Exploration of Smart Classroom Teaching Based on the OBE Concept—Taking University Information Technology Courses as an Example

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Abstract: With the deep integration of the Internet and education, the concept of "smart education" has been proposed, and the concept of "smart classroom" as an important part of "smart education" has emerged. Currently, there is a gap between the practical application and theoretical guidance of smart classrooms in the environment of higher education. Based on the OBE (Outcome-based Education) concept, this article combines multimedia digital technology and designs, organizes, and implements teaching activities using the example of university information technology courses. The learning effect is analyzed through student satisfaction surveys and comprehensive testing. The results show that this model helps improve students' interest in learning and their ability for independent study, and accumulates experience for further development of smart classroom teaching.

1. The significance of the integration of OBE concept and smart classroom

1.1. Analysis of the Current Situation of Talent Training in Colleges and Universities

Currently, prominent problems faced by talent development in Chinese universities are mainly reflected in the lack of students' ability for independent study and their weak intrinsic motivation for learning. This is closely related to the mainstream teaching model, where teachers take the lead and students passively receive knowledge. This model restricts the development of students' ability for independent learning and innovation. Post-2000 college students have a strong sense of autonomy, but due to the constraints of traditional classrooms, they are unable to engage in personalized learning. With the development of modern information technologies such as the Internet and big data, there is a deeper reflection on teaching and learning. How to transform knowledge learning into intelligent development will gradually become a core issue of concern for teachers and students. Therefore, traditional knowledge classrooms need to transform into future-oriented digital and intelligent smart classrooms.

1.2. The concept and characteristics of the results-oriented concept of OBE

OBE, also known as Outcome-based Education, is a "new paradigm" of education based on outcome-oriented nurturing. This concept was proposed by American scholar William G. Spady and quickly gained widespread recognition in the field of education[1].

1.2.1. Student-centered approach

In the traditional teaching model, teachers are the leaders in the classroom, and the teaching content mainly follows the teaching plans prepared by teachers in advance. Although students seem to be the main learners, they are actually passively receiving knowledge. Students' participation in the classroom is not high, making it difficult to stimulate their intrinsic interest and motivation for learning, resulting in overall unsatisfactory learning outcomes. OBE advocates returning the classroom to the students, with students actively participating in the classroom, while teachers play a role in guiding and evaluating[2]. For practical courses like university information technology, students are required to be more hands-on, engage in more practical activities, and participate more

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in classroom activities.

1.2.2. Ability-based approach

With the gradual maturity of high-tech technologies such as big data and artificial intelligence, future companies will inevitably put forward corresponding requirements for college graduates. OBE emphasizes the improvement of students' future life skills, and educational goals should specify specific core competencies. Each core competency should have clear requirements, and each requirement should have detailed corresponding courses. Only in this way can the ability-based thinking be fully utilized[3]. Practical courses should focus on improving students' innovative thinking and practical operation skills, essentially addressing the problem of a gap between theory and practice, and bringing education back to the focus on abilities.

1.2.3. Personalized assessment and evaluation

The assessment methods in traditional teaching often rely on final exams to determine students' performance. OBE advocates personalized assessment and evaluation of students, mainly based on factors such as student participation in classroom interactions, completion of assignments, and online course click rates during the learning process. Final exams are used as complementary methods. The focus is on students' performance in the learning process, rather than solely focusing on final exam scores. This approach can better stimulate students' awareness as the main learners and promote the formation of self-directed learning habits.

1.3. The concept of smart classroom

Smart classrooms are a form of classroom that focuses on developing students' intelligence as the core goal, emphasizing the cultivation of students' personalized learning abilities. With the support of modern information technology, smart classrooms can carry out personalized and precise teaching for different students, with functions such as intelligent resource recommendation, continuous collection of learning data, timely and efficient feedback, and flexible teacher-student interaction. This helps teachers effectively grasp students' learning situations, providing technical prerequisites for precise and efficient teaching[4]. Although scholars in the field of education at home and abroad have conducted comprehensive research and exploration on the design and application of smart classrooms and have confirmed the positive impact of smart classrooms on learning outcomes, there are still frontline teachers who have insufficient understanding of smart classrooms themselves. Previously, during the epidemic, some universities adopted online teaching, and some teachers even regarded online or blended teaching as the model of smart classroom teaching, completely ignoring the need for personalized learning in smart classrooms. This reflects the current situation where the implementation and theoretical understanding of smart classrooms are disconnected. This article will present a comprehensive analysis of the comprehensive teaching results of smart classrooms guided by the OBE concept, from learning analysis to comprehensive learning outcome evaluation, in the form of data.

Based on the OBE concept as a guide, the exploration of smart classroom teaching is a new experience and exploration that combines mature teaching concepts with advanced teaching models. The characteristics of student-centeredness in the OBE concept, the emphasis on cultivating students' personalized learning abilities in smart classrooms, the ability-based thinking in the OBE concept, and the emphasis on the development of students' comprehensive abilities in the smart classroom concept are highly compatible. At the same time, the personalized assessment and evaluation characteristics of the OBE concept are also very applicable to the comprehensive assessment in smart classrooms. Therefore, the integration of the OBE concept and the smart classroom exploration will be a very meaningful research for higher education teaching.

2. Smart classroom design based on OBE concept

2.1. Course overview and learning analysis

The university information technology course is a compulsory course offered to freshmen at the

university where the author is located, and it is a course taught in the computer lab. Through the course, students are required to be able to proficiently apply relevant software to solve practical problems. The teaching target of this study is the freshman accounting class. Freshmen are still in the stage of adapting to and exploring the learning mode of university, so this group is more likely to accept novel teaching models. Accounting students generally have meticulous and rigorous logical thinking, but their innovative awareness may be relatively weak.

2.2. Design of teaching and learning activities

The design of the smart classroom is guided by the personalized learning concept of OBE. It is designed and planned from several aspects, including the preparation of teaching resources, the planning of classroom interactions, and the evaluation of learning outcomes. In terms of preparing course resources, teachers will pre-record videos, courseware, and other online resources related to knowledge points and upload them to the learning platform for students to preview, and design preview assignments. In terms of classroom activities, project-based learning mode is adopted in small groups, according to students' gender, personality traits, knowledge and skill characteristics, and the principle of complementary advantages of male and female pairing is adopted to better promote group learning. Classroom activities mainly include group discussions, group sharing, group peer assessments, and teacher comments. In terms of evaluating learning outcomes, students are assessed comprehensively based on assignments submitted during the preview stage (20%), student participation in classroom interactions (20%), peer assessment scores (20%), and final in-class tests (40%).

2.3. Learning Outcome Analysis Design

The research results of this study compare the learning outcomes of 150 students (the "traditional group") from the 2022 accounting class who participated in traditional classroom teaching and 150 students (the "smart group") from the 2023 accounting class who participated in smart classroom teaching. The "traditional group" adopted the traditional teaching method of teacher-centered lesson preparation, classroom lectures, and homework assignments, with assessments based on one test after learning. The "smart group" adopted the teaching method described in Section 2.2 of the teaching activity design, with assessments conducted comprehensively throughout the process. Finally, a comparative analysis of the learning outcomes of the two groups of data is conducted.

3. Smart classroom implementation based on the OBE concept

3.1. Organizing and Implementing Teaching - Before Class

Both the smart group and the traditional group of students use the textbook "University Information Technology (3rd Edition)" published by East China Normal University Press, and the teaching content is Chapter 4 on data management technology. The smart group students are provided with online video learning resources for preview on the learning platform, which cover basic concepts related to data management technology, introduction to practical application scenarios, and case explanations. At the same time, the smart group students are assigned preview assignments, requiring them to complete learning tasks as required through online resources and submit them on the learning platform. In the process of completing the tasks, they record any questions and provide feedback to the teacher via the learning platform, allowing the teacher to flexibly adjust the teaching content and strategies based on the feedback in the preview stage (as shown in Figure 1). In this stage, teachers grade students based on their completion of preview tasks (20%). Lecture PPT slides are prepared for the traditional group students for learning reference.The learning tasks for the smart group are as follows:

1) Summarize the number of employees in each department and position in material file 1 using classification.

2) Use a pivot table to summarize the total salary and average performance salary of male and female employees in each position in material file 2.

3) Use advanced filtering to filter out the employee information of all purchasing department employees and female employees with a salary greater than 8500 in material file 3.

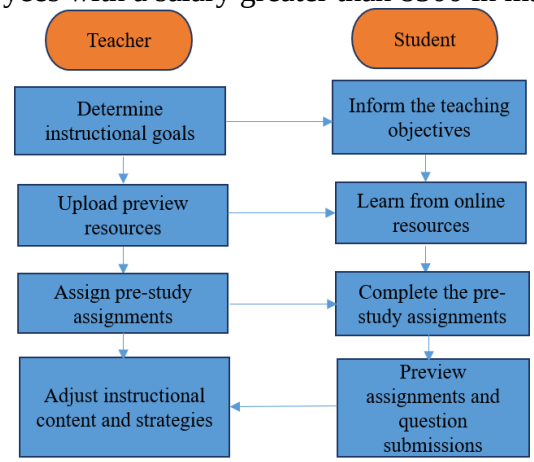

Figure 1 The design of pre-class activities in the smart classroom

3.2. Organizing and Implementing Teaching - In Class

In the smart classroom, students are divided into small groups of 5-6 people to participate in the class, following the grouping principles described in Section 2.2 of this article. First, the teacher delivers the course content, mainly providing targeted guidance based on the questions and feedback from students' pre-class preview. Then, learning outcome presentations, classroom discussions, group presentations, and inter-group questioning activities are conducted. In this stage, each group member takes turns to speak as the representative, determined by drawing lots, encouraging all students to participate in the class. After this stage, members within the group evaluate and score each other, and groups evaluate and score each other, and the scores are used to rank the groups and give points to the group members, which are included in the student peer assessment scores (20%). Finally, the teacher provides additional comments and summaries, personalized evaluations and scores for each group, which are included in the score for student participation in classroom interactions (20%). Based on the scores from these aspects, outstanding groups and outstanding members are selected, motivating excellent students to play a role in passing on knowledge(as shown in Figure 2). Traditional teaching methods are used for the traditional group students.

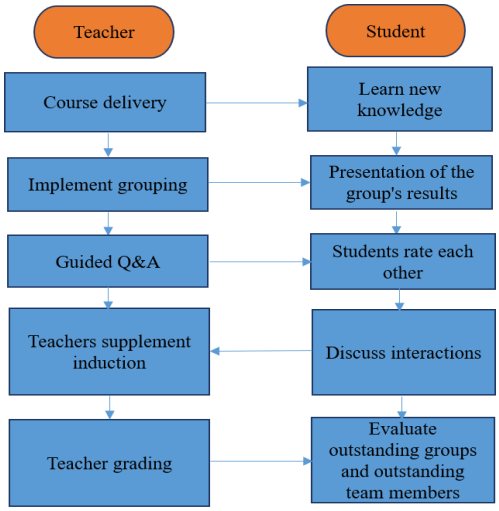

Figure 2 The design of in-class activities in the smart classroom

3.3. Organizing and Implementing Teaching - After Class

After class, teachers assign homework as a review and consolidation measure. Based on students' completion of the homework, personalized online tutoring and learning resource recommendations

are provided to ensure precise teaching and learning that never goes offline, fully reflecting the timely and efficient feedback and flexible interaction between teachers and students in smart teaching(as shown in Figure 3).

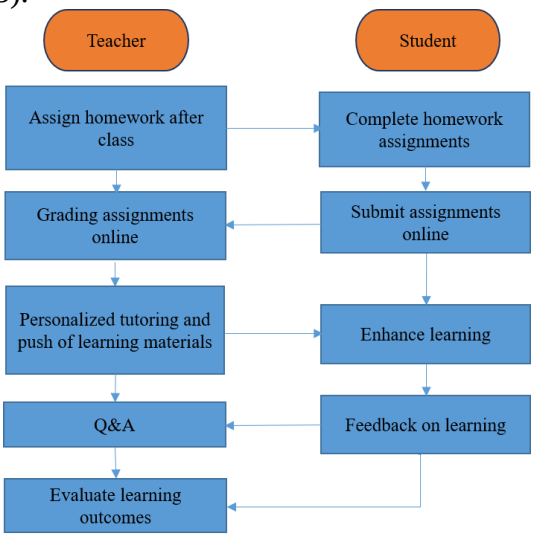

Figure 3 The design of after-class activities in the smart classroom

4. Analysis of the learning effect of smart classroom based on the concept of OBE

4.1. Learning Outcome Evaluation

After the teaching ends, the learning outcomes of this course are assessed through in-class tests. The teacher designs the exam questions, mainly assessing students' understanding of theoretical knowledge and their ability to apply and operate data management technology covered in this course.

For the smart group students, the total score of 100 includes scores for preview assignments (20%), classroom interaction (20%), peer assessment (20%), and in-class tests (40%). For the traditional group students, the in-class test score is used as the overall score for analysis.

Both the smart group and the traditional group are divided into different grades based on their total scores. Grades A, B, C, D, and E are given for scores ranging from 90-100, 80-90, 70-80, 60-70, and below 60, respectively.

4.2. Comparison and Analysis of Smart Classroom and Traditional Classroom Learning Outcomes

Through the analysis of the in-class test scores of the smart group and the traditional group, it can be observed that for objective questions that require understanding and memorization, the smart group performs better than the traditional group, although the difference is relatively small, as shown in Figure 4 for theoretical questions. However, for practical questions, the smart group's scores are significantly higher than those of the traditional group, as shown in Figure 4 for practical questions. In terms of the total scores of the in-class tests, the smart group also outperforms the traditional group, as shown in Figure 4 for the total scores. The comparative analysis of the two sets of data shows that the smart classroom is significantly better than the traditional classroom in improving students' practical and comprehensive abilities.

Looking at the distribution of grades for the two groups, compared to the traditional group, the smart group has significantly fewer students in the D and E grades (2 and 22, respectively), while the traditional group has 27 and 40 students in the D and E grades. On the other hand, the smart group has a clear advantage in the number of students in the A and B grades (30 and 35, respectively), while the traditional group has only 18 and 20 students in the A and B grades, significantly lower than the smart group, as shown in Figure 5. Overall, the learning outcomes of the smart classroom are better than those of the traditional classroom. Consequently, it can be

concluded that the teaching model of the smart classroom is more conducive to implementing differentiated instruction and personalized teaching for students with different backgrounds.

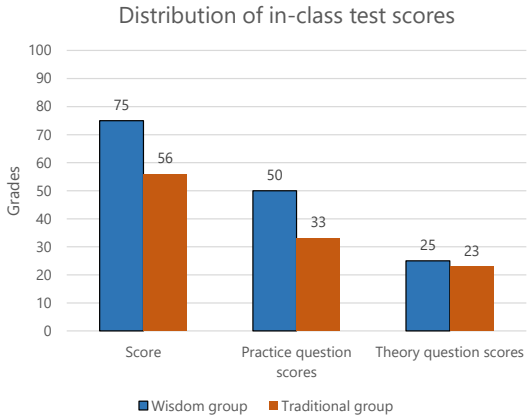

Figure 4 Comparison of in-class test

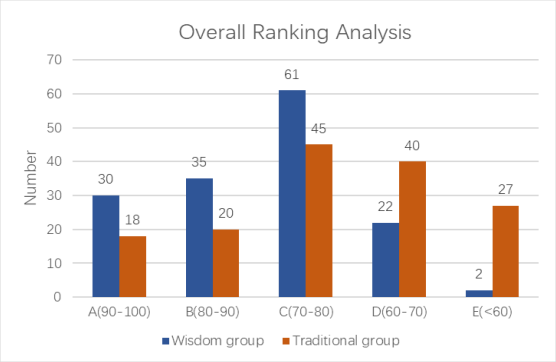

Figure 5 The distribution of the overall score rankings

4.3. Analysis of Teaching Effect of Smart Classroom

A survey was conducted on 150 students participating in smart classrooms. The results analysis shows that 66% of students believe that smart classrooms help enhance self-directed learning ability, 63% of students believe that smart classrooms help improve confidence and public speaking skills, 69% of students believe that smart classrooms help improve analytical and problem-solving skills, 71% of students believe that smart classrooms help enhance teamwork skills, and 80% of students believe that smart classrooms help students understand and master knowledge, as shown in Table 1.

Table 1 Analysis of the results of the survey on student acceptance in smart classrooms.

The content of the investigation item	Yes	(n=150)	No
Smart Classroom helps to improve the ability of self-directed learning.	99(66%)		51(34%)
Smart Classroom helps to improve self-confidence and public speaking skills.	95(63%)		55(37%)
Smart Classroom helps improve analytical and problem-solving skills.	104(69%)		46(31%)
Smart Classroom helps to improve teamwork skills.	106(71%)		44(29%)
Smart Classroom helps students understand and master knowledge.	121(80%)		29(20%)

From the students' perspective, this survey concludes that smart classrooms based on the OBE concept fully embody student-centered and competency-based learning, which helps enhance students' overall quality, strengthen their understanding and mastery of knowledge, better meet students' personalized learning needs, and stimulate proactive learning, thinking, and exploration.

5. Conclusion

Research results indicate that for practical courses like university information technology, the learning effectiveness of smart classrooms based on the OBE concept is significantly superior to traditional classroom teaching. However, smart classrooms require higher preparation from teachers and students compared to traditional classrooms. Teachers should be able to adjust teaching content and strategies according to students' learning progress at each stage, highlighting the student-centered learning concept. From the survey results, some students do not adapt well to the smart classroom model, especially those with weak foundations in information technology. They feel that smart classrooms require a significant amount of effort for pre-class preparation, or they may not fully engage in classroom discussions. Therefore, further in-depth research is needed on how to design smart classrooms based on the OBE concept more effectively to meet the diverse learning needs of different students.

As a new educational model, the integration of smart classrooms and the OBE concept represents a deep fusion of new teaching methods, mature teaching philosophies, and advanced modern information technology. By recording learning data throughout the process, personalized learning resource delivery, integrating online and offline teaching, and diverse and precise assessments, smart classrooms truly focus on student-centered, outcome-oriented education, emphasizing personalized development, and cultivating students' comprehensive qualities[5]. The continuous exploration of smart classrooms in higher education based on the OBE concept will further contribute to nurturing highly qualified talents for the information society's comprehensive development[6].

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