Research on Experimental Teaching Mode Based on Internet+OBE Concept

Pingting Ai 1,a, Junbo Chu 1,b,*, Lianpeng Song 1, Li Zhou 1 and Nan Wang 1

1 Department of Basic, Dalian Naval Academy, China.

a pingtingi@foxmail.com, b,* 17519565@qq.com

Abstract. Under the era background of "Internet plus education", based on the deficiency of traditional experimental teaching mode for the cultivation of innovative talents, this paper proposes the teaching mode of Internet+OBE concept, and constructs the teaching mode framework, teaching implementation framework and OBE achievement ladder with the experiment of basic courses of electronic technology as an example. Practice has shown that this teaching model has a significant effect on improving student course grades, enhancing their innovative activity abilities, and enhancing their learning interest and satisfaction.

Keywords: OBE; Internet plus education; experimental teaching; teaching model.

1. Introduction

With the rapid development of technology, the cultivation of innovative talents has become one of the primary goals of education reform in major universities. Experimental teaching and the second classroom are important teaching links for cultivating students' practical ability, self-learning ability, engineering literacy, and innovative thinking. Exploring a teaching model that promotes ability growth is particularly important and urgent.

Due to the strong dependence of traditional experimental teaching on laboratory environment and equipment, the traditional experimental teaching model confines students to a limited space in the laboratory. When the laboratory is used for experimental teaching in other courses, even if the experimental equipment is idle, students cannot use it for experimental design and learning. This makes the traditional experimental teaching model inadequate in cultivating students' creative thinking and stimulating their enthusiasm for self-directed learning, especially in today's rapidly developing network technology, where its shortcomings are even more apparent. Meanwhile, traditional experimental teaching equipment often uses independent experimental modules. When there are many experimental students, teachers can only evaluate their experiments based on the experimental results, lacking process tracking and monitoring. Due to the operational characteristics of experimental classes, the importance of the process is often much greater than the experimental results.

In response to the shortcomings of traditional experiments, this article takes the electronic technology experimental course as an example to explore a "learning centered, teaching led" experimental teaching model. This model is based on a digital online intelligent experimental platform, with OBE education philosophy as the core, and internet thinking as the framework. By breaking the constraints of traditional experimental courses on students in time and space, it stimulates the internal driving force of students to learn and innovate independently; By establishing a complete supervision system for the experimental process, teachers can understand the experimental operation of each student and provide more targeted guidance for students.
2. Realistic demand for carrying out Internet+OBE experimental teaching mode

2.1 The demand for curriculum construction

Experimental teaching is an important component of the overall teaching process in higher education institutions, especially in engineering courses. It not only undertakes the task of cultivating students' practical abilities and engineering literacy, but also requires students to personally experience the process of engineering operations, feedback engineering experience to theoretical teaching, and achieve the role of raising students' awareness and understanding of theoretical knowledge to a higher level. However, under the current traditional teaching mode, there is a serious disconnect between experimental and theoretical courses. Most students lack thinking and understanding of the relationship between theoretical knowledge and experimental verification content when completing experiments step by step to obtain experimental data. The guidance efficiency of theoretical courses on experimental courses and the feedback efficiency of experimental courses on theoretical courses are very low.

In addition, under the traditional teaching mode of task driven approach, students focus on completing the teacher's assigned tasks step by step during the experimental class, resulting in many students still having a vague understanding of what tasks they have completed after the experiment. Although formative elements such as pre class preparation, in class experiments, post class reports, and grade evaluations have also been introduced in the teaching implementation process, the interconnection between each element is relatively rigid.

The pre class preparation in traditional teaching often uses pre release of videos or text materials and test questionnaires. Although digital platforms are used, the core concept of the fixed single answer mode of the test questionnaire is still the traditional exam oriented mode. The process supervision of in class experiments can only rely on the teacher's on-site inspections and guidance. Whether it is the supervision of individual student operations or the statistical analysis of the operation of the entire class, it depends on the teacher's classroom impression and lacks objective data-driven analysis. Teachers usually only leave a deep impression on a few outstanding students, making it difficult to provide effective targeted guidance to them. The experimental reports submitted by students after class cannot prevent students from borrowing experimental data from each other or even plagiarizing reports.

Therefore, the curriculum construction has put forward new requirements for the experimental teaching mode. The new experimental teaching mode should not only improve the connection between theoretical and practical courses, but also organically integrate the three links before, during, and after class; At the same time, it can also monitor the completion of experiments by students in real-time and generate quantitative data, thereby conducting three-dimensional big data statistics and analysis on the completion of experiments.

2.2 The demand for student self-directed learning and innovative practice

The demand for innovative talents in today's society has put forward new requirements for interdisciplinary education in higher education institutions. For experimental teaching in basic disciplines, innovative and autonomous interdisciplinary experiments are often motivated by students' interests, as students have not yet been exposed to deep professional knowledge. The source of interest is often the "flash of light" generated by students during in class experiments. This sudden internal driving force source has the psychological characteristics of strong randomness, high instantaneous amplitude, and fast attenuation speed. This requires laboratory and experimental teachers to provide timely equipment support and relevant guidance, so as to turn innovation interest into innovation consciousness and pulse motivation into sustainable and sustainable development motivation.
The traditional object-oriented experimental model is mostly based on the prescribed experimental content of a certain type of course, with poor comprehensiveness and weak subject compatibility, which cannot support the autonomous and design-oriented experiments to achieve innovative ideas. At the same time, the equipment that supports traditional experimental modes is highly constrained by time and space. If there are other classes in the laboratory, even if the relevant experimental equipment is idle, it cannot guarantee the independent experimentation of other students.

Therefore, there is an urgent need for a new experimental teaching model that can extend students' interests in experimental classes to extracurricular activities, cultivate their instantaneous innovative impulses into sustained innovative consciousness, and break the time and space constraints of students in experimental design and operation.

In response to the shortcomings of traditional teaching models in cultivating innovative talents, this article explores a new OBE online experimental teaching model under Internet thinking. With the OBE teaching model as the clear line, and with the help of its results oriented characteristics, starting from the current comprehensive ability level of students and ending with the expected ability quality level, a progressive teaching model is constructed layer by layer; At the same time, Internet thinking, as a dark thread, permeates every teaching process, enabling experimental teaching to truly integrate the first and second classrooms, integrate in class and off class, and integrate online and offline.

3. Theoretical Basis of Internet+OBE Experimental Teaching Mode

OBE (Outcome Based Education) is a construction concept that focuses on achievement and abilities, with a student-centered approach and a reverse thinking approach in curriculum system construction [1]. Its core idea is that students can gradually achieve predetermined stage results through learning and accumulation, and ultimately achieve the final results step by step. This is not only in line with the synchronous advancement of experimental courses with theoretical courses, but also with the idea of understanding the engineering ideas of the entire course through completing independent experiments. It is also consistent with the idea of jointly growing knowledge, abilities, and qualities through learning different courses during school.

To truly achieve the ultimate goal for students, it is necessary to ensure that students are always in a central and subject position throughout the entire teaching model. This means that in this process, the vast majority of innovation generation, information resources, thinking and communication, and even summary and evaluation are independently completed by students. In this process, the characteristics of Internet plus, such as students' spontaneous innovation drive, cross-disciplinary integration, and the reshaping of the old knowledge system, often play a decisive role in supporting.

4. Construction of Internet+OBE Experimental Teaching Mode

If you follow the “checklist” your paper will conform to the requirements of the publisher and facilitate a problem-free publication process.

4.1 Thoughts on the Construction of Internet+OBE Experimental Teaching Mode

In combination with the ability needs of today's innovative talents, the characteristics of basic electronic technology course experiments and the shortcomings of traditional experimental teaching models, the construction of the Internet+OBE experimental teaching model mainly focuses on the ability growth as the final result, the ability expectation instead of the knowledge and skills expectation, and the multi-dimensional integration of interests, originality and specialty to guide the diversified growth path. The implementation path is based on the three core pillars of reverse staircase achievement design, as shown in Fig.1.
In this teaching model, the key is to use reverse thinking to construct phased results on each step of the achievement ladder. In the process of building tiered outcomes, each level of achievement is essentially an expectation of the abilities that students should possess. It should be a challenging expectation, which is the comprehensive ability that students can possess after independent deep learning and completing phased tasks.

Taking the electronic technology basic course experiment as an example, this course experiment is the first engineering course experiment that students are exposed to. Based on the current ability foundation of students, it is expected that the final result of students is to have the preliminary ability to discover problems and abstract them, coordinate planning, task decomposition and allocation, and summarize and summarize them in four aspects. However, most students only have the corresponding theoretical knowledge and the ability to learn according to the established goals set by the teacher at this time. Therefore, in the construction of the achievement ladder, a double-layer ladder model combining the first classroom and the second classroom is adopted. The outer staircase is divided into two levels: the first classroom and the second classroom. The lower staircase is the first classroom, and its starting point is the ability that the student currently possesses. Its results will serve as the upper staircase, which is the starting point of the second classroom. The results of the second classroom will be the final result of the entire experimental teaching activity.

In the first classroom, students can stimulate their interest in further research on creativity, design, practice, etc. by completing the prescribed experimental content in the teaching syllabus. At the same time, with the guidance of teachers and relevant laboratory guarantees, we will transition from the results of the first classroom to the second classroom, achieving the final result of ability growth in the second classroom. We will evaluate the teaching effectiveness through corresponding assessment strategies and propose suggestions for continuous improvement, as shown in Fig. 2.

Based on the starting point and expected outcomes of the first and second classrooms, construct a ladder of outcomes using reverse thinking, as shown in Fig. 3.
4.2 Teaching platform of Internet+OBE experimental teaching mode

The OBE teaching model highlights the student-centered concept, places high demands on students’ autonomy, and the demand for experimental support is also on the rise. The Internet+OBE experimental teaching mode of our electronic technology basic course experiment is implemented relying on the ELF-BOX online intelligent experiment platform developed by Shenzhen Yixingbiao Technology. The system architecture of the experiment platform is shown in Fig. 4 [2].

This platform can achieve remote online experiments, breaking the limitations of time and location in student experiments. At the same time, the process monitoring and management function in the experimental platform can monitor the entire experimental process by recording the schematic design, experimental operations, experimental data, and completion time information of students, and conduct statistics and analysis to help teachers objectively grasp the experimental situation of each student. Furthermore, provide targeted guidance to students. At the same time, the platform can make judgments and statistics on real-time collected data, and generate data reports to prevent data plagiarism, thereby ensuring students’ autonomy in completing experiments.

5. Teaching effect of Internet+OBE experimental teaching mode

After the experimental teaching was completed, the teaching effectiveness was analyzed through the experimental results of electronic technology basic courses, participation in competitions, and
questionnaire surveys. In the analysis of experimental results, both the traditional teaching mode and the Internet+OBE experimental teaching mode select 81 students of the same major as the analysis sample. In the traditional teaching, the average experimental score of students is 75 points, and in the new experimental teaching mode, the average experimental score of students is 85. The number of students participating in the competition has increased from a single person to 30, and the number of awards has increased to 18. In January 2024, the teaching team organized a survey questionnaire for a total of 151 people in four majors. The comprehensive survey results are shown in Table 1.

<table>
<thead>
<tr>
<th>Question</th>
<th>The proportion of students(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>agree</td>
</tr>
<tr>
<td>Personalized guidance provided by teachers</td>
<td>96.02</td>
</tr>
<tr>
<td>Increased learning interest and expanded the scope of knowledge</td>
<td>90.73</td>
</tr>
<tr>
<td>Deepening the understanding of theory and cultivating the ability to analyze and solve problems in theory</td>
<td>92.72</td>
</tr>
<tr>
<td>Enhanced team collaboration awareness</td>
<td>96.02</td>
</tr>
<tr>
<td>Improved knowledge transfer ability and innovation awareness</td>
<td>89.4</td>
</tr>
</tbody>
</table>

6. Summary

At present, putting learning at the center is one of the important contents of educational reform. In view of the shortcomings of traditional experimental teaching, this paper constructs an experimental teaching mode based on the concept of Internet+OBE, which has achieved good results, made a useful exploration for experimental teaching reform, and also provided ideas for guiding students to conduct interdisciplinary experiments and innovative design in the future.

References

[2] FENG Tao, YANG Xu, CUI Jiarui, LIN Ying, LI Qing. Exploration on Distance and Online Experiment Teaching. [J]. RESEARCH AND EXPLORATION IN LABORATORY.2022(05):0179-0188