Curriculum reform of integrating ideological and political education into Advanced Mathematics based on information-based teaching

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Abstract. Based on the information platform—intelligent cloud of vocational education (ICVE), this paper integrates ideological and political education into Advanced Mathematics teaching and, through the teaching content design of two courses—with the second important limit formula and the concept of definite integral and the content display of its application in classroom teaching, briefly introduces the curriculum reform and its results of Advanced Mathematics teaching in our school. Different from the traditional mathematics teaching methods, the arrangement of pre-class tasks improves students’ ability of investigation and practice, and the introduction of cases makes students see through the trap of campus loans. Through the idea of division in the concept of definite integral, it can also be similar to the idea of the Chinese thinker Xunzi’s thought “perseverance makes a great learner,” which shows that “hard work” leads to students’ mastery of knowledge and skills which can not be achieved overnight, thus achieving the purpose of ideological and political education for students. Teachers do not spend most of their time in explaining and using formulas, but draw relevant formulas and definitions vividly through the introduction of cases, and then combine actual cases to apply mathematical knowledge. In this way, they impart mathematical ideas and carry out ideological and political education as well.

Keywords: intelligent cloud of vocational education (ICVE), curriculum reform, ideological and political education, campus loan

1. Introduction

1.1. Research background of information-based mixed teaching

The Outline of the National Program for Medium- and Long-term Educational Reform and Development
(2010-2020) emphasizes that “information technology has a revolutionary impact on the development of education” [1], which establishes the key strategic position of educational informatization in the whole tide of educational development. The birth and development of information technology has brought great challenges, innovations and breakthroughs in the traditional teaching mode. How to better promote the two-way integration of technology and education and realize the transformation from traditional closed classroom teaching to online-and-offline hybrid teaching has become the hotspot of research on educational technology. In 2018, China’s “Educational Informatization 2.0 Action Plan” proposed to promote the transformation from dedicated educational resources to universal educational resources by 2022, from the promotion of teachers and students’ ability of information technology application to the overall improvement of their information literacy, and from integrated application to innovative development, for the purpose of building a new mode of talent training under the condition of “Internet Plus”, developing a new model of educational service based on the Internet, and exploring a new model of educational governance in the information age [2]. Our country promotes the integration of information technology and higher vocational classroom education through various forms, from the early information-based teaching ability contest to renaming it as the teacher ability contest. It takes the efficient integration of information technology and teaching as an important evaluation standard of the competition, which plays a great role in promoting the deep integration of information technology in education and teaching in vocational education. This year, as the last year of the time requirements of the Outline of the National Program for Medium- and Long-term Educational Reform and Development (2010-2020), the use of information technology combined with classroom teaching has been very widespread in colleges and universities. No matter in terms of the proficiency of teachers or the acceptance of students, they have become flexible and comfortable. Teachers have found a suitable information-based online and offline hybrid teaching mode according to their own courses. The information-based teaching reform of Advanced Mathematics is based on rich information resources, supported by modern information technology, and with students’ needs of self-exploration, collaborative discussion, active acquisition of knowledge and skills, as well as their interest and emotion as the goal [3]. The deep integration of information technology and teaching is a core research content of the informatization process, while classroom teaching is the main battlefield of educational informatization. A whole set of ability, knowledge and training structure concerning innovative thinking in classroom teaching are given using information technology [4].

1.2. Background of ideological and political education

At the national conference on ideological and political work in colleges and universities, General Secretary Xi Jinping stressed that in order to make good use of the main channel of classroom teaching, all kinds of courses should go hand in hand with ideological and political theory courses to form a synergistic effect. The ideological and political courses in colleges and universities are in full swing, and the ideological and political courses are integrated into the non-ideological and political courses to cultivate students’ moral education. At the same time, teachers also make great efforts to dig and refine the ideological and political elements in various courses, which is undoubtedly a promotion to the improvement of teachers’ overall ability and literacy.
and has built the carrier of the construction of teachers’ ethics in schools for the realization of the unity of knowledge transfer and value guidance [5]. Through the integration of ideological and political education with information-based teaching in the curriculum reform of “Advanced Mathematics”, the course of “Advanced Mathematics” has changed from the original high degree of abstraction and strict logic, from the original rote memorization, boring and obscure concept into a simple and easy-to-understand course step by step through willow leaf area calculation.

This paper will briefly introduce the integration of informatization and ideological and political education in the curriculum reform of Advanced Mathematics from two classroom teaching reforms. One is to introduce the second important limit formula, which uses the curriculum platform to lead to the calculation of loan benefits. Combined with the problem of campus loan, ideological and political education will be integrated into classroom teaching. One is the concept and application of definite integral, which calculates the area of willow leaves through students’ hands. In the process of hands-on and analysis, the concept of definite integral is obtained and combined with Xunzi’s thought “perseverance makes a great learner,” to make students understand more deeply that the mastery of knowledge and skills can not be achieved overnight.

2. Curriculum reform of the second important limit formula  \[ \lim_{x \to 0} \left(1 + \frac{1}{x}\right)^x = e \]

Around 2016, with the popularity of the online financial platform, the new term “campus loan” has entered the field of vision of many college students, such as the simplified operation before the loan, the easy availability of the loan, and the negligence of the interest calculation of the loan. Regardless of the consequences after the loan, many college students have fallen into the abyss and been trapped in the campus loan. In the reform of this course, firstly, the deposit model of Alipay, which is popular among students, is used to introduce the calculation method of daily interest to students, which further leads to the main contents of this course. Finally, through the introduction of “campus loan” into classroom teaching, it conveys to the students the harm and serious consequences of “campus loan”.

2.1. Introduction of cases

In the pre-class preview, the intelligent cloud of vocational education (ICVE) is used to assign homework to students:

(1) Suppose that you are given a capital of 5000 yuan, please use the financial platform you are familiar with to find the relevant interest rate. For example, in a certain Alipay, the 7-day interest rate given that day is \( r \), please calculate what will your income be at this interest rate, if you invest for different days \( t_1 = 60, t_2 = 30, t_3 = 1 \).

(2) According to individual needs and convenient access, banks all have transfer business. Please calculate the total income of the above three investments within one year and answer the questions in groups.
Then, in class, the students are first asked to show and explain their pre-class homework, and the teacher makes comments, thus obtaining the functional analytical formula of the benefit of the first question as follows:

\[ R^{(1)}_k = 5000 \left(1 + \frac{r}{365}\right) (k = 1,2,3); \] (1)

In the second question, it is analyzed that the distribution of rollover times corresponding to these three kinds of investment in one year is \( n = \frac{365}{t_k} (k = 1,2,3) \), and the total income is calculated as follows:

\[ R^{(2)}_k = 5000 \left(1 + \frac{r}{365}\right)^{\frac{365}{t_k}} (k = 1,2,3). \] (2)

In the process of acquiring this knowledge, the students have mastered the method of calculating interests.

2.2. The formation of the second important limit formula \( \lim_{x \to \infty} (1 + \frac{1}{x})^x = e \)

Now, entering the lecture on the main knowledge in the class, the teacher asked the question: under the condition that the annual interest rate is known to be \( r \), if we take the investment days \( t \) for a shorter time, for example, \( t \to 0 \), then, how will the total income transferred within one year be calculated? After thinking for a while, the students can get the expression of the total income from the second question of the preview before class as follows:

\[ R = 5000 \left(1 + \frac{r}{365}\right)^{\frac{365}{t}}. \] (3)

Furthermore, the second important limit formula \( \lim_{x \to \infty} (1 + \frac{1}{x})^x = e \) is obtained; that is, the total income \( R = Ae^r \) in the case of infinite deposits and transfers of funds. Finally, in the class, taking the “campus loan” of a certain network platform as a case, the teacher mainly introduces to the students that the interest rate in the campus loan generally refers to the daily interest rate or the monthly interest rate, and then according to the time of the loan, uses formulas \( R^{(1)}_k \) and \( R^{(2)}_k \) to get the total loan amount.

For example, a campus loan platform gives a daily interest rate of 0.2% for a 30-day loan. If it is overdue, the daily interest rate will become 2%. If the amount of a student loan is 2000 yuan, then the total amount of repayment is calculated to be \( R^{(2)} = 2000(1 + 0.002)^{30} = 2323.5 \), then suppose it is overdue by 30 days, and calculate the total amount of repayment. \( R^{(2)} = 2323.5(1 + 0.02)^{30} = 4207.85 \). Similarly, when the student’s loan is overdue for more days, the sum of principal and interest he needs to repay will become larger and
larger, $R_n = 2323.5(1 + 0.02)^n$, where $n$ is the number of days overdue. We can find that this is actually an exponential function with a base of 1.02, and its growth rate is very fast. From this case, we can see that “campus loan” is actually “usury”, which teaches students the harmfulness of “campus loan” and enables students to put an end to all such illegal loans and guard against social and network-related traps.

2.3. Teaching effect

Through the curriculum reform model of this class, students have an understanding of the second important limit formula $\lim_{x \to \infty} (1 + \frac{1}{x})^x = e$, and transformed from the original easy-to-forget rote memorization to the current full understanding of the definition. For example, the first 1 in the formula can be understood as the original principal of the investment, and x can be understood as the number of deposits, and so on. At the same time, it deepens the understanding and application of the formula by combining the case of “campus loan”. The following picture shows the learning results of students majoring in mechatronics from Grades ’17 and ’18 in this course. By comparison, it is found that the learning effect of students of Grades ’18 is much better than that of Grades ’17.

3. The concept of definite integral and the curriculum reform of its application

Summing up the content design and teaching of this course in the past, because of the four parts of the process of solving the area of obscure irregular graphics, there is a big gap between the students’ understanding of the concept of highly abstract definite integral and their accurate mastery of the formulas. In the reform of this course, first of all, the intelligent cloud of vocational education (ICVE) is used to complete the pre-class task of manually calculating the area of willow leaves, so that students can really participate in the formation of the concept of definite integral, followed by the teacher’s comparative explanation and students’ discussion, hence the formation of the concept, which leads to the ideological and political education, and then the teacher explains the actual application cases.

3.1. Introduction of cases

Use the pre-class preview of the intelligent cloud of vocational education (ICVE) to introduce two pre-class tasks: watch the courseware of dividing the area, and calculate the area of “willow leaves” (assuming that willow leaves are 5 cm long and 2 cm wide). Let students stimulate their interest in learning and enthusiasm for participation through simple and interesting examples. In class, the teacher shows the students’ different calculations and methods for comparison. The following are the calculation results of some students (including the number of divided small rectangles):
And through brainstorming set in the teaching cloud, the teacher and the students discuss the reasons for the formation of the above three different kinds of calculation results and how to divide the calculation in order to have a more similar willow leaf area, so that students can sum up ideas and methods in operation and comparison and students can acquire knowledge and methods in a relaxed and interesting learning process.

### 3.2. The formation of the concept

\[
\int_{a}^{b} f(x)dx = \lim_{\Delta \to 0} \sum_{i=1}^{n} f(\xi_i)\Delta x_i \quad \text{of definite integral}
\]

Through the analysis and summary of the pre-class problems, the teacher further leads to the concept of definite integral through four steps: division, approximation, summation and limit.

\[
\int_{a}^{b} f(x)dx = \lim_{\Delta \to 0} \sum_{i=1}^{n} f(\xi_i)\Delta x_i
\]  \hspace{1cm} (4)

At the same time, in the summary of the idea of infinite division and peace in the concept, Xunzi’ s thought “perseverance makes a great learner” is introduced: “if you don’t accumulate steps, you can’t reach thousands of miles; if you don’t accumulate small streams, you can’t have rivers and seas” so as to encourage students to master knowledge and to tell them that skills can not be achieved overnight. Finally, in the class, by citing the v(t) curve of the known non-uniform motion of the object and asking the displacement of the object in a certain period of time, the students can combine the concept of definite integral to get the conclusion \( S(T) = \int_{t_0}^{T} v(t)dt \). Let students feel the practical application of definite integral.

### 3.3. Teaching effect

Through the curriculum reform model of this class, students can not only fully deepen their understanding of the concept, but also understand the mathematical research methods and experience the limit thought. At the same time, on the basis of guiding students to give full play to their main role, teachers’ leading role should be properly reflected. Also, the teacher should let students understand and apply knowledge as mechatronics majors on the known current I(t) and how to calculate the current passed in a certain period of time in the follow-up professional knowledge study, according to the concept of definite integral properly combined with
professional cases. This is the application of definite integral. The following figures show the learning results of students majoring in mechatronics from Grade ’17 and ’18 in this course.

4. Conclusion

From the above two teaching effects, we can find that information technology and ideological and political education have made some progress in the curriculum reform of Advanced Mathematics teaching. However, as regards how to integrate information technology and ideological and political education into the curriculum reform more comprehensively and correctly, it is urgent that we teachers need more thinking and accumulation in teaching. Under the guidance of this educational concept, it is necessary to deeply understand and practice General Secretary Xi Jinping’s important thought on education, and to implement the fundamental task of establishing morality and cultivating people, focusing on students’ learning, understanding and practice, and it is all the more helpful to cultivate students’ creative thinking.

References

[1] Central Government of the People’s Republic of China. Outline of the National medium-and long-term Education Reform and Development Plan (2010-2020) [EB/OL]. http://www.gov.cn/jrzg/2010-07/29/content_1667143.htm.

[2] Central Government of the people’s Republic of China. Education Informatization 2.0 Action Plan. Http://www.moe.gov.cn/srcsite/A16/s3342/201804/t20180425_334188.html.

[3] Li Hua. Discussion on Advanced Mathematics Teaching Reform in higher Vocational Education based on Information Construction [J]. Curriculum Education Research. 2018 (50).

[4] Tang Yewei. The Construction Method and Case Study of Smart Classroom in the Environment of Information Technology [J]. Audio-visual Education in China. 2014.

[5] Han Xianzhou. Promoting the Practical Innovation of Establishing Morality and Cultivating People by Ideological and Political Education [J]. Chinese Journal of Higher Education. 2019 (23).

[6] Luo Xiaoli, Jiao Hongyi. On the Organic Combination of Advanced Mathematics Teaching and Ideological and Political Education [J]. Learning Weekly. 2018 (23).

[7] Pang Shiyou, Miao Lianying. Driving the Reform of Innovative Teaching Mode of Advanced
Mathematics with Primitive Problems [J]. Educational Modernization. 2015 (12).

[8] Wang Yunqing, Li Meiling, Jiang Yue. The infiltration of moral education in Advanced Mathematics teaching [J]. The Guide of Science & Education. 2015 (12)