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Innovative Research on Online and Offline Hybrid Teaching Mode of Higher Mathematics

Hong Zheng
Foundation Department, Liaoning Institute of Science and Technology, BenXi, China

Abstract: Advanced mathematics is a fundamental course for all majors in science, engineering, management and economics in higher education institutions, and it plays a very important role in both professional studies and further studies. Therefore, an in-depth study on the teaching mode of higher mathematics course is very necessary to improve the teaching quality of this course. In this study, we suggest the teaching methods, teaching concepts, evaluation system and course thinking and politics in order to provide reference and reference for the teaching reform of higher mathematics.

Keywords: *Advanced Mathematics; Online And Offline; Teaching Mode*

I. INTRODUCTION

The Newcastle pneumonia epidemic has not only disrupted people's lives, but has also changed the way they work and learn. Teachers need to use online teaching models to overcome the impact of the epidemic on their daily teaching work during special times [1-3]. The online teaching model has solved the problem of teaching during the special period, but the teaching effect has not reached the expected requirements and there are certain limitations, such as the teacher cannot control 100% of the students' learning effect [4].

The traditional teaching mode also has shortcomings, such as a single classroom format and low interactivity [5].Based on this, online teaching and traditional teaching mode are combined, and a hybrid online and offline teaching mode is used for teaching to improve teaching quality and teaching effect [6]. Advanced mathematics is a very important public foundation course for all majors in science and technology [7-8], which covers functions, limits, derivatives, differentiation, integration, differential equations, vectors, space geometry and series, etc. It requires students' reasoning, imagination, abstractionand other abilities. A student's ability to reason, imagine, abstract and so on is a major requirement of higher mathematics courses, and a student's learning of higher mathematics will directly affect the learning of other courses, and may even have an important impact on their career choice. Therefore, as a teacher of advanced mathematics courses, you should think about the teaching process of advanced mathematics courses and create a teaching mode in line with the trend of the times, so as to lead students to learn this course well.

II. PROBLEMS IN THE TEACHING OF HIGHER MATHEMATICS

A. Single form of classroom teaching

Many teachers still adopt the traditional teaching form of writing on a board when teaching higher mathematics. Although the process of writing on a board can show the process of derivation and proof in detail, which helps students understand the knowledge, the efficiency of teaching on a board is low. For example, in the section on the application of definite integrals to find the volume of three dimensions, the board book cannot demonstrate the process of finding the elements very well, so the teaching effect will be affected, which is not conducive to students' learning and acceptance. In addition, the traditional teaching mode of teachers speaking and students listening is boring and tedious, which makes it difficult to motivate students to learn.

B. Poor articulation of the content of the teaching materials

With the continuous development and changes of the times, the content of senior secondary school textbooks has also undergone great changes. For example, in the section on trigonometric functions in high school mathematics textbooks, the existing textbooks only briefly introduce sine, cosine and tangent, while important formulas such as cotangent, inverse trigonometric functions and interconversion of sum and product are no longer mentioned, whereas these are often used in higher mathematics courses at university. For example, in higher mathematics, we have to find the area and arc length under the polar coordinate system, but the knowledge of polar coordinates is taught as an elective in high school, and most students have not learnt it. Moreover, the mathematical foundation of students in arts and science subjects and in different regions varies, with some students having learnt simple calculations of definite integrals and derivatives in senior secondary school, while others have not been exposed to them at all.

C. Course content with many lessons and few hours

Although advanced mathematics is an important basic course for all science and technology majors, universities are constantly adding courses and expanding the number of hours of specialized courses in order to reflect the characteristics of the majors and to make them more competitive and more responsive to the needs of society. In order to balance the total number of hours in the training programme, the only way is to compress the number of hours of advanced mathematics. However, the content of higher mathematics is large, and after the class time is compressed, sometimes a large class has to cover two small sections of content, and students are generally unable to keep up with the teacher's lecture rhythm, and this situation keeps accumulating, leading to poor learning results, which will eventually make students lose interest in learning, and then affect the teaching effect of subsequent related professional courses.

D. Evaluation system needs to be improved

At present, most tertiary institutions still use marks to assess students' mastery of the courses they study, although the final overall assessment grade consists of several parts in a certain proportion, such as 70% of the final examination grade, 20% of the usual grade and 10% of the homework. This

assessment method often results in some students not paying attention to lectures, missing lectures, copying assignments, or even not completing homework, and only intensifying the assault before the final examination by reciting theorems, definitions, key questions and so on. Although the final overall assessment grade may reach a pass, or individual students can achieve relatively good results, but the depth of students' understanding of knowledge only stops at simple calculations, and they are not able to solve practical problems flexibly.

III. WAYS TO IMPROVE THE TEACHING OF HIGHER MATHEMATICS COURSES

A. Use of information-based teaching tools to enhance classroom interaction

With the development of science and technology, the improvement of hardware and software, and the emergence of various teaching aids, the traditional form of teaching based on board books is no longer able to adapt to the needs of modern education, the new era of education needs more abundant teaching methods to continuously improve the quality of teaching and improve the teaching effect.

1. Modern teaching requires the full use of a wide range of teaching equipment and the reasonable integration of multimedia technology

As multimedia has the characteristics of image, intuition and vividness, it can better present the contents that are not easy to write on the board, and help students to understand what they have learnt when teaching dynamic processes and multi-dimensional three-dimensional graphics in higher mathematics. However, if the classroom adopts multimedia technology alone for teaching, the speed and volume of multimedia lectures will cause some students to fail to keep up with the pace and affect the teaching effect.

2. Make full use of new smart teaching tools, such as Rain Classroom, Learning Pass and other online platforms

Before the class, teachers can send students online the MOOC videos, essays and exercises that need to be pre-studied; during the class, you can understand students' learning status in real time through interactive functions such as check-in, tests, pop-ups and contributions; after the class, you can understand students' mastery of what they have learnt through functions such as discussion forums and questionnaires. In this way, by starting from three aspects, such as before, during and after class, the challenge of single assessment in traditional teaching is solved and students' learning can be understood through concrete data.

B. Update teaching philosophy and optimise classroom teaching

At present, most institutions still adopt the traditional teaching method, i.e. the teacher dominates the whole classroom, from the beginning to the end of the class, the teacher teaches and the students receive knowledge passively. The advantages of this traditional teaching method are that the teacher is able to master the classroom process, grasp the pace of the class, teach each knowledge point in detail according to the syllabus, and complete the teaching plan on time, but the students are not easily able to take initiative, and the interaction between teachers and students is not sufficient.

C. Improving the course evaluation system to enhance learning interest

The existing evaluation system of higher mathematics courses is single, mainly measuring students' learning level through grades. In order to further improve students' motivation, the course evaluation system should be enriched and improved, and a more reasonable and motivating evaluation mechanism should be established. The assessment mechanism can be divided into two parts: online and offline. Online grades are given according to realistic criteria based on data such as students' pre-study, in-class learning and post-class practice feedback; offline grades are mainly given in the traditional mode, but not only through final exam results, but also through a combination of class performance, homework and exams. The offline results are not only measured by final examinations, but also by classroom performance, homework and examinations. This assessment mechanism, on the one hand, solves the problem of students only doing questions for exams and not thinking; on the other hand, it alleviates the situation of only "brushing up on data" online.

D. Strengthen the ideological education of the curriculum and implement moral education

As a core foundation course for science and technology majors in China's higher education institutions, higher mathematics carries the role of bridging and bridging secondary and higher education, and occupies a quarter of the time of university studies. It is a major responsibility and of great significance to educate people for the Party and the country, and to cultivate quality talents in universities. Therefore, teachers of higher mathematics should dig deeper into the thinking and politics elements of the curriculum and integrate them effectively into the whole teaching process, which is very important for students' knowledge mastery, ability enhancement, personality building and value shaping.

1. Introduce elements of science and technology into the teaching of higher mathematics

"Various vehicles such as Shenzhou-6 and Beidou were sent into space, which is a major achievement of China's space scientists in exploring the space sector, and this involves differential equations in higher mathematics. The temperature of the materials involved in the operation of the vehicles is closely related to the conditional extrema of multivariate functions in higher mathematics. China is a world leader in the development of high speed railways, the design of which uses curvature in higher mathematics. In classroom teaching, introducing science and technology cases into the curriculum for specific knowledge points can cultivate students' patriotism and enhance their sense of national pride and glory.

2. Introduce elements of mathematical culture into the teaching of higher mathematics

When explaining the concept of limits, you can draw on the approach taken by Professor Xu Liji, a renowned mathematics educator, in his lectures for arts students, when he quotes Li Bai's Sending Meng Haoran to Guangling from the Yellow Crane Tower' to talk about the process of infinite approximation of limits. When lecturing on least squares, the idea and method of least squares can be demonstrated by drawing on the 3D animated diagram of the search for Ceres. When talking about differential equations, introduce the fundamental equation of electromagnetism in physics,

according to which the existence of electromagnetic waves can be determined.

3. Introduce elements of philosophical thinking into the teaching of higher mathematics

Differentiation and integration in higher mathematics embody the philosophical relationship between opposites and unity. Differentiation is the infinite subdivision of a quantity, reflecting the 'transformation of whole into zero'; integration is the accumulation of countless tiny quantities, i.e. the 'accumulation of zero into whole'. Differentiation and integration are linked by the basic formulas of calculus, and are unified. The various integral concepts in higher mathematics are in the process of division, coarsening, summing and refinement, replacing irregularity with straightness, approximation with precision, and finally achieving the paradoxical transformation and unity of opposites from quantitative to qualitative change through finite and infinite, stationary and motion. Therefore, philosophical ideas are integrated into teaching and learning to develop students' dialectical thinking skills.

4. Introduce elements of musical art in the teaching of higher mathematics

When the mathematician Taylor studied the shape of strings through second-order ordinary differential equations, he deduced that the fundamental frequency of a vibrating string, the frequency of a gene, can determine the pitch of this tone. On the basis of the principle of resonance, Euler initiated new research into music theory. Bernoulli, by studying the vibration of a suspended chain line with a fixed upper end, discovered that the system of masses was capable of vibrating in different modes, and that in each mode each mass had its own frequency. Fourier solved the controversy caused by the string vibration problem, typified by the violin, through knowledge of the series, making the first real success of partial differential equations.

CONCLUSION

The teaching of higher mathematics has a long way to go. As the teacher of the course must recognise its importance, he must constantly think, summarise and improve in his teaching work in order to adapt to the teaching requirements of the new era and contribute his modest efforts to the development of education.

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