

# The Construction and Practice of the High-Quality Online Open Course "Advanced Mathematics" under the Background of New Engineering

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**Abstract:** Under the background of new engineering, the goal of talent training has been repositioned, and the new teaching concept has highlighted the important position of Advanced Mathematics in engineering majors, and has played an important role in promoting teaching reform, improving teaching quality, and broadening teaching channels. The measures of curriculum construction and practice include curriculum planning, construction concept, teaching design, development of teaching resources, and establishment of assessment mechanism; Through the establishment of operational mechanisms such as organization and implementation, technical support and optimization evaluation, we can ensure that the best online open courses can bring maximum benefits.

**Keywords:** Background of new engineering; Online open courses; Curriculum construction; Reform in education

## 1. Introduction

With the rapid rise of the national economy and the gradual realization of the strategic vision, the demand for new engineering talents is also increasing. The Ministry of Education put forward the concept of "new engineering" for the first time in 2016. The "new engineering" aims to cultivate diversified and innovative talents and provide intelligence and talent support for the future by taking inheritance and innovation, intersection and integration, coordination and sharing as the main means. From the aspect of talent training in schools, it is how to systematically optimize the talent training system of "new engineering" around the implementation of the fundamental task of establishing morality and cultivating talents, and adhere to the student development as the center [1].

The continuous integration of information technology and higher education in the context of new engineering has promoted the reform and development of traditional courses, not only laying the foundation for the sustainable development of students, but also promoting the all-round collaborative development of teachers. The Ministry of Education designated 2013 as the first year of MOOC and launched the construction and development of online open courses, marking that China's college curriculum has entered a new era of deepening reform and rapid development.

The construction of high-quality online open courses in colleges and universities is of great significance. It can not only broaden the teaching space of colleges and universities, enhance the attractiveness of classroom teaching, but also stimulate students' enthusiasm and initiative in learning mathematics, and expand the benefits and utilization of high-quality teaching resources; At the same time, curriculum construction will also have a profound impact on promoting the reform of teaching models, teaching strategies and teaching theories in colleges and universities as well as promoting the innovation and development of higher education in China [2].

## 2. The present analysis of the construction of the online open course of advanced mathematics

As a public compulsory course in engineering colleges, Advanced Mathematics still has many problems in talent training mode, objectives, methods and training process. For example, the course content setting is less in line with professional courses, the teaching method focuses on theoretical proof and tedious calculation, the teaching method is relatively simple, the students' rising rate is low, and the ability to solve practical problems with mathematical knowledge is poor; At the same time, students in engineering colleges and universities generally have a weak foundation in mathematics and lack the

necessary interest and enthusiasm in learning "high number" courses, resulting in the lack of vitality in most "high number" courses, while mathematics courses are very important for the study of subsequent professional courses, resulting in incomplete curriculum teaching system and poor overall teaching effect. Based on the characteristics of the above mathematics courses and the current trend of educational information development, the construction of high-quality online open courses in colleges and universities has become the top priority of teaching reform in the context of new engineering [3].

In 2011, the Ministry of Education formulated the Opinions on the Implementation of the Construction of National Quality Open Courses, aiming to further improve the quality of higher education, broaden learning channels, broaden students' horizons, improve teachers' overall teaching level and information level, and share high-quality teaching resources, so as to promote education fairness and build a learning society [4].

As a new form of curriculum, high-quality online open courses contain all the elements of traditional courses, highlighting the dominant position of teachers and the dominant position of students; The construction of the course is to carry out the organization of teaching from the perspective of students by adjusting the teaching content, optimizing the teaching mode, determining the teaching methods and means, and paying attention to the implementation of the teaching process and the achievement of the teaching effect, and making necessary adjustments and supplements to the follow-up construction of the course in combination with the learning experience and existing problems fed back by students, so as to achieve the set teaching objectives [5-6].

At present, the construction scale of the high-quality online open course "Advanced Mathematics" is increasing, but there are also many problems, which are shown as follows: 1. The concept of course construction is relatively backward, the quality and level of construction are uneven, the overall teaching design is not reasonable, the construction objectives are not clear, and the assessment and evaluation mechanism is not perfect; 2. The lack of effective integration measures of teaching resources leads to the low utilization rate of the courses built. At the same time, the development of high-quality teaching resources is less, which cannot meet the learning needs of students; 3. The lack of effective supervision mechanism and inspection mechanism for students and the lag in updating and improving the construction content lead to the lack of learning interest and enthusiasm of students, and the overall teaching effect is poor.

### **3. Construction content of high-quality online open course of Advanced Mathematics**

#### ***3.1 Determine the construction objectives and refine the teaching content***

According to the talent training objectives set by each specialty, formulate the construction objectives of mathematics curriculum in the background of new engineering: on the basis of existing teaching resources, continuously develop and apply high-quality teaching resources, form a teaching resource library, and provide students with learning convenience; Through the construction of high-quality courses, gradually build a teaching team with high teaching and theoretical level; Gradually improve the construction level and application efficiency of high-quality online open courses, and constantly expand its benefits and influence. Construct the overall framework for the construction of the course content of Advanced Mathematics, and highly refine the teaching content of the course, including important mathematical concepts (such as limit, derivative, integral, differential equation, series, etc.), theorems (Rolle's theorem, Lagrange's mean value theorem, Cauchy's theorem, etc.), typical examples, and so on, as well as the solution methods, theorem proofs and applications of various problems, so as to improve students' logical thinking ability The ability to calculate and solve practical problems with mathematical knowledge has been improved.

#### ***3.2 Revise the syllabus and build the teaching resource database***

According to the talent training plan of engineering related majors under the new engineering background, the syllabus of Advanced Mathematics is revised, and the following four types of resource database are developed: 1. According to the learning level and comprehension ability of students, the paper is compiled with different degrees of difficulty, and the corresponding paper database is developed by consulting documents, collecting data and accumulating at ordinary times; 2. Through screening and arranging the past year's "Advanced Mathematics" postgraduate examination questions from different schools, build the postgraduate examination question bank to meet the needs of students who need to take the postgraduate examination; 3. Build the test paper library of Advanced Mathematics course,

standardize the construction standard and process of the test paper library, and dynamically manage the test paper library, constantly enrich and update the content, and apply the test paper library to teaching. Through the analysis of students' test quality, the construction level of the test paper library can be tested, and then continuously adjust and optimize the difficulty and proposition range of the test paper; 4. Build and expand the resource base, such as the history of mathematics development, interesting mathematics and the introduction of mathematicians, and other mathematical cultural resources. At the same time, create a mathematical modeling garden, carry out lectures related to mathematical modeling, train and guide students to participate in the National Undergraduate Mathematical Modeling Competition. Through participation, students' comprehensive ability and mathematical literacy in writing, calculation, innovation, teamwork, and solving practical problems with mathematical knowledge can be improved, "One entry, one lifetime benefit" is conducive to comprehensively promoting the sustainable development of students.

### ***3.3 Build a new learning space and build a smart learning platform***

Through information technology and school network platform, build a new type of learning space and intelligent learning platform for engineering "Advanced Mathematics", break the knowledge barriers existing in traditional teaching, explore and use high-quality online teaching resources, which can be started from the following three aspects: 1. Reconstruct the interactive, inquiry and self-help learning mode, and gradually form a new teaching methodology; 2. Reconstruct the learning mode of cutting-edge science and technology applications such as AI, big data, Internet of Things, and lead the construction and development of disciplines; 3. Reconstruct the learning mode of Internet thinking, information technology application and classical mathematical thinking, and organically combine modern science and technology with mathematical thinking.

## **4. Practical Measures for the Excellent Online Open Course of Advanced Mathematics**

### ***4.1 Formulate scientific and reasonable construction plan***

Through the analysis of students' learning situation, taking into full consideration the students' mathematical foundation, learning enthusiasm and understanding ability, as well as the characteristics and advantages of application-oriented undergraduate colleges, and according to the talent training programs formulated by various majors, the mathematical knowledge and theories that need to be mastered, the mathematical ability and mathematical literacy that need to be improved are abstracted, and through the accumulation and absorption of high-quality teaching resources, Adhering to the principles of scientific rationality and sustainable development of students, the construction plan of this course is formulated, laying a solid theoretical foundation for the subsequent construction and application of the course.

### ***4.2 Absorb advanced curriculum construction concepts***

With the development of higher education in the new era and the improvement of the level of information technology, a number of new teaching concepts such as results-oriented education (OBE) concept, CDIO teaching concept, innovative education concept, curriculum ideological and political concept have been emerging in the field of higher education. These new forms of teaching concepts have promoted the reform of traditional teaching models, promoted the construction and development of high-quality online open courses, and the reform process of education information technology is also accelerating. Through in-depth analysis of the current teaching situation of the course "Advanced Mathematics", integrating new teaching concepts into the teaching syllabus, teaching content, teaching methods, teaching evaluation and other aspects, deleting some tedious theoretical proofs, adding teaching cases combined with practice, improving traditional teaching methods, etc., can effectively improve the teaching effect of the classroom.

### ***4.3 Formulate reasonable course teaching design***

In view of the various problems existing in the traditional teaching process and the wide application of information technology, the development of scientific and reasonable online open course teaching design will help to improve the teaching quality and thus improve the classroom teaching effect. In the teaching process, multimedia technology is effectively used to optimize classroom teaching design in

teaching content, teaching method, teaching mode and teaching effect evaluation through grouping teaching, flipping class, layered teaching and other teaching modes, thus greatly improving teaching efficiency; In the classroom teaching, mathematics software should be appropriately introduced, such as using matlab, mathematics and other software for drawing or numerical calculation, so as to improve students' practical ability; In the assessment and evaluation, add process assessment, that is, increase the proportion of classroom performance, homework, classroom tests, and so on, so as to enhance the enthusiasm of students in learning.

#### ***4.4 Develop high-quality curriculum teaching resources***

Due to many disadvantages of the traditional offline teaching mode, it has been unable to meet the learning needs of modern students. It is necessary to continuously develop and utilize high-quality teaching resources. Give full play to the advantages of the Internet, carry out online and offline teaching through high-quality teaching platforms such as Tencent Conference, Xuetong and Dingding, and continue to develop, integrate and utilize high-quality teaching resources; In addition, the textbook of Advanced Mathematics can also be developed according to teaching needs and students' actual conditions, and teaching cases related to majors or close to life can be incorporated into the textbook, and the textbook can be compiled based on the principles of reasonable arrangement and logic; The idea and method of mathematical modeling are integrated into daily teaching, so as to improve students' comprehensive abilities and comprehensive mathematical literacy such as calculation, literature review, writing and teamwork.

#### ***4.5 Use scientific and reasonable means of curriculum evaluation***

Due to the large proportion of mid-term and final examinations in the traditional assessment mode, the students' process assessment is ignored, and the expected teaching effect is not achieved. The main reason is that the assessment and evaluation mode is relatively single. Therefore, it is very necessary to develop scientific and reasonable curriculum assessment methods. Based on the characteristics of Advanced Mathematics course, we can make full use of modern multimedia technology to upload high-quality teaching resources to the teaching platform such as Learning Pass and teaching website. By arranging homework after class, such as watching teaching videos, completing quizzes after class, answering online questions, etc., students can arrange their study independently after class, and take attendance, homework and final examination as offline assessment content, The implementation of a diversified curriculum evaluation system through the formulation of assessment rules can not only effectively grasp the learning dynamics and learning effects of students, but also provide a basis for scientific assessment of students.

### **5. The operation mechanism of high-quality online open course of Advanced Mathematics**

#### ***5.1 Organization and implementation mechanism***

In the context of the new engineering, in order to integrate the course of Advanced Mathematics with the relevant engineering majors, it is necessary to find out the connection between the course theory and the specialized courses, summarize and sort out the teaching cases, coordinate the course construction resources, formulate the construction plan and construction standards, unify the technical standards, standardize the course management and application while doing a good job in the course teaching design, and constantly optimize the course implementation mechanism.

#### ***5.2 Establish technical guarantee mechanism***

According to the needs of curriculum construction and resource sharing, the school level needs to determine the technical planning scheme, which can use the Deshi platform or the Learning Platform to develop and build the curriculum. On the one hand, the school can strengthen teaching management and share high-quality teaching resources through the construction of the platform. On the other hand, the supplier of the platform can provide technical support and real-time online services for the school curriculum construction. This can achieve win-win cooperation between schools and technology companies.

### **5.3 Optimize the curriculum supervision and evaluation mechanism**

Through the construction and application of the course, on the basis of the evaluation method of the national high-quality online open course, the monitoring and evaluation method of the course can be further optimized. On the one hand, students' feedback information on the course can be obtained through questionnaires and other ways during the course operation. On the other hand, students' learning records can be collected through the course platform, such as the number of courses selected, the length of study and other information, so as to understand the utilization of the course resources by students. On this basis, we should further optimize and update the curriculum resources, diversify the curriculum supervision and evaluation methods, and improve the application efficiency of the curriculum.

## **6. Conclusion**

In the context of new engineering, the use of information technology to build high-quality online open courses and share high-quality teaching resources will help to improve classroom teaching effects, promote traditional teaching reform, and promote curriculum construction. At the same time, the operating mechanism of the curriculum should be established from the aspects of organization and implementation, technical guarantee and curriculum supervision, so as to ensure the use efficiency of the curriculum and improve the construction level of the curriculum.

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