Abstract. With the continuous development of modern computer technology, more and more fields are beginning to use the latest computer technology. The application of computer technology in the daily subject teaching of colleges and universities has been popularized. Especially in the field of higher mathematics, the optimization and integration of computer technology and traditional teaching is obvious. Therefore, it is necessary to further study and make full use of modern educational computer technology to design and conceive an auxiliary teaching mode that conforms to students' cognitive rules and cognitive levels, so as to fully mobilize students' enthusiasm for learning and improve the efficiency and teaching quality of higher mathematics teaching.

Keywords: Advanced mathematics; Mathematical experiment; Mathematical modeling; Mathematica software.

1. Introduction

The computer's large capacity and powerful functions are the ideal auxiliary tools for advanced mathematics teaching. Computer technology can be used to interpret the generation process of mathematics problems and the use of mathematics knowledge in a way that combines sound, graphics and text. For example, the human-computer interaction function is enough to mobilize the college students' interest cells, making it more intuitive to operate and think. Another example is the use of flash and other related mathematics software to create animation effects, to achieve graphics and image transformation; image realistic simulation of trajectory movement and formation process, therefore, the combination of advanced mathematics teaching and modern computer technology can attract the interest of college students in the concept of development of the times. At the same time, the combination of computer technology and traditional advanced mathematics teaching enables teachers to save a lot of time in the teaching process, and put more energy into combining more classic and scientific teaching structures. In this way, teachers can effectively improve the quality and teaching efficiency of advanced mathematics.

2. Research on Experimental Teaching Mode of Integration of Computer Technology and Advanced Mathematics Course

2.1 Task-driven Pedagogy for Curriculum Integration

The task-driven approach to computer technology and the integration of advanced mathematics courses. Task-driven teaching method is a student-centered, task-driven teaching method, which is a teaching method based on constructivist teaching theory [2]. Students' learning activities should be combined with related tasks and problems to complete tasks and solve problems to guide and maintain learners' interest and motivation, and let students learn with tasks and problems. Students must have the autonomy to learn. Therefore, teachers must constantly guide and motivate students. In the task-driven teaching method design, the teacher decomposes the teaching content into a plurality of specific tasks according to the teaching theme. Each task contains relevant knowledge and skills that the students must master, guiding the students to analyze the problem through independent exploration and group collaboration. The method and steps for solving the problem are proposed. The process of completing the task is a process of continuously discovering the problem, analyzing the problem and solving the problem. In the task-driven teaching, the teacher no longer dominates the
entire teaching process, but only helps the students to complete the task, and the teacher plays the role of inspiration and guidance.

2.2 Principles of Integration of Computer Technology and Advanced Mathematics Courses

First of all, it is necessary to combine the characteristics of advanced mathematics courses to train students to understand the discovery and exploration process of mathematics learning, and to use computer technology to show students, emphasizing the exploration, application and migration of mathematics knowledge. Second, we must have a correct attitude towards the use of computer technology. Computer technology is an auxiliary means for teachers to teach, but it cannot completely replace the traditional teaching methods or teaching content [3]. In order to meet the requirements of modern teaching, teachers should combine traditional teaching with computer technology, and strive to develop high-level, high-quality curriculum design and constantly supplement, modify and improve, so that computer technology can really play a role in promoting teaching. Again, we must deal with the teacher-student relationship in the context of computer technology. In traditional teaching, teachers are the owners of knowledge and the protagonists of the classroom. It is the main task of the classroom to teach students the knowledge they have directly. The introduction of computer technology has made subtle changes in the connotation of teachers and students. In addition to the teacher-based classroom experiment teaching mode, students may also use their own computer technology to explore, get knowledge outside the classroom, and expand the knowledge. To narrow the knowledge gap between teachers and students, and also to change the dominant position of teachers in the classroom.

2.3 Mathematical Experiment Teaching Mode based on Computer Technology

According to the principle of integration of computer technology and advanced mathematics course, the task-driven teaching method is the premise of computer technology and advanced mathematics course integration. Based on the integration of computer technology and advanced mathematics course, a mathematical experiment based on computer technology is proposed. Teaching mode. Mathematical experiment is a brand-new teaching method and mode of advanced mathematics, which makes mathematics teaching develop from simple teacher lectures and student listening modes to learning modes that use teachers and students to participate in modern computer technology. The purpose of mathematical experiments is to discover and understand more abstract or complex content in mathematics through experiments.

3. How to Integrate Computer Technology into the Teaching Process of Advanced Mathematics

As for how to integrate computer technology into the advanced mathematics teaching process, I think it is necessary to give full play to the role of the computer to help teachers complete the teaching more efficiently and intuitively in the teaching process.

3.1 Replace Traditional Board Books with Courseware to Make Teaching More Efficient

For example, at the beginning of the class, the teacher can first enumerate the content of the lesson in the form of PPT, so that students can clearly know what they want to master in this lesson. And for some concepts, the formula will have a more intuitive understanding.

[Case 1] Limit.
1) The limit of the series is \( \lim_{x \to a} a_n = A \) and the limit of the function is \( \lim_{x} f(x) = A \).
2) The relationship between the function limit and the one-sided limit is

\[
\lim_{x \to x_0} f(x) = A \iff \begin{cases} f(x_0^-) = \lim_{x \to x_0^-} f(x) = A \\ f(x_0^+) = \lim_{x \to x_0^+} f(x) = A \end{cases}
\]
3) Special limits: infinity and infinity. If \( \lim n = \infty, \lim n = -\infty \), the variable \( n \) is said to be infinitely large (or infinite).

4) The relationship between the limit and infinity: \( n \to A \iff n = A + \alpha \), where \( \alpha \) is the infinitesimal of the limit process.

Some formulas and theorems are often cumbersome. If you can use courseware instead of traditional blackboards, you can save classroom time and give full play to classroom efficiency. The study of Taylor's formula is a good example.

[Case 2] Taylor formula with Lagrangian remainder.

Let \( f(x) \in C^k (U(x_0)) \) \((k = 0, 1, 2, \cdots, n)\), and \( f^{(n+1)}(x) \) exist, and there is

\[
f(x) = \sum_{k=0} f^{(k)}(x_0)\frac{(x-x_0)^k}{k!} + R_n(x) \tag{2}
\]

Among them: \( R_n(x) = \frac{f^{(n+1)}(\xi)}{(n+1)!}(x-x_0)^{n+1} \quad \xi \in (x, x_0) \), called the \( n \) Lagrangian remainder. This formula is called the Taylor's formula with \( n \) Lagrangian remainder.

For example, if you want to talk about the example, you can play the prepared courseware directly, instead of letting the students read the textbook themselves, or the teacher himself can write on the blackboard, and all the points and knowledge points can be visually reflected in the courseware.

In addition, the placement of exercises in the classroom or assignments after class can also be made more efficient and intuitive through the form of courseware.


Mathematica is a commonly used math software that not only processes a variety of data, but also programs and maps. It is useful to build mathematical models using this software. In the square table problem, using this software can make the problem easier to analyze. Place the square table on the uneven ground and move it so that it rotates around the center to analyze whether the four legs of the square table can land at the same time. This is actually a function to find the extreme value, we can build a function model. First, we use Mathematica to draw a model map. Teachers can analyze and teach students how to use the software to enhance students' ability to operate the software. The picture is shown below.

[Case 1] Square table problem.

As shown in the figure, A, B, C, and D respectively represent the initial position of the four legs of the square table, and \( o \) represents the center of the square table. After analysis, the distance between the legs and the ground cannot be determined when the four legs of the square table are not fully grounded [4]. Therefore, it is necessary to establish functions \( f(\theta) \) and \( g(\theta) \), which represent the sum of the distances of A, C/B, and D from the ground, respectively. Here we need to set \( f(\theta) \) and \( g(\theta) \) as continuous functions, get the product of the two to be 0, and convert the problem into the \( \theta_0 \) and \( f(\theta_0) = g(\theta_0) = 0 \). The entire analysis process and problem-solving process can be performed on a computer, using mathematical software to process the calculations in the problem-solving process. This will not only improve the teaching effect of teachers, but also enhance students' practical ability.
Due to the high degree of abstraction and rigorous logic of mathematics, many graphics in teaching are quite complicated, teachers are difficult to draw by hand, and simple language descriptions are often difficult for students to understand. At this time, it can be easily solved by using mathematical software such as geometric drawing board and MATLAB. For example, geometric drawing board, as a CAI application software, combines modern teaching methods with advanced mathematics based on the advantages of large amount of computer information and static movement [5]. It provides teachers and students with an open world of mathematics, changes the limitations of passive acceptance of students in traditional teaching, and allows the learning subjects to passively accept and actively explore, making the advanced mathematics classroom teaching a lively trend.

Difficulties in teaching: the tangent of the curve. Practice has proved that traditional teaching methods are difficult to achieve results. However, if the "extreme position of the secant line" is outlined by the information technology using the geometric drawing board, and then the dynamic erasing tangent effect is added through PowerPoint (as shown in Fig. 2), it is intuitively shown that the tangent line T is the limit position at the time of the secant line, which is intuitive and easy to understand, the problem "to solve the problem."

In the teaching process of spatial analytic geometry and multivariate function differential calculus, it is often necessary to understand by means of multivariate function graphs, while the textbooks often give static plane graphics [6], students cannot establish the concept of spatial graphics, so in this part of the content teaching process MATLAB animation can be used to create functional graphs in three-
dimensional space, demonstrating the formation of some abstract conclusions, making it easier for students to understand and master.

[Case 1]

Use the numerical integration method to find \( y = x^3 + x^2 + 3x + 4 \) the area of \( x \in [0,10] \). The numerical integration can be obtained by the Euler method and the trapezoidal method, respectively, and can be compared. Let the integral interval of \( x \) be divided into \( n \) segments, each segment length is \( \Delta x_i \quad (i = 1, \ldots, n) \), there are \( n+1 \) point, and the function value corresponding to each point is \( y(i) \quad (i = 1, \ldots, n) \), then the Euler integral formula is

\[
s = \sum_{i=1}^{n} y(i)\Delta x_i
\]

(3)

The integral formula of the trapezoidal method is

\[
q = \sum_{i=1}^{n} \left( \frac{y(i) + y(i+1)}{2} \right)\Delta x_i
\]

(4)

The results of the operation are shown in Table 1.

<table>
<thead>
<tr>
<th>Step size ((d_x))</th>
<th>Number of segments ((n))</th>
<th>Euler's solution ((s))</th>
<th>Trapezoidal solution ((q))</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
<td>2240</td>
<td>3470</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>2770</td>
<td>3385</td>
</tr>
<tr>
<td>0.5</td>
<td>20</td>
<td>3056.2</td>
<td>3295.5</td>
</tr>
<tr>
<td>0.1</td>
<td>100</td>
<td>3363.8</td>
<td>3357</td>
</tr>
</tbody>
</table>

The exact solution obtained by analytical method is \( 10070/3 \) 3356.7;

You can also directly call the MATLAB internal command quad \((y(i))\) to calculate the result of 3.3567.

When \( d_x = 2 \), the Euler's integral result is too small, and so on; when the slope of the curve is negative, the Euler's integration result will be too large. The trapezoidal method is the area surrounded by the connecting lines of each sampling point. The slope of the curve is formal, the area of the trapezoidal method is too large, and so on. When the slope of the curve is negative, the integral result of the trapezoidal method will be too small. Therefore, the integral exact solution results between the two.

3.4 Use Computers to Conduct Appropriate Mathematical Experiments to Cultivate Students' Interest in Mathematics

Mathematical experiments are new things that emerged after the introduction of computer technology and mathematical software. The development of mathematics experiments can embody the subjective consciousness of students in mathematics education, and enable students to learn, use, and do mathematics, improve students' enthusiasm for learning mathematics, improve students' awareness of mathematics application, and train students to learn. The ability of mathematical knowledge and computer technology to understand problems and solve practical problems.

It is advisable to set up a mathematics lab in the second or first grade, so that students can learn the basic concepts necessary in advanced mathematics without having to learn a lot of mathematical theorems.

Arrange 9 experiments per semester and do an experiment every two weeks. Each lesson is taught by the teacher for two lessons. The remaining three of the two sessions are arranged for students to take the opportunity to complete the experimental work in two weeks. The teacher mainly asks questions, appropriately introduces the background of the problem, and introduces the main experimental principles and methods. Then let the students do it themselves, observe, and draw conclusions through observation. Teachers should not take the time to make theoretical derivations.
It is best not to tell students the results of experiments in advance. The results of the experiments are for students to observe. After the experiment, let the students talk about their learned income into an experimental report, which will deepen the students' understanding of each knowledge point [7].

4. Conclusion

Computer-aided teaching is the specific application of high-tech in teaching and a powerful means to improve teaching quality. Schools should increase investment in computer-aided teaching facilities and equipment and strengthen infrastructure. At the same time, teachers should be encouraged and advocated to use modern teaching methods to give full play to the role of various computer-aided teaching facilities and equipment. Computer-assisted instruction has created a new world for mathematics teaching, but it must be recognized that the computer is only an auxiliary tool, and it cannot replace the communication between teachers and students. It cannot replace the teacher's guidance and the student's subject status. In teaching, it is decided that the cause is a person, and it is the teacher of the first line of teaching. With computer technology, it is not a teacher, but a higher requirement for teachers. Therefore, for the majority of teachers engaged in front-line teaching, we must always adhere to base on "people", we will give full play to people's subjective initiative and make bold practice and innovation in mathematics teaching.

References


