

Advanced Mathematics in Vocational Universities

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Abstract: Science and technology are advancing at a breakneck pace. Only individuals with strong mathematical skills and knowledge will be able to adapt to social development and progress. However, advanced mathematics education is often neglected in vocational universities. Student and conceptual factors are invariably to blame. Therefore, it is urgent to improve the teaching quality of advanced mathematics in vocational universities. In improving the teaching quality, it is necessary to change the teaching mode, advocate interest in learning, emphasize on the cultivation of students' skills during teaching, implement stratified teaching, lay emphasis on mathematical models, and strengthen the evaluation and assessment of students.

Keywords: Advanced mathematics; Vocational education; Vocational university

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1. Introduction

Chengtong Qiu is a master of modern mathematics, and he once said, "To become an economic power, China must first become a scientific power. Mathematics is the foundation of science. Only when China gains mathematical power can it become a scientific power ^[1]." Today, with the rapid development of science and technology, mathematical thinking and methods have penetrated into all disciplines. For every educated person, no matter what profession he or she holds and what goals he or she pursue, each individual needs to learn mathematics, apply it, and also research on it. Only those with good mathematical skills and knowledge will be able to adapt to social development and progress. Mathematics at vocational universities enables students to not only master certain knowledge while receiving professional education, but also to develop a good habit of thinking. It can also improve students' comprehensive quality and skills ^[2]. Hence, advanced mathematics is the core of vocational education, as it determines the professional quality of learning.

2. Problems of advanced mathematics in vocational universities

It is a common phenomenon that advanced mathematics is often neglected in vocational universities ^[3]. It affects the overall teaching purpose and teaching quality of vocational universities.

2.1. Student factor

Majority of the students in vocational universities have weak mathematical foundation, and they find it difficult to grasp abstract mathematical concepts ^[4]. Among the students in vocational universities, some

are from secondary vocational colleges, others after enrolling independently, and still others after passing the National College Entrance Examination. Students from secondary vocational colleges and those enrolled independently have a generally weak foundation. Aside from that, many students struggle to acclimate to the teaching style upon commencement. Due to their lack of self-learning skills and poor self-control skills, they are incapable of organizing their leisure time in a reasonable manner and complete their learning tasks well. In addition, influenced by external notions, their learning objectives are ambiguous. They feel that learning mathematics is not only boring, but also irrelevant to their field of study. As a result, a large number of students are unable to learn in class.

2.2. More teaching contents and fewer class hours

At present, many vocational universities are reducing the class hours of basic theory courses^[5]. Advanced mathematics is an important basic theory course, and similarly, its class hours have been reduced drastically. However, the teaching content of advanced mathematics is increasing, with a wide coverage. Hence, it poses a challenge to complete the teaching task in a short period of time for such a subject that emphasizes logic. Many topics cannot be discussed in an in-depth manner. For example, calculus is an important part of advanced mathematics, but due to the reduction of class hours, students will only be exposed to basic definitions and theorems, without much emphasis on the application of knowledge points^[6].

2.3. Conceptual factor

At present, most people do not have an accurate understanding of higher vocational education, especially among students, in which they think that higher vocational education only focuses on professional training. However, the purpose of vocational education is to train applied talents, so that they have both, professional knowledge and skills, with a certain level of education. Compared with ordinary education and adult education, vocational education lays more emphasis on the cultivation of practical skills and practical working ability. General education and vocational education are two distinct forms of education that are equally important. Vocational education is a distinct sort of education in China's education system. In fact, China has the world's largest vocational education system.

3. Teaching strategies of advanced mathematics in vocational universities

It can be seen from the analysis that a vocational university's direction determines the quality of its students, its teaching methods, and the teaching mentality of its teachers. Under current circumstances, the teaching effect will only serve to reinforce people's deviated beliefs. Therefore, it is imperative to improve the teaching quality of advanced mathematics, grasp the essential concepts, and think broadly.

3.1. Laying emphasis on "interest" in learning

Albert Einstein once said, "Interest is the best teacher." Learning without interest is dull and monotonous for students. They are the keynote in the teaching process. It is important to ensure their interested in learning advanced mathematics^[7]. For this reason, multimedia can be used to assist the teaching process^[8]. The used of multimedia can ensure that the object described is more specific, for example, in terms of the concept of derivative and the definition of definite integral. In this way, it is easier for students to comprehend and accept derivate and definite integral, thus piquing their interest in learning.

3.2. Paying attention to training students' practical skills, thinking ability, and thinking method

Mathematics has two characters; one is instrumental character, and the other is cultural character^[9]. The instrumental character of mathematics has been gaining more attention, while its cultural character is being neglected. Hence, the cultural character of mathematics should be emphasized in the teaching process.

Since the purpose of higher vocational education is to train application-oriented talents, practical skills should be emphasized even more. Graduating and stepping into the working environment, the majority of students will forget the knowledge learned during their schooling days, but the mathematical training they received as students remains. It leaves an impact on the way they live and think ^[10], and it will be valuable to them for the rest of their lives. Therefore, in the teaching of advanced mathematics, it is crucial to pay more attention to students' thinking ability, so that students can feel the "spirit" of mathematics while learning. In that way, they will be able to experience the mathematics culture and also exercise their thinking ability ^[11].

Other than their thinking ability, the methods of thinking are also important ^[12]. There are many thinking methods used in mathematics, among which transformation is one of them ^[13]. Transformation is a basic thinking method for problem-solving. Transformation and induction are highly generalized ^[14]. Its core idea is to boil down the original problems into relatively easy or familiar problems through transformation and reconstruction. Since there are mature solutions to easy or familiar problems, the original problem can then be solved ^[15]. The idea of transformation is used in philosophy, economics, physics, and mathematics ^[16]; additionally, we often use it in our daily lives. The idea of transformation was employed by Cao Chong, a young boy during the Three Kingdoms period, where he "transformed" the task of weighing an elephant into a task of weighing stones (**Figure 1**).

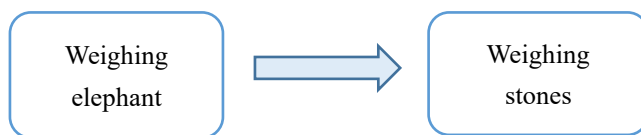


Figure 1. Weighing elephant

In calculus, the definition of definite integral is an abstract concept. Hence, the idea of transformation can be applied in this context. First of all, the curved trapezoid is cut into slices. In that way, the area of the trapezoid is "transformed" into the area of a smaller trapezoid; this is known as segmentation. When determining the area of the smaller trapezoid, consider using a rectangle to make an approximation (**Figure 2**).

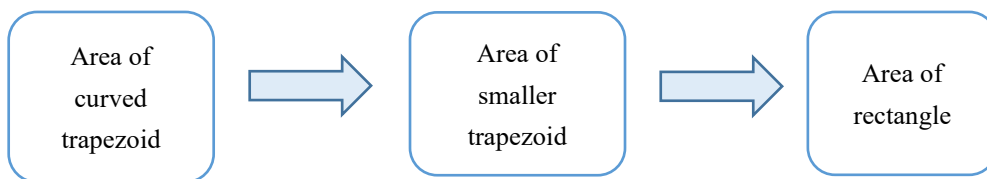


Figure 2. Definite integral

When can such an approximation be more accurate? Our division is, of course, fine enough. The challenge then becomes, under what conditions can we ensure that the segmentation is fine enough? In that context, if we locate the longest interval and let it approach zero, we can make sure that the partition is thin enough; then, the segmentation will be fine enough. In the course of explaining the definition of definite integral, we should not only make use of multimedia to provide an intuitive feeling to students, but also emphasize the thought of transformation.

3.3. Implementing stratified teaching

As each student's learning level is different, stratified teaching should be considered in the teaching process [17]. Among the students in vocational universities, there are certain differences in their academic performance, learning ability, professional knowledge understanding, and application skills. Some students are more interested in mathematics and have stronger learning ability. In teaching these students, deep mathematical knowledge and mathematical problems should be put forward, as these will improve students' practical and professional skills as well as stimulate their innovative thinking. On the other hand, some students have a fair interest in mathematics and have an average learning ability. For such students, the focus should be on guiding them in such a way to heighten their interest in learning and their capacity to understand through simple and easy methods. This method will not only help students to gain more knowledge, but also learn something. Therefore, the traditional classroom narration should be transformed into classroom instruction, experimental teaching, and classroom discussion [18]. Besides that, teaching based on indoctrination should be replaced with independent learning. Therefore, in the course of teaching, we should focus on applications rather than demonstrations and pay special attention to intuitive and image understanding.

3.4. Emphasizing on mathematical models

Students should not only be introduced to basic definitions and theorems, as well as the relevant proofs of theorems, but also to mathematical models. Mathematical models are considered as a bridge linking mathematics with real life [19]. Through mathematical models, students will be able to appreciate mathematics in such a way that it is no longer a boring definition, theorem, or deduction. They will come to acknowledge that it can be used to solve practical problems. Other than that, students should be encouraged to participate in mathematical modeling contests. This provides a platform for students to apply and exercise the knowledge they have and further enhance their interest in learning. The National College Students Mathematical Contest in Modeling was founded in 1992. Since then, it has become the largest and most influential basic discipline competition in China. This kind of competition can cultivate students' creativity and innovative consciousness. It trains students' skills in acquiring information and materials, as well as provides an opportunity for them to practice their skills. In that way, they will be able to grasp and master new information more quickly. In addition to that, it also cultivates teamwork consciousness and teamwork spirit among students. It improves students' capabilities in applying mathematical knowledge to solve practical problems and enhance their interest in mathematical learning. It is more important to nurture people's receptiveness and logical thinking. Mathematical modeling competitions exercise these skills not only for students, but also for teachers. Since mathematical modeling involves many branches of mathematics, it is also a self-improvement process for instructors. Encouraging students to participate in modeling competitions will not only stimulate their interest in learning, cultivate their sense of cooperation, and foster their innovation skills, but also widen the reach of teachers. It is a process of common progress for both, students and teachers.

3.5. Emphasizing on the evaluation of students' skills and improving the assessment system

For a long time, advanced mathematics examinations were nearly entirely conducted without the use of books. This examination format does not allow for a thorough analysis of the nature of advanced mathematics. Hence, we should renew the examination concept and improve the examination process. At present, there are many new learning platforms, which have a variety of functions. They can be used for storing teaching materials and conducting assessments in addition to class purposes. The majority of assessment systems have two components; the first is the standard homework and classroom questions,

while the second is the grasp of fundamental mathematical knowledge. If process evaluation is frequented, students' performance will be more scientific and reasonable.

4. Conclusion

Mathematics is not only a culture, but also a spirit – a rational spirit. This spirit is what inspires, motivates, and drives human thoughts along the path of idealization. As time passes, students' perspectives and understandings are evolving. Hence, teaching methods should also be revised and upgraded accordingly. Only by keeping pace with the times and innovating constantly can we improve the teaching quality of advanced mathematics and cultivate excellent talents.

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