

Research and Discussion on the Innovative Model of Hierarchical Teaching of College Mathematics

Xiao Xiaonan

Xiamen University Tan Kah Kee College, Zhangzhou, Fujian, China.
xiaoxn@xujc.com

Abstract: With the rapid development of modern science and technology and the advent of the information age, higher education puts forward higher and higher requirements for students' comprehensive innovation quality. As an important basic course in college education, how to closely combine the development of modern science and technology, constantly explore teaching laws, reform teaching methods, and strive to cultivate students' innovative thinking and independent innovative learning ability has become a problem that every college mathematics teacher is very concerned about and urgently needs to solve. In this regard, combined with the practice of college mathematics teaching, this paper discusses the new problems of teaching reform such as the establishment, implementation and ability training of layered teaching mode in college mathematics teaching, which provides new methods and new ideas for further stimulating students' enthusiasm for autonomous learning and effectively cultivating students' innovative learning ability.

Keywords: Layered teaching, Innovation quality, Ability training.

INTRODUCTION

If education is the foundation of a nation's survival, then higher education is the source of its development. In the higher education of science and engineering, the teaching of higher mathematics is undoubtedly the cornerstone of the education of other disciplines. It has many class hours, wide coverage and wide influence. Its status can be said to be the top priority. Facing the requirements of training a new generation of high-quality talents in the new century, reform has become the only way for higher mathematics teaching. As an important content of teaching reform, the implementation of undergraduate higher mathematics hierarchical teaching has become the focus of common concern of colleges and universities.

THE LAYERED TEACHING MODE IS THE DEVELOPMENT DIRECTION OF COLLEGE MATHEMATICS INNOVATIVE TEACHING AND RAPID IMPROVEMENT OF TEACHING QUALITY

The traditional mathematics teaching unilaterally emphasizes the preciseness of mathematics and the formalization of logical reasoning, and ignores the creativity of mathematics; The evaluation of learning effect under the traditional teaching mode only focuses on Teachers' evaluation of students' learning, and is used to measuring students' learning only by examination results. This single evaluation method can not comprehensively and comprehensively reflect the development degree of students. It is a typical evaluation method of "exam oriented education", which is extremely unfavorable to students' quality education.

In the face of education in the 21st century, UNESCO puts forward four kinds of basic learning ability training, namely learning to learn, learning to

do things, learning to cooperate and learning to survive, and believes that learning to cooperate is the most important foundation of education. Competition and cooperation are the theme and inevitable trend of today's social development. Learning to communicate, cooperate, compete and get along with people is the need of human survival in the new century.

With the rapid development of modern educational technology with multimedia technology and network technology as the core in the 21st century, the reform of college mathematics teaching mode in China is facing an excellent opportunity. The "people-oriented" education concept we have always advocated is to recognize differences, publicize personality and improve quality. It is necessary to abandon the traditional teaching mode and carry out targeted, scientific and feasible layered teaching mode [Chang, *et. al.*, 2021]. In this regard, we have conducted in-depth research and Exploration on the innovative model of hierarchical teaching of college mathematics, made various beneficial attempts, and constructed a model with the purpose of cultivating students' autonomous learning ability, innovative spirit and practical ability and the main means of mathematical experiment teaching, The layered teaching mode of College Mathematics in the network environment with students' self-evaluation as the main evaluation method: the teaching mode of creating situations, asking questions, independent exploration, comment and summary.

PRECONDITIONS FOR LAYERED TEACHING

Hierarchical teaching of college mathematics is a teaching implementation strategy under the guidance of the educational concept of "focusing on the sustainable and benign development of students". There are three preconditions for layered teaching in

College Mathematics Teaching: first, we should recognize that there are differences between students. Among students, there are not only differences in mathematical cognitive structure, but also differences in the ability to assimilate or adapt to new mathematical knowledge and construct new mathematical cognitive structure, as well as differences in personality qualities such as thinking mode, interest and hobby. Without exception, these differences have different effects on students' mathematical learning, and then form different types of learning disabilities; Secondly, every student can learn mathematics well. As long as we provide students with a good mathematics learning environment and adopt different correction strategies for students' learning disabilities, different students will improve. In other words, each student can build a new mathematical cognitive structure commensurate with his own ability, get a new emotional experience, form a good personality quality and achieve a win-win result of knowledge and ability: Third, From the new teaching view, mathematics teaching requires teachers to create a teaching environment suitable for the development of different students and reflect the student-oriented teaching view, rather than blindly requiring different students to adapt to the monotonous and unique teaching environment created by teachers.

Classroom teaching design is the preparatory stage for the implementation of layered teaching. Determining what kind of teaching goal is an important prerequisite for the implementation of layered teaching to achieve the predetermined goal. In the process of implementing layered teaching, the determination of teaching objectives shows distinct differences from the conventional teaching design.

First of all, from the current situation, there are actually two different levels of requirements for students' knowledge and ability in Teaching: one is based on the requirements that students can master the level of university mathematics knowledge and ability, and the other is the requirements that students have excellent academic achievements and can further study. Neither can be neglected. This requires teachers to be aware of the different requirements of these two types of students in learning knowledge and ability. Different teaching methods and means are adopted for students at different levels.

Secondly, how do students fit in with the requirements of all levels? As mentioned earlier, we recognize that there are differences among students, which is the objective requirement for different levels of teaching objectives. But sometimes, this difference is often not obvious. Even some students who are considered to be poor students may perform better than good students at a certain time, a certain place or a specific knowledge point or in a certain examination. Therefore, no matter what level of students we belong to, we should hold a non biased and dynamic view. Moreover, in the teaching design,

we should also adopt different levels of teaching means for different students. No matter which level of students, we can not reduce the requirements of the teaching plan.

IMPLEMENTATION OF HIERARCHICAL TEACHING OF COLLEGE MATHEMATICS

Change the teaching concept and adjust the curriculum

Thought is the forerunner of action. The guiding ideology of the reform we have determined is "based on the foundation, give consideration to the elite, cultivate interests, develop specialties, face all students and implement quality education." According to this guiding ideology, we clearly put forward the requirement of "making every student become a qualified graduate", and determined the operability scheme of "opening up basic courses, improving courses and implementing activity courses" [Qi, et. al., 2020].

Adjust the teaching content to ensure that each has his own income

Adjusting the curriculum is only one aspect of the reform. The core of the reform is to arrange the teaching content hierarchically from the beginning of freshman year. This is also a difficulty in specific operation. Our arrangement is:

(1) The teaching content is divided into levels. When preparing lessons, teachers should take into account the requirements of the two sets of syllabus, design the classroom teaching content, focus on the basic courses, and properly infiltrate and improve the course content.

(2) After class exercises are divided into levels. In addition to leaving enough necessary questions according to the requirements of the basic course syllabus, one or two exercises to meet the requirements of the postgraduate entrance examination shall be added as optional questions.

(3) The examination content is divided into levels. In each examination, the weight and difficulty of the test questions are distinguished. The general basic content accounts for 65% - 70%, and the improved content accounts for 30-35%. This ensures that all kinds of students can learn.

Change the guidance mode and cultivate self-study ability

Modern education pays more and more attention to the research of teaching and learning methods. We believe that the important point of teachers' teaching is to teach students to learn. Therefore, while adjusting the curriculum and teaching content, we also changed the counseling methods. We have adopted the method of "individual counseling and classified promotion". Specifically:

(1) For excellent students, teachers should purposefully arrange questions, bear the burden, and try to tap their internal potential.

(2) For most students with middle and lower grades, teachers should add some improvement content on the basis of basic courses, so as to deepen and broaden their knowledge.

(3) For a few students with poor grades, we should adopt the method of students practicing more, teachers correcting more, and concentrated training, so as to strengthen the consolidation of basic content. Due to the adoption of different counseling methods, the pertinence is stronger, which improves the students' self-study ability.

LAYERED TEACHING AND ABILITY TRAINING OF COLLEGE MATHEMATICS

Cultivate students' awareness of "asking questions"

We make full use of multimedia network to show students the history of science and technology development, especially the history of mathematics development, so that students realize that important problems have always been the most important force to promote the progress of mathematics science, and let students realize that the development prospect of a person who is good at raising questions and shows extraordinary "questioning" talent will be very optimistic.

Create a "ask questions" scenario

To enable students to put forward valuable "good questions", teachers need to create problem situations for students to observe, analyze, reveal and summarize. Multimedia technology is just the most effective tool to create real situations. If combined with simulation technology, it can produce immersive and realistic effects. By elaborately designing teaching procedures and using modern educational means with multimedia technology and network technology as the core, teachers create as real a situation as possible related to the theme in mathematics teaching, so that learning can occur in a situation basically consistent with or similar to the actual situation.

Create a variety of teaching situations to stimulate students' learning emotion. In the teaching process, teachers and students can fully communicate with each other and participate in the teaching process democratically, harmoniously and rationally, which is the best form of interaction between teachers and students, so it is also a reliable guarantee to give full play to the overall benefits of Teaching.

Guide students to master the method of "asking questions"

(1) Subject questioning method

Mathematics learning objectives, such as the compass, point out the direction for later learning.

We can question from the generation and application of knowledge and the connection of knowledge.

(2) Causal questioning method

There is an inevitable connection between the cause and result of anything, that is, if there is "result", there must be "cause", and if there is "cause", there must be "result". We can ask questions from the "conclusion" or question from the "conditions".

(3) Associative questioning method

We often associate according to the similarities or similarities between two objects or two types of things in some aspects (such as characteristics, attributes, relations, etc.), and start with this to ask the question: do these objects also have similarities or similarities in other aspects? Why?

(4) Method questioning method

When students finish their math exercises, we guide them to question the solution method: "is there a simpler method?" "What types of exercises can this method solve?" wait.

(5) Comparative questioning method

There are many related concepts with only one word difference in mathematics curriculum. It is difficult to master these concepts, and they are easy to be confused. We guide students to question while comparing.

(6) Critical questioning method

Critical questioning means not relying on the existing methods and answers, not easily agreeing with the views of others, but putting forward their own unique opinions through their own independent thinking and judgment, which is more challenging. It dares to get rid of habits, authority and other stereotypes, breaks the shackles and influence of tradition and experience, and promotes the development of students' understanding and thinking to a certain extent. In order to obtain the results of preliminary exploration, we should cultivate students' habit of continuing to explore what they have understood, never satisfied, and conduct exploratory questioning, so as to fully stimulate students' curiosity and internal desire for innovation and cultivate students' exploratory thinking quality [Wilson, et. al., 2021].

Guide students to master the way of "asking questions"

(1) Students ask themselves questions

Each student has his own experience world. Different students will form different understanding and views on the same problem, and their acceptance ability is also different. In the mathematics experiment class, we create a situation related to the theme and as real as possible, and guide students to ask questions independently on the basis of independent exploration.

(2) Ask questions among students

Students often encounter some problems that they can't solve in the process of autonomous learning mathematics courses in mathematics teaching. At this

time, they can ask other students through the network or directly. For some aspects of mathematics teaching content, it is necessary for teachers to organize students to ask questions among students through the network or form learning groups.

(3) Hierarchical design of test paper

In order to make students with low scores feel successful and motivate students with high scores, we design the test questions into four levels:

The first level is the standard level, which is designed according to the requirements of the syllabus;

The second level is to improve the advanced level. On the basis of reaching the standard level, analysis test questions and improvement exercises are added:

The third level is the winning level, which increases the comprehensive level practice of the connection between new and old knowledge;

The fourth level is the appreciation level, which provides analysis and solutions to postgraduate entrance examination questions and mathematics competition questions related to learning content.

CONCLUSION

Practice has proved that layered teaching has effectively stimulated students' learning enthusiasm and rapidly improved teaching quality. It has the following advantages:

(1) The practice of focusing only on a few excellent students has been changed, so that it has been implemented to face all students, teach students according to their aptitude and improve teaching quality in a large area.

(2) It enhances the pertinence of teaching work and enables students to get what they need and learn.

(3) Layered teaching makes the students with poor grades change quickly, and the students who are tired of learning are greatly reduced.

(4) All students can experience the joy of success through their own efforts, which stimulates the self-confidence of all students and plays a positive role in promoting students to form optimistic and tenacious psychological quality.

(5) It harmonizes the relationship between teachers and students and promotes the formation and consolidation of a good style of study and teaching.

(6) The transformation and improvement of poor students have been praised by the society and parents, and promoted the formation of the three combination education network of school, parents and society, so as to optimize the educational environment.

At present, the teaching reform of colleges and universities is deepening, and the talent training mode is also being explored. In the teaching of college mathematics, we must closely focus on the theme of innovative education, constantly deepen the teaching and reform of college mathematics courses, constantly reform teaching methods, innovate the layered teaching mode of college mathematics, further stimulate students' enthusiasm and creativity of autonomous learning, and constantly strive to cultivate more compound talents for China's higher education.

REFERENCES

- Chang J, Lan W, Lan W. Higher education innovation and reform model based on hierarchical probit[J]. *Applied Mathematics and Nonlinear Sciences*, 2021, 7(1): 175-182.
- Gallagher H A. Vaughn Elementary's innovative teacher evaluation system: Are teacher evaluation scores related to growth in student achievement?[J]. *Peabody Journal of Education*, 2004, 79(4): 79-107.
- Jantsch E. Inter-and transdisciplinary university: A systems approach to education and innovation[J]. *Higher education*, 1972, 1(1): 7-37.
- Qi Y. Research on Evaluation Model of College Students' Mathematical Modeling Ability Based on Hierarchical Clustering Method, *Journal of Physics: Conference Series*. IOP Publishing, 2020, 1453(1): 012150.
- Wilson Z S, Holmes L, Degrauelles K, et al. Hierarchical mentoring: A transformative strategy for improving diversity and retention in undergraduate STEM disciplines[J]. *Journal of Science Education and Technology*, 2012, 21: 148-156.