

# *Teaching Reform of Higher Mathematics Course*

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**Abstract:** As one of the important factors in demonstrating the comprehensive ability of a country, China is very concerned about the quality of output of higher education. The traditional way of teaching HM ignores the differences of individual students, and the teaching form is boring, which makes many students' learning autonomy low and the course learning effect poor, especially students with poor mathematics foundation have learning difficulties in higher mathematics (HM) and other problems. This paper therefore examines and discusses the reform of the teaching of HM courses. The paper begins with a brief overview of the teaching objectives and problems of the current teaching mode, followed by a study of the teaching methods of HM teachers and students' attitudes towards learning HM, and finally an analysis of the effectiveness of micro-courses and suggestions for the reform of higher mathematics teaching (HMT).

## **1. Introduction**

In recent years, with the development of higher education in China, our teaching conditions and facilities have been steadily improved, and the teaching methods have also been well improved in the reform [1]. HM has high system requirements in the learning process, with the characteristics of strong fundamentals, extensive logic and high abstraction [2]. The purpose of studying Advanced Mathematics is not only to solve problems, pass examinations and obtain credits, but also to learn to analyse and solve problems in a mathematical way and gradually change from primary mathematical thinking to advanced mathematical thinking through the training of mathematical thinking [3]. In the teaching of HM courses, we should pay attention to the influence of factors such as learning methods and mathematical foundations, as well as non-intellectual factors such as motivation and interest [4].

With the development of teaching reform, a large number of scholars have analysed and researched the reform of teaching HM and achieved good results. For example, Sofia Sivena et al. conducted an action research study of a university general education mathematics course in which all three students were diagnosed with learning difficulties related to mathematics, the item emerged in response to a question about performance in a mathematics course in which understanding mathematics would be a major focus, the study reported that mathematics struggling students did not fully understanding [5].Suparoek Chootongchai et al. in a study of students with some mathematical learning difficulties and students with relatively good mathematical foundations in a

goal directed survey, showed that students were interested in developing competencies, expected and believed that they could do challenging work and showed a positive mathematical self-concept, however teachers did not adequately through the mathematics classroom giving students high levels of confidence and motivation to learn [6]. Reform of HMT and learning is important for the development of higher education in China.

The need and importance of HM education in opening students' minds, improving the quality of their thinking and enhancing their ability to re-learn has been widely recognised. Therefore, this paper conducts a study on the reform of HM curriculum. The first part of the paper is about the concepts, including the teaching objectives and the problems of the teaching mode; the second part is about the current situation of HMT, which is analysed from three aspects: data classification, teaching methods of HM teachers and students' attitudes towards learning HM; the third part is about micro-course teaching, which consists of three main aspects: the current situation of micro-course teaching The third part is on micro-course teaching, which mainly covers three aspects: the current situation of micro-course teaching, the effectiveness of micro-course teaching implementation, and suggestions and strategies.

## 2. Relevant Concepts

### 2.1 Teaching Objectives

From the perspective of talent cultivation objectives, the construction of a process evaluation system of HM should be based on the actual teaching situation and the requirements of cultivation objectives, so that the teaching of basic courses and students' skills mastery can be combined in order to establish a reasonable objective orientation of HMT evaluation. The teaching objectives of the reform of HMT are as follows [7].

(1) To establish the purpose of service and improve the quality of talents.

As a basic course, HM is responsible for serving students' professional skills, and for serving students' employment, entrepreneurship and further study after they leave school. The process evaluation system of HMT must help students improve their ability to adapt to professional changes, and must be conducive to the development of students' comprehensive professional literacy.

(2) Focus on core literacy and strengthen expansion objectives.

Focus on innovation education to equip students with the ability to carry out further professional studies. Process evaluation of HMT should generate evaluation indicators corresponding to each of the tasks given in the syllabus on an article-by-article basis in order to successfully complete that teaching task.

(3) Comprehensive training for students to achieve lifelong education.

Process evaluation of HMT and learning focuses on students' interests, habits, behaviour and abilities in a holistic manner, so that students can learn to learn, not only at school but also after they have entered the workplace, to achieve the goal of lifelong education.

### 2.2 Problems of the Teaching Mode

HM courses are boring for many students, and the teaching methods and teaching means in the traditional teaching mode are relatively homogeneous, with the teaching process mainly being teacher's explanation, and students are only passive recipients of knowledge and not highly motivated to learn [8]. The traditional teaching mode is not supported by clear educational ideas and theories, teachers' interpretation of educational objectives varies, and in terms of teaching design, they are mostly stuck to the classical design of experienced teachers[9]. The educational tools do not keep up with the times, and the teaching effect is not significant. In terms of classroom effects,

teachers did not dissect and reinforce concepts enough, making most students struggle to learn, which in the long run led to students' self-confidence being easily frustrated and lacking motivation to learn [10]. Furthermore, students' understanding of HM concepts only remained at the activity stage. Students did not really experience the formation process of the relevant concepts and did not go through a complete mental construction stage, so they were unable to understand the meaning accurately and construct a complete conceptual schema. In addition, the summaries of conceptual knowledge points and the post-learning summaries of students were also neglected at the end of the whole teaching.

### 3. Current Status of Teaching HM

#### 3.1 Classification of Data

Since the data analysed covered students' performance in language, mathematics and HM, in order to ensure the reasonableness of the classification of students' performance, this paper used hierarchical cluster analysis to cluster the language and HM, mathematics and HM, and English and HM respectively. The paper uses the mean distance method for cluster analysis of the data, calculated using formula (1), and uses formula (2) to discount the major grades in the Advanced Placement examinations before analysis to ensure that each course is analysed under the percentage system.

$$s(d_i, d_j) = \frac{1}{m_i m_j} \sum_{f \in d_i} \sum_{f' \in d_j} |f - f'| \quad (1)$$

$$N_i = (K_i / 150) \times 100, i = 1, 2, 3 \quad (2)$$

$N_1$ ,  $N_2$  and  $N_3$  denote the converted Advanced Mathematics, Language and English grades respectively, and  $K_i$  is the student's actual exam score respectively. Because HM is generally divided into two semester courses, equation (3) was also used in the analysis to correlate HM.

$$Z = (z_1 + z_2) / 2 \quad (3)$$

$Z$  denotes the converted Advanced Mathematics grades, with  $z_1$  and  $z_2$  being the grades for Advanced Mathematics 1 and Advanced Mathematics 2 respectively.

#### 3.2 Teaching Styles of HM Teachers

For the analysis of the current situation of teaching HM, 945 students in a university were selected for this paper. Table 1 shows the results of the survey on the teaching styles of HM.

Table 1: Results of the teaching style survey

	Number of people	Percent(%)
Teacher speaks alone with little student participation	543	57.46
Teacher narration is not linked to student participation	213	22.54
Little integration with the profession	114	12.06
More linked to the major	75	7.94
Total	945	100

In Table 1, it can be seen that the teaching style of HM teachers is most often taught by teachers alone, accounting for 57.46%, and the teaching style linked to the major is the least, accounting for

only 7.94%. In the case of predominantly teacher alone lectures, most of the students existed deserted and did not actively cooperate with the teacher, thus, the teacher teaching style was one of the reasons for students' learning difficulties. HM is generally taught on the blackboard using chalk to develop explanations of problems, and students nowadays do not like this boring way of learning, and with the proliferation of electronic devices nowadays, students are often attracted to mobile phones. In contrast, traditional teaching methods lack appeal and students are not well engaged. Moreover, the lectures do not involve professional knowledge, which is even more lacking in new gravitational force for the post-00 students nowadays.

### 3.3 Students' Attitude Towards Learning HM

Figure 1 shows the statistical results of students' attitudes towards the study of HM. The survey data shows that only 17.9% of students agreed that the main purpose of learning HM is that they want to learn it, which shows that students' willingness to learn is not strong; 46.2% of students agreed that learning HM knowledge is useful for learning other courses, and students affirmed the importance of the knowledge; 48.5% of students thought that the biggest difference between HM and other subjects is the symbolic language, which shows that Students have a clear understanding of the characteristics of HM; 56.9% thought that it was difficult to learn HM, and only 19.8% had mastered the specific concepts and definitions of HM after studying it.

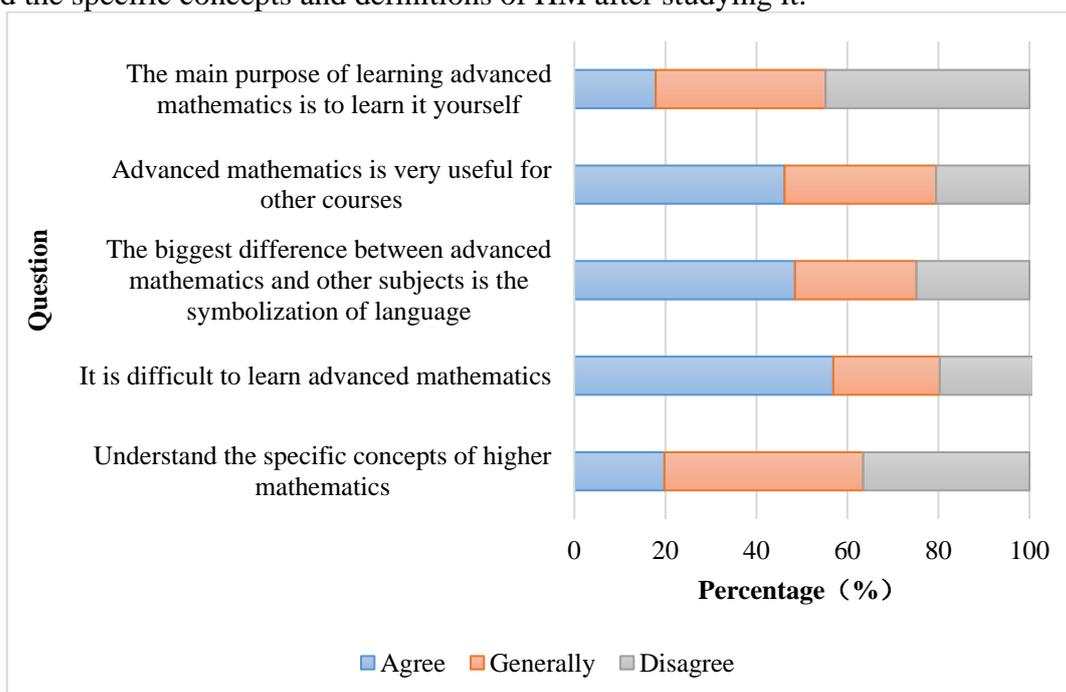


Figure 1: Students' overall perception of HM

## 4. Micro-class Teaching

### 4.1 Evaluation of Micro-Course Teaching Status

Teaching mode affects students' learning process. For highly abstract advanced mathematics, teaching mode is particularly important. We can make use of the characteristics of micro-courses to provide students with diverse and diversified learning methods to meet their diverse needs of acquiring knowledge. In this paper, the use of micro-class mathematics in a university was

investigated, and the questionnaire survey mainly analyzed the following three questions: Question 1: How much do you know about micro-class: A doesn't know, B just knows, C knows and can use; Question 2: Can you make micro-lessons: A can, B can't; Question 3: Has your school invested in the promotion of micro-courses? A has not invested, B has invested, and C is planning to invest in the promotion. The survey results are shown in Table 2.

Table 2: Statistical Table of Micro-course Teaching Survey

Options	Question 1(%)	Question 2(%)	Question 3(%)
A	29.4	21.7	63.5
B	47.5	60.3	7.4
C	23.1		29.1

It can be seen from Table 2 that although the slogan of implementing micro-courses has been put forward for many years, micro-courses have played a positive role in teaching, but micro-courses have not played a practical role. However, 29.4% of teachers in this university don't know much about micro-courses, 47.5% of them only know about micro-courses, only 23.1% of them know and can use micro-courses, and only 21.7% of them can make micro-courses. As a new thing, the value of micro-courses naturally needs to be paid attention to and taken seriously. From a macro point of view, for HMT, the appearance of micro-courses can obviously highlight the key points of classroom teaching, thus resolving the learning difficulty in traditional classroom. Therefore, as a HM teacher, we should actively accept this new thing. At the same time, however, based on the dialectical thinking, we should also consider the problems that may arise and must be avoided in the concrete implementation, so it is necessary to evaluate its effectiveness so as to make it more effective.

#### 4.2 Micro-course Teaching Implementation Effect

In this paper, 500 students were selected to carry out micro-class teaching experiments, and the results of micro-class teaching were compared and analyzed. As can be seen from Figure 2, students' understanding of the role of mathematics has changed greatly before and after the implementation of micro-class teaching. Before the experiment, 247 students thought that learning mathematics had no effect, accounting for 49.4% of the experimental students. After the experiment, the number of students thought that learning mathematics had no effect dropped to 62, accounting for only 12.4% of the experimental students. Before the experiment, 176 students thought that learning mathematics was useful, but it was not, accounting for 35.2% of the total number of students. After the experiment, it only accounted for 10.8% of the total number of students. Before the experiment, only 77 people thought that learning mathematics was very useful, and after the experiment, 384 people thought that learning mathematics was very useful, with an increase of 61.4%. It can be seen that after the implementation of micro-class teaching, students' understanding of learning mathematics has been greatly improved, which basically changed the misconception that learning mathematics is not useful.

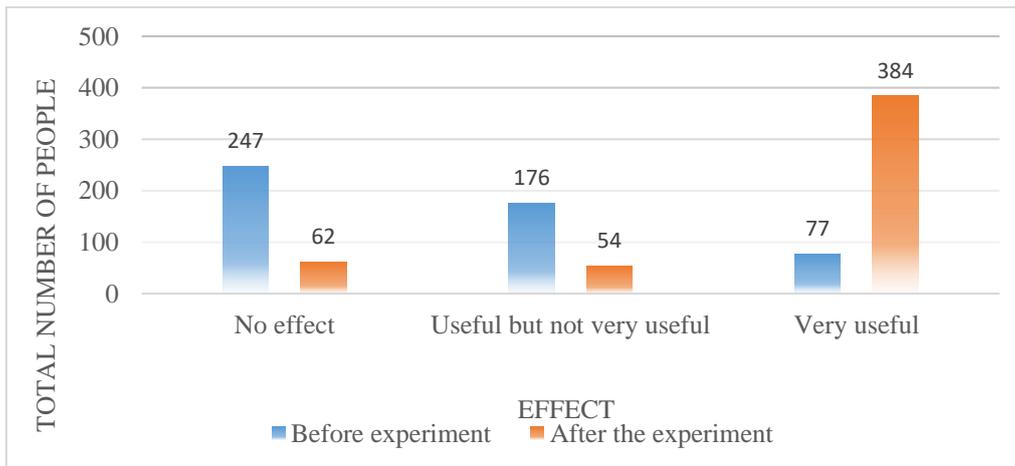


Figure 2: Experimental results of micro-class teaching

### 4.3 Suggestions and Strategies

In terms of teaching, teachers should be able to create situations that meet the requirements of teaching content, which requires mathematics teachers in higher vocational colleges to keep learning, update their teaching ideas and reform their teaching methods. Classroom teaching can adopt micro-class teaching, which can be used to improve classroom participation. On the teaching content, according to the differences of students' thinking development level, intelligence and cognitive structure at different levels, examples with different degrees of difficulty are selected for teaching. For students with learning difficulties, examples should still be combined with professional courses, but the difficulty of examples can be reduced. In science teaching, the mathematical model of problem solving is adopted to learn knowledge by asking and solving problems. In terms of teaching atmosphere, we should create a good learning atmosphere, improve the learning atmosphere of HM on campus, add optional courses, attach importance to the cultivation of top students, and pay attention to teachers' lifelong learning.

### 5. Conclusion

With the continuous development of China's social economy, the concept of talent cultivation and development in colleges and universities is also constantly improving. In order to better cultivate qualified talents, the teaching reform must be continuously promoted. As one of the important contents, the teaching reform of HM has a direct and far-reaching impact on the quality revolution of applied talents in China. In this paper, the current situation of HMT in a university is investigated and analyzed. The traditional teaching methods are unattractive, the classroom is dominated by teachers, and students' participation is not high. Through the evaluation of the present situation of micro-class teaching and the analysis of the implementation effect of micro-class tuition, this paper puts forward the teaching method of micro-class tuition. There are innovations in this paper, but there are also many shortcomings, which need to be improved.

### References

- [1] Sri Sumarwati, Harina Fitriyani, Fathin Muhammad Azhar Setiaji, Mohd Hasril Amiruddin, Siti Afiat Jalil. *Developing Mathematics Learning Media Based on E-Learning using Moodle on Geometry Subject to Improve Students' Higher Order Thinking Skills*. *Int. J Interact. Mob. Technol.* 14(4): 182-191 (2020).
- [2] Nils A. Baas. *On the mathematics of higher structures*. *Int. J. Gen. Syst.* 48(6): 603-624 (2019).
- [3] Tatyana Anatolievna Brodskaya. *Competence Approach in Teaching Higher Mathematics Students of Bachelors of*

*Direction of Preparation 13.03.02 - "Power and Electrical Engineering" in oil and Gas University. Russ. Digit. Libr. J.22(6): 542-546 (2019).*

[4] *Anatolii Egorovich Policka. Implementation of the Impact of Ict on Methods of Teaching Mathematics in Higher Education. Russ. Digit. Libr. J. 22(6): 686-693 (2019).*

[5] *Sofia Sivena, Yiannis Nikolaidis. Improving the quality of Higher Education teaching through the exploitation of student evaluations and the use of control charts. Commun. Stat. Simul. Comput. 51(3): 1289-1312 (2022).*

[6] *Suparoek Chootongchai, Noawanit Songkram, Krerk Piromsopa. Dimensions of robotic education quality: teachers' perspectives as teaching assistants in Thai elementary schools. Educ. Inf. Technol. 26(2): 1387-1407 (2021).*

[7] *Isam Abdul Qader Abdul Rahman Elbadawi. Investigating the teaching of 'advanced quality methods' through lean manufacturing techniques in industrial engineering. Int. J. Comput. Aided Eng. Technol. 15(4): 529-537 (2021).*

[8] *Anna Sendra, Natalia Lozano-Monterrubbio, Jordi Prades-Tena, Juan Luis Gonzalo-Iglesia. Developing a Gameful Approach as a Tool for Innovation and Teaching Quality in Higher Education. Int. J. Game Based Learn.11(1): 53-66 (2021).*

[9] *Jawad Ali, Zia Bashir, Tabasam Rashid o. Weighted interval-valued dual-hesitant fuzzy sets and its application in teaching quality assessment. Soft Comput.25(5): 3503-3530 (2021).*

[10] *Lentswe Sokwane, Gbolagade Adekanmbi. Exploring the Teaching and Learning Quality Question in Technical Education in Botswana: A Case Study of Gaborone Technical College. Int. J. Adult Vocat. Educ. Technol. 10(2): 25-39 (2019).*