Ideological and Political Construction of Higher Mathematics Course in Application-Oriented Universities from the Perspective of "Moral Education"

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Abstract. The teaching mode of higher mathematics in traditional research universities is not suitable for the current situation, knowledge requirements and training objectives of students in application-oriented universities. Through many years of higher mathematics teaching practice in application-oriented universities, in order to moisten the ideological and political education in higher mathematics courses and truly realize the educational goal of "cultivating people with virtue", this paper focuses on the necessity of ideological and political education in higher mathematics courses. Theoretically, mathematicians combined the core literacy framework of Chinese mathematics to construct the ideological and political textbooks of higher mathematics courses. In practice, it has put forward teaching models such as mixed teaching, "5e" teaching, BOPPPS teaching, paying attention to the teaching of mathematical concept system, paying attention to applied mathematics, enriching teaching methods, improving mathematical evaluation methods, etc. Through the two-way implementation of theory and practice, it has really implemented higher mathematics ideological and political education in application-oriented universities.

Keywords: application-oriented universities · higher mathematics · moral education · core literacy

1 Research Background

1.1 Differences Between Application-Oriented Universities and Traditional Research-Oriented Universities

Application-oriented university is a new comprehensive university group with higher vocational education and advanced technical personnel training as its main body. It adapts to the trend of science and technology, popularization and popularization of higher education, closely links with economy, society, production front line and local people's life, and directly serves them. It focuses on the cultivation, training and scientific research of knowledge, technology and quality in the application of science and technology, and is different from traditional universities in discipline construction, specialty setting, training methods, enrollment and employment, and the structure of students.

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The application-oriented university is a university that is oriented to cultivate high-level application-oriented talents and the needs of social and economic development, aiming at improving students' practical ability and employability and promoting students' success.

Traditional research-oriented universities cultivate social elites and high-level specialized talents for the development of science, society and human civilization [3].

In terms of training objectives, the historical mission of application-oriented universities is to choose education suitable for non-elite people and promote the progress of human civilization. In terms of knowledge requirements, application-oriented universities are not as "broad" as research-oriented universities, but more "specialized" than research-oriented universities, and they are not as "profound" as research-type universities, but more practical than research-type universities. In terms of teaching law, application-oriented colleges and universities follow the law from theory to practice, and then from practice to theory.

For applied colleges and universities, generally speaking, solid subject knowledge, complete subject system and professional ability to use subject knowledge to study, analyze and solve practical problems are equally important. We should not only pay attention to students' ability to apply knowledge, strengthen the cultivation of students' practical ability, innovative spirit and autonomous learning ability, but also not abandon the systematicness of traditional subject curriculum and preset teaching objectives. The construction of application-oriented curriculum is bound to break the subject architecture based on knowledge storage and reconstruct it into an action architecture based on knowledge application. The former emphasizes the amount of knowledge mastered as the basis for evaluation. Under such an evaluation system, teachers will teach more knowledge in the curriculum, but the attention to students' solving practical problems is far from enough; the latter emphasizes the application of knowledge as the main basis for evaluation, in which case teachers mainly focus on the cultivation of students' application ability. Focus on the operability of theoretical knowledge and the application of knowledge in practice [4].

To sum up, the differences between application-oriented universities and traditional research-oriented universities can be summarized as Table 1.

Naturally, there are also differences in higher mathematics courses of public theory courses offered by both application-oriented universities and research-oriented universities, which can be summarized as Table 2.

The cultivation of applied talents is based on extensive basic knowledge, its training cycle is longer, and its nutrients need to be more abundant, so its training mode cannot be slimmed down through the reduction of public theoretical knowledge.

After many years of teaching experience, it is not conducive to the development of higher mathematics teaching in application-oriented colleges and universities to blindly imitating the teaching mode of traditional colleges and universities. In order to achieve the goal of "educating people" and carry out targeted teaching based on not "slimming down" higher mathematics, application-oriented colleges and universities should seek new teaching modes suitable for application-oriented colleges and universities.

Table 1. Differences between application-oriented universities and research-oriented universities

Type of colleges	Application-oriented colleges	Research-oriented colleges
The training objective	Application-oriented general specialized talents	Research-oriented elite talents
Curriculum System	The Action Architecture of Knowledge Application	Disciplinary Architecture of Knowledge Storage
Knowledge requirements	"Specialized" and "Practical"	"Broad" and "profound"
Student source structure	Above the ordinary universities admission mark	Above the key universities admission mark
Teaching methods	Theory → Practice → Theory	Inspiration + guidance + self-study
Employment Direction	Applied technology general Talents	Senior specialized talents

Table 2. Differences of Advanced Mathematics Courses

College courses	Higher mathematics course in application-oriented universities	Higher mathematics course in research-oriented universities
Current status of student source	Above the ordinary universities, Learning consciousness is not high	Above the key universities, Learning consciousness is high
Knowledge requirements	"Specialized", "Practical" and "Sufficient"	"Broad" and "profound"
Training objectives	To serve the follow-up professional application	To serve the follow-up professional research

1.2 Ideological and Political Concept of Curriculum

Ideological and political course is a concept and practical exploration of integrating ideological and political education into classroom teaching and tapping the moral education function of the course. As a teacher of higher mathematics, we should keep a good "canal" and plant a good "responsibility field", so that the course of Higher Mathematics and the ideological and political guidance go hand in hand to form a synergistic effect.

1.3 The Necessity of Ideological and Political Education in Higher Mathematics Course

1) Current importance of "Advanced Mathematics" course

Higher mathematics is an important public basic course for engineering undergraduates in application-oriented colleges and universities. Compared with other basic courses, it

has a wide coverage, more class hours and longer teaching duration, which has a very important impact on the quality of personnel training and the future development of students.

2) Current situation of teaching design of "Higher Mathematics": light concept and heavy calculation

Higher mathematics contains profound mathematical thinking methods, which can not only be directly applied to engineering problems, but also provide ideas for engineering students to solve professional problems. Calculus, the most basic theory in higher mathematics, has a long history of development, and its thinking method should not be underestimated. However, in the teaching design of "Higher Mathematics" course, teachers often "neglect concepts and emphasize calculation", and do not explain calculus theory thoroughly, which leads to students not grasping the essence, only using rote memorization to solve problems, and still do not know how to use mathematical tools to solve related professional problems in the future.

3) The teaching method of "Higher Mathematics" is single

"Higher mathematics" classroom teaching methods are generally single, teachers either use PPT or write on the blackboard in the whole process; the classroom generally ignores the management of students; students cannot contact the teacher after class; the feedback of higher mathematics homework is not timely; these factors make students not interested in mathematics, even despise mathematics.

4) Ideological and political integration of "higher mathematics" course is not much.

"Ideological and political curriculum" is based on the basic position of curriculum as the development of disciplines and specialties. Taking care of the value of curriculum from the dimension of educating people, realizing the integration of "ideological and political" into curriculum, integrating "ideological and political" into curriculum, and giving full play to the ideological and political education resources of various courses. It is a new concept and mode of ideological and political work in colleges and universities to work together to improve students' ideological level, political consciousness, moral quality and cultural accomplishment [5]. Although the value of ideological and political courses has been widely recognized, the existing ideological and political elements of higher mathematics courses are often difficult to tap, so they are less integrated.

5) "Advanced Mathematics" has too much content to keep up with practice

The knowledge capacity and difficulty of higher mathematics are far greater than the elementary mathematics that students learn in three years of high school. However, the course requires students to complete the first and second volumes of higher mathematics textbooks in one year, which is undoubtedly very difficult for students. Influenced by class hours, many after-class exercises teachers cannot take up classroom time to explain for students, at the same time, after-class exercises assigned by teachers, because they are not explained in time after correction, students often do not correct errors and make homework lose its due effect. At the same time, in universities, the number of student tests is only once a semester, and there are no periodic tests.

2 Research on Ideological and Political Theory of Higher Mathematics Course

The core literacy of Chinese students' development is to cultivate "all-round development of people" as the core, which is divided into three aspects: cultural foundation, independent development and social participation. It is comprehensively manifested in six qualities: humanistic connotation, scientific spirit, learning to learn, healthy life, responsibility, practice and innovation. It is specifically refined into 18 basis points such as national identity. Each accomplishment is interrelated, complementary and mutually reinforcing, and plays an integral role in different situations. According to this overall framework, we develop ideological and political cases to enrich the connotation of higher mathematics based on not changing the basic knowledge structure of higher mathematics, and further realize the whole, full and all-round education of ideological and political education in higher mathematics courses.

Constructing the ideological and political case of higher mathematics course through the core literacy framework of Chinese students can not only enhance students' interest in learning, but also help to cultivate the scientific research level and ability of a small number of high-level students. The interesting ideological and political cases introduced in teaching make mathematical knowledge lively and interesting. Mathematics can also be literary and artistic, and mathematics can be vivid and colorful. It can help students understand mathematical knowledge in a relaxed atmosphere. Through the ideological and political course of higher mathematics, we can cultivate students' core literacy and promote students' all-round development.

3 Integrating Ideological and Political Education into Practical Reform of Higher Mathematics Curriculum

Combined with Table 1, Table 2, in order to better integrate into the ideological and political education of higher mathematics courses, we have carried out the following reforms in teaching practice.

3.1 Overcome Difficulties and Practice Blended Teaching, "5e" Teaching and BOPPPS Teaching

Based on the characteristics of higher mathematics curriculum, in order to better integrate into the ideological and political curriculum and students, we adopt online and offline blended teaching, specifically in the following three parts:

Before the class, the key questions of this class are released in the cloud class, and students are invited to study independently with relevant resources (including MOOC courses recorded or selected by teachers).

The first form of class is to invite groups to explore and send representatives to report, other groups to supplement, teachers to summarize and explain, and the second form is mainly heuristic teaching.

After class, record the key and difficult micro-lessons of this class, record the exercise book to explain the video, and record the weekly small test video to share the resources

in the cloud class. The video playback function in the cloud class can help students achieve personalized self-learning. First, it can help students consolidate their review. Second, it provides a way for students who have not learned well in some classes to learn again. The task push function realizes effective course management. First, the deadline for submission of homework can be limited to help urge some procrastinating students. Second, the weekly test can realize the disorder of test options and questions, so that the test results are more real and effective; third, we can carry out real-time discussion and question-answering activities, teachers and students answer each other, students answer each other, solve problems in time, and lay a solid foundation. Data storage function, to achieve an objective grasp of learning. Resource sharing function, to achieve courseware, video and other sharing.

The specific flow chart is shown in Fig. 1.

The front link of the mixed teaching model can be to introduce interesting cases related to the ideological and political courses, or to ask students some systematic questions. Before concept teaching, we can also consider finding some examples of similar problems in life in advance and recording them in the micro-class to help students think and attract students before class. Let students ask questions in class to improve the learning efficiency of the course. At the same time, let students learn independently before class, assign tasks in groups, and play the role of cooperation and communication.

The post-teaching link of blended teaching mode is an effective way for students to follow classes and re-study. The advanced mathematics course group compiles the essence of exercises according to the syllabus of advanced mathematics. In view of the limited class hours, the exercises are recorded and explained online. Through the cloud class app or QQ class group, the teacher collects the difficult points of the students' chapters and records the micro class to explain and answer questions. At the same time, the cloud class offers a weekly discussion class, students can ask questions at a fixed time, students answer each other and teachers supplement. To ensure that students can keep in touch with teachers when they leave the classroom. By recording exercise lessons, it can also provide learning materials for some postgraduate students, and provide an effective way for students to continue learning. This not only does not take up class hours, but also

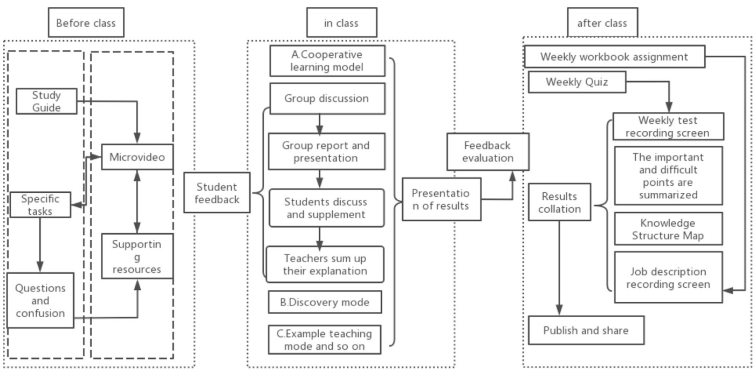

Fig. 1. Flow Chart of Blended Teaching Design

the video exercise class is always new, which can help students learn more effectively than erasing it after explaining it on the blackboard.

In view of the difficult characteristics of higher mathematics, for example, in the section on rational function integration, teachers can first give some preparatory questions:

$$\int \frac{x+1}{x^2+2x+5}dx, \quad b. \int \frac{x+3}{x^2+2x+5}dx, \quad c. \int \frac{2x^4+x^2+3}{x^2+1}dx$$

$$d. \int \frac{1}{(x+1)(x-2)}dx, \quad e. \int \frac{x}{x^2-x-2}dx.$$

We can solve these problems through learning and invite five groups to report solutions in class. The advantage is that if these problems are solved, we can make a high generalization of the knowledge points in this lesson. It will be much easier for students to solve the examples in the textbook [6].

Through online and offline blended teaching, it can promote students to consolidate and digest a large amount of knowledge, reduce the uneven learning among students, and help those students who need help but are unwilling to ask to learn again. Micro-lesson summary fragments are often used to help students clarify the context of knowledge points and establish knowledge points branches through structural teaching, which not only helps to understand the knowledge system of this lesson and chapter at a glance, but also helps students to apply the classified mathematical ideas to the study and research of other disciplines.

The "5e" teaching mode can be used in the teaching of the substitution method of definite integral, the extreme value of multivariate function and the double integral in higher mathematics, which is a mode based on constructivist teaching theory developed by American Biology Curriculum Research (BSCS, 1989) [8]. The "5e" teaching mode is divided into five steps, which are engagement, exploration, explanation, elaboration and evaluation. For example, the extreme value of multivariate function, first throw out the extreme value problem of binary function $z = xy$, and $z = -\sqrt{x^2+y^2}$ to attract students, ask students to explore, the teacher explains the concept of binary function extreme value, and use knowledge transfer, ask students to review the concept of univariate function extreme value, especially the situation of univariate function $y = x^3$ and $y = |x|$ extreme value. Reasonable evaluation in the process of students' inquiry.

The teaching of chapters involving calculation in higher mathematics is adapted to the BOPPPS teaching model, which is based on cognitive theory and constructivism. How to make students master knowledge to the maximum extent in the classroom is the focus of its attention, so teaching interaction and feedback are its prominent features [9]. The teaching mode consists of introduction (Bridge), learning objective (Objective) and pre-assessment. Participatory Learning, Post-assessment and Summary. For example, in the section of derivation rule of teaching function, students have a certain foundation in middle school. Combining with the preview task before class, students can be tested through cloud class before class. Students can understand the teaching content more pertinently according to their own situation, and then take a test after class to monitor students' mastery, and finally summarize the screen summary.

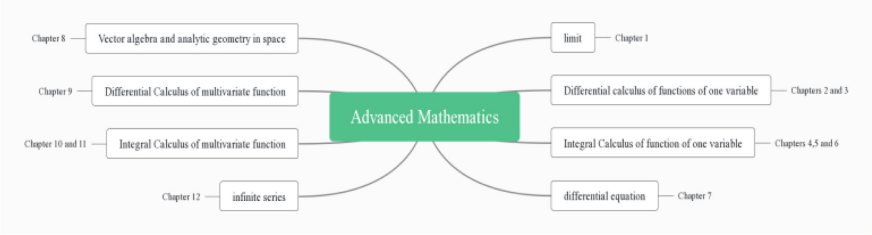

Fig. 2. Frame diagram of advanced mathematics knowledge

3.2 Change the Concept and Attach Importance to the Teaching of Mathematical Concept System

Mathematics, as a public compulsory course, has its own unique knowledge system. Higher mathematics, as a tool subject of engineering specialty, is more important in its way of thinking. Only when students learn the essence of knowledge and construct the knowledge system of mathematics, can they have a long-term development in their specialty. At the same time, the concept is clear, the calculation comes from the concept and nature, and the students' calculation difficulties will be solved.

Taking the first lesson of advanced mathematics as an example, it is necessary for us to briefly explain to students that the whole advanced mathematics is inseparable from the tool of limit. Help students understand higher mathematics from the system. As shown in Fig. 2.

Take the teaching of the basic integral table as an example, and use the basic formula of derivative to lead students to analyze systematically. The result of trigonometric function derivation is trigonometric function. On the contrary, the integral of trigonometric function is also trigonometric function, and the power function and exponential function are similar. For another example, through the first important limit $\lim\limits_{x\to 0}\frac{sinx}{x}=1$ we use $\lim\limits_{\propto(x)\to 0}\frac{sin\propto(x)}{\propto(x)}=1$ more generally, but use the substitution method. This is also true in the following Table 3.

Through the study of higher mathematics, it is important for students to acquire the learning ability of mathematics, spread this ability to other disciplines for re-cognition, re-learning, then reconstruct cognition, and then improve learning ability. The teaching process of emphasizing mathematical concepts is an important process to improve students' mathematical thinking ability.

3.3 Teaching Students in Accordance with their Aptitude and Attaching Importance to the Application of Mathematics

Higher mathematics should "take application as the purpose and sufficiency as the degree", pay attention to the combination of theory with practice and the cultivation of students' basic operation, problem analysis and problem solving abilities. In teaching, we should go deep into students' professional fields, introduce professional examples, and deepen the application after giving mathematical concepts. For example, for computer majors, when learning the continuity and discontinuity of functions, we can use

Table 3. Understanding formulas to common conclusions in the knowledge system

	Formula	Application
The first important limit	$\lim\limits_{x\to 0}\frac{sinx}{x}=1$	$\lim\limits_{\alpha(x)\to 0}\frac{sin\alpha(x)}{\alpha(x)}=1$
The second important limit	$\lim\limits_{x\to\infty}\left(1+\frac{1}{x}\right)^{x}=e$	$\lim\limits_{\alpha(x)\to 0}[1+\alpha(x)]^{\frac{1}{\alpha(x)}}=e$
Equivalent infinitesimal	$x\to 0, \sin x\sim x, \cdots$	$\alpha(x)\to 0, \sin\alpha(x)\sim\alpha(x), \cdots$
Definition of derivative limit	$\lim\limits_{h\to 0}\frac{f(x_0+h)-f(x_0)}{h}=f'(x_0)$	$\lim\limits_{\alpha(x)\to 0}\frac{f[x_0+\alpha(x)]-f(x_0)}{\alpha(x)}=f'(x_0)$
Integral of the first kind by substitution	$\int\frac{1}{x}dx=ln\lvert x\rvert+C$	$\int\frac{1}{a(x)}da(x)=ln\lvert a(x)\rvert+C$
	$\int\frac{1}{1+x^2}dx=arctanx+C$	$\int\frac{1}{1+a(x)^2}da(x)=arctana(x)+C$

the flow chart in Fig. 3 to teach students to intuitively understand the classification of discontinuity points.

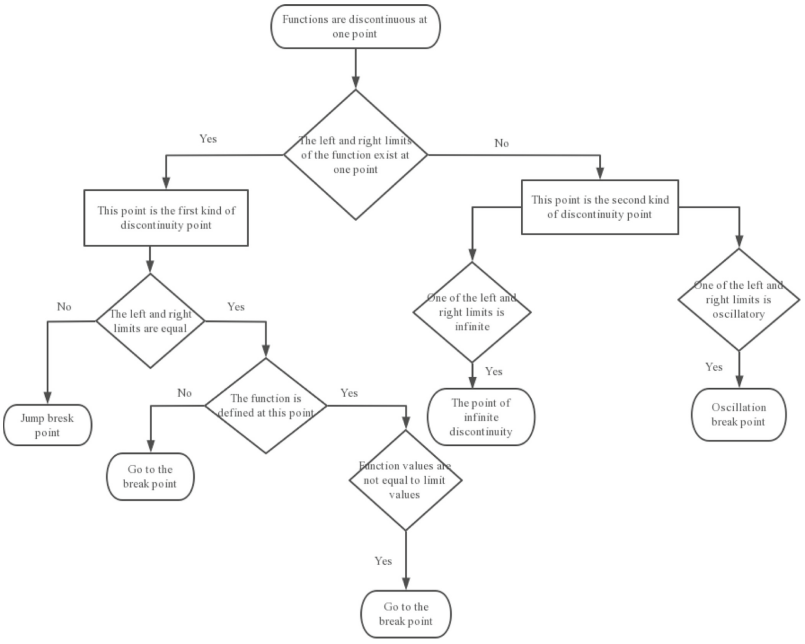

Fig. 3. Flow chart of discontinuity classification

3.4 Scientific Teaching and Rich Teaching Methods

There is a large amount of knowledge in advanced mathematics. Teachers should consider students' receptivity. Therefore, teachers should choose different teaching methods to teach courses in different chapters.

The combination of multimedia and blackboard writing is adopted in the teaching process. In terms of teaching methods, in order to highlight "student-centered", case teaching method and conversation method are generally used. The case teaching method focuses on the analysis, solution and abstract generalization of the universal methods and steps to solve the case, and the process focuses on guiding students to think. In order to implement the conversation method well, teachers need to understand the situation of students, make appropriate questions in advance, and make appropriate adjustments according to the actual situation of teaching. The teacher should guide the students to think systematically, and at the same time summarize the thinking of mathematicians to make the thinking sparks collide.

Teachers should help students test their learning effects through example teaching, which can deepen students' understanding of mathematical concepts, guide students to think and solve mathematical problems, and build a bridge from mathematics to life and profession. When it comes to calculation problems, students are required to randomly demonstrate on the blackboard. On the one hand, they can check the learning effect in this lesson. On the other hand, they can keep thinking positively.

3.5 Perfecting the Way of Mathematics Assessment and Evaluation

The evaluation of application-oriented university students can be combined with diagnostic evaluation, process evaluation and summary evaluation (as shown in Fig. 4). Through diagnosis and early warning, pay attention to the students with weak mathematical foundation, understand the students who do not like to learn mathematics, and remind the students who do not study seriously and have a bad attitude. Through the test released by the cloud class every week, we can understand the students' grasp of the past week. On the one hand, it gives students the opportunity to practice, on the other hand, it gives teachers the corresponding screen explanation, which makes up for the lack of classroom teaching time.

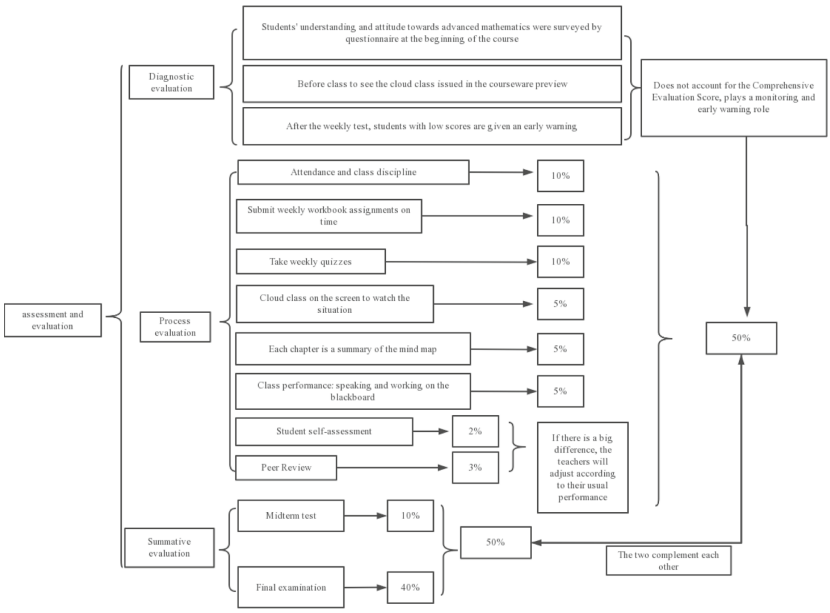

Fig. 4. Flow chart of evaluation method

4 Summary

The teaching of higher mathematics in application-oriented universities is different from that in traditional research-oriented universities. We should teach students in accordance with their aptitude and suit the remedy to the case. "Moral education" should not be a slogan, but should be an organic integration of theory and practice.

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