computer operations. When establishing teaching concepts, it is necessary to emphasize the dominant position of students in learning. Regardless of how classroom activities are designed, students must participate and create more space for students to play. In addition, it is necessary to change the old concept that mathematics is boring and visually display some mathematical theorems or formulas with the aid of computers. For example, when teaching Taylor's formula, you can draw a polynomial approximation function and the original function into a graph. As the number of polynomial terms increases, it becomes closer and closer to the original function. If this process is demonstrated through animation, it can not only exercise students' spatial thinking ability, but also make students feel that mathematics is actually very interesting. In addition, in the selection of teaching materials, you can choose the appropriate teaching materials according to the specific situation of the school and students. Different majors

should also be different. For example, students in engineering, foreign language or Chinese, and economics and management can choose textbooks such as *Advanced Mathematics in Engineering*, *Advanced Mathematics in Liberal Arts*, and *Economic Mathematics* respectively, which will be more targeted and students will not find the content too difficult. In short, for the teaching of "Higher Mathematics", it is necessary to change existing teaching concepts, boldly innovate, make more use of the opportunities brought by big data, and turn "Higher Mathematics" into a more interesting and vivid course.

3.2. Enriching Teaching Content

Although big data is an IT technology that involves multidisciplinary knowledge, it contains a large amount of mathematical knowledge, mainly including advanced mathematics, linear algebra, probability theory and mathematical statistics, discrete mathematics, optimization theory, etc. "Higher Mathematics" is the foundation and a tool for learning other mathematical knowledge. The most basic knowledge in "Higher Mathematics", such as sets, functions, derivatives, vectors, and integrals, is very important for the theoretical foundation behind the learning and programming of statistical methods. For example, when updating the weight of a model in big data, a gradient method is used, and the gradient is calculated using the partial derivatives in "Higher Mathematics". Another example is that when seeking the optimal solution in big data, one can determine the direction of optimization by calculating the derivative of a function to determine its change trend. In addition, if there is no "Higher Mathematics" knowledge, learning other mathematical content is impossible. Therefore, teachers should combine the current development trends and application fields of big data, emphasize the importance of learning "Higher Mathematics", and make students understand that mathematics is essential in any industry, so as to stimulate their interest in learning "Higher Mathematics". In addition, in terms of teaching content, it can be divided into theoretical courses and experimental courses. The theoretical course mainly teaches the basic knowledge and theory of "Higher Mathematics". Experimental courses mainly train students to use computer technology to solve problems in "Higher Mathematics". For example, teachers can guide students to use Matlab or Python language to solve problems such as limits, derivatives, extreme values, and integrals in "Higher Mathematics", which can enable students to master the implementation methods of using computer technology to solve "Higher Mathematics" problems while improving their programming skills.

3.3. Adopting Diverse Teaching Nethods

Modern teaching methods should be dynamic, personalized, and open. The use of innovative teaching methods and platforms such as QQ groups and WeChat groups can stimulate students' interest in learning and enhance communication and interaction between teachers and students, which is conducive to teachers better mastering students' knowledge needs and providing timely answers to students' problems encountered in learning. Before class, teachers can upload teaching resources such as teaching plans and coursewares to the teaching platform, so that students can have a clear target when previewing. During the teaching process, a combination of "online+offline" methods can be used for teaching, such as using platforms such as Rain Classroom, Tencent Classroom, or Learning Connect to conduct exercise tests and raise hands to ask questions, which makes it easier for teachers to grasp the overall learning situation of students. Through the accumulation of multiple test data and relying on big data technology to analyze and feedback on teaching conditions, teachers can better understand students' learning conditions, thereby adjusting teaching methods, and effectively improving the teaching quality of "Higher Mathematics". For chapters that are not required or optional in the syllabus, as well as content that students are interested in, students can be encouraged to use teaching platforms such as Chinese University Students' MOOC or Xuetang Online to conduct self study, expand their knowledge, and cultivate their ability to think independently. In addition, due to the strong theoretical nature and abstract knowledge of "Higher Mathematics", teachers can visually display the content of books by combining multimedia means such as images and videos on the big data platform. For example, when explaining the Fourier series of "Higher Mathematics", the construction idea of Fourier

transform can be demonstrated through multimedia (Figure 1), as well as the dynamic representation of the gradual approximation process of Fourier series to curves. By combining traditional knowledge with modern technology, students' interest in learning can be enhanced, and the teaching of "Higher Mathematics" can be promoted towards a more practical development.

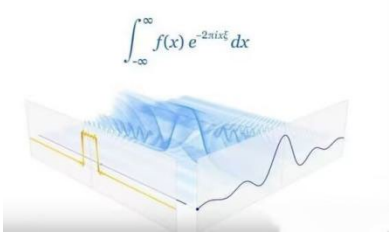

Figure 1 Visual Fourier Transform: The principle of the Fourier transform process for rectangular waves.

3.4. Adopting a Comprehensive Assessment Method

In the assessment of "Higher Mathematics", the mode of combining examination and examination can be adopted. The computer operation section mainly conducts practical examinations, and adopts weighted scoring based on the length of online learning and the situation of answering questions. Adjust the teaching content and modify the weight of each part of the total score accordingly through the digital evaluation results. The examination is recommended to be conducted in the form of test papers, and students' mastery of theoretical knowledge cannot be ignored. Comprehensive analysis of all student examinations and exam results is conducted through big data technology. This assessment method not only obtains the final score of the "Higher Mathematics" course, but also understands the learning process of students at every step, which provides sufficient data support for carrying out teaching reform to achieve better teaching results.

4. Conclusion

The 21st century is known as the era of big data. Only by following the trend and utilizing the powerful network and data analysis capabilities of big data to provide better assistance for "Higher Mathematics" teaching can teachers promote the reform of "Higher Mathematics" teaching towards practicality and modernity. This article analyzes the common problems existing in the teaching of "Higher Mathematics" at present, and makes analysis and suggestions from four aspects: teaching philosophy, teaching content, teaching methods, and assessment methods. It is hoped that it can improve students' interest in learning, enhance their hands-on ability, cultivate their mathematical literacy, and achieve their comprehensive development.

References

[1] Zhang Xiaoxia. Practical Research on Higher Mathematics Teaching Reform in the Context of Big Data [J]. Science and Technology Wind, 2022,492 (16): 136-138.

[2] Zhang Su, Song Xiaoping. Exploration of Higher Mathematics Teaching in the Context of Big Data [J]. Mathematics Learning and Research, 2021, (03): 4-5.