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Research on the Teaching Reform of SketchUp Courses in Application-Oriented Undergraduate Colleges under the "OBE" Educational Philosophy

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Abstract: This article provides an in-depth analysis of the SketchUp course and proposes a series of teaching reform methods based on the Outcome Based Education (OBE) concept. Firstly, clarifying the course objectives is the first step in reform, ensuring that every student is clear about their learning direction and expected outcomes. Second, this study reshapes the teaching concept from traditional knowledge transfer to student-centered, encouraging independent learning and practical exploration. Third, this study reformed teaching methods and contents, adopted project-oriented and problem-oriented teaching strategies, combined with actual cases, and strengthened classroom interaction and practice. Fourth, this study optimizes the evaluation mechanism, establishes a diversified evaluation system, and comprehensively evaluates students' learning outcomes and abilities through various forms such as daily assignments, practical projects, group cooperation, and end-of-term reports. By implementing these reform measures, the research results of this article show that students' practical ability and innovative consciousness have been significantly improved, and the classroom atmosphere has become more active. The reform has also promoted effective interaction between teachers and students, enhanced students' learning enthusiasm and initiative, and made them more actively participate in the curriculum. At the same time, this method effectively solves the problems of insufficient self-learning ability of students and disconnection between course content and industry needs under traditional teaching modes, thus better cultivating applied talents that meet industry requirements.

1. Introduction

The OBE (Outcome-Based Education) concept is an educational model that is based on learning outcomes, where the design and implementation of curriculum should focus on the specific learning outcomes that students are expected to achieve. The article integrates the current status of computer-aided design using SketchUp and introduces the OBE educational concept into the practice of curriculum reform. It clarifies teaching objectives and course positioning, restructures course content, innovates practical teaching methods, optimizes course assessment models, and enhances teaching quality.

2. Overview of the OBE Teaching Concept

OBE is an outcome-oriented educational philosophy that primarily focuses on the specific abilities, knowledge, and skills that students achieve through learning. Its core idea is that the success of education should be measured by the learning outcomes of students, rather than solely by the teaching process. OBE emphasizes active participation from students and focuses on their learning experiences and needs. The teaching process should be flexible and diverse, allowing students to learn at their own pace and in ways that suit them, thereby promoting autonomous learning and exploration.

3. Analysis of the Current Status of Computer-Aided Design SketchUp Courses in Applied Undergraduate Colleges

Currently, most teachers primarily use a "lecture + in-class exercise" teaching approach in the classroom. Teachers demonstrate the operations of the software, and students follow along with practice. This teaching method is too monotonous, often leading to a loss of students' independent exploratory learning thinking, resulting in rigid thinking. While students may be adept at practicing alongside the teacher, they often find themselves at a loss when faced with project practice independently [1].

Moreover, due to the time constraints of the class, teachers often have to speed up the software demonstrations in order to complete the course objectives. This can make it difficult for students with weaker foundations to keep up with the pace of the class, resulting in a loss of interest and enthusiasm for the course.

Some teachers lack proficiency in using SketchUp software and have insufficient practical application experience, which leads to poor teaching outcomes and makes it challenging to inspire students' design ideas and creativity.

Most universities do not update their software in real-time, and teachers do not keep up with the updates of the latest versions of the software. As a result, students are still learning outdated versions, leading to obsolete teaching content and slow updates. This prevents students from fully mastering the skills that are urgently needed in the current industry, causing them to lag behind and resulting in a disconnect from the development of the industrial sector. Consequently, it hinders the cultivation of application-oriented talents and, in turn, affects their career development.

Through the above analysis, it is evident that a comprehensive professional course teaching system has not been established, and the approach is not student-centered or outcome-oriented. Therefore, in response to these issues, teachers should improve their teaching methods to stimulate students' motivation to learn.

4. Reform Strategies for Curriculum Teaching Based on OBE (Outcome-Based Education)

4.1. Define Course Objectives and Reshape Teaching Philosophy and Approach

The SketchUp course for Computer-Aided Design is a required course for the Environmental Design major. Its teaching objectives and positioning are to serve the Environmental Design specialty by providing three-dimensional visual presentation of design proposals. This course is highly practical and has a wide range of applications, including fields such as architecture, urban planning, landscape design, and interior design. Through this course, students will develop the ability to flexibly use software for graphical expression in real case scenarios, enabling them to apply relevant skills in the design field to meet industry demands [2].

Under the guidance of the OBE (Outcome-Based Education) concept, it is essential to clarify the

learning outcomes and objectives of the SketchUp course, which are specifically composed of the following four parts.First, the basic knowledge objective: Students should be able to understand the fundamental functions of SketchUp and its application in the field of Environmental Design. The third aspect is project-based practical skills. By participating in practical projects, students can apply theoretical knowledge in real-world scenarios, enhancing their ability to independently model and render [3].The fourth aspect is teamwork skills. Through group work, students can improve their ability to collaborate within a team and enhance their communication skills. Clear course objectives provide guidance for the delivery of course content.

Based on clear course objectives, educators need to reshape their teaching philosophies and approaches to achieve more effective instruction. The first step is to adopt a student-centered teaching model that emphasizes personalized learning. After completing the foundational theoretical knowledge, educators can use apps like Rain Classroom and Chaoxing to assess students' professional abilities. By considering students' diverse backgrounds, interests, and needs, personalized learning plans and goals can be developed for each student, encouraging them to explore and learn independently. Diverse teaching activities, such as project case studies, extracurricular practice, and interactive discussions, can be used to engage students, stimulate their enthusiasm for learning, and foster intrinsic motivation. Secondly, an outcome-based teaching approach should be adopted, focusing on real-world case studies. This method encourages students to analyze and solve practical problems, thereby enhancing their applied skills and critical thinking through case-based learning [4].

4.2. Improving Teaching Methods

Shifting from traditional content-based teaching to an outcome-oriented approach is essential. In the traditional model, instruction primarily involves the teacher lecturing, with students following along and practicing exercises from the textbook. Student performance is then evaluated through a final exam. This teaching method can easily lead to a loss of students' ability to think independently and diminish their enthusiasm for learning.

By applying the OBE (Outcome-Based Education) philosophy, the traditional lecture-based teaching model is transformed into an outcome-oriented approach. This model emphasizes clear teaching objectives, a structured teaching process, and measurable outcomes. Before teaching begins, specific course goals are established, and the teaching process is then carried out in alignment with these objectives. Computer-Aided Design (CAD) with SketchUp is a highly practical course focused on learning the use of SketchUp software tools and commands. The primary content involves mastering the various functions and features of SketchUp to effectively create and manipulate 3D models. The course content includes the use of basic tools, plugin modeling, CAD drawing modeling, model optimization, and post-rendering presentation.

The overall course structure is divided into two main sections: modeling and post-rendering. In the outcome-oriented teaching model, the instruction is divided into three parts.

The first part focuses on industry understanding, where students learn about the relevance of the course within the industry. This involves understanding what the course can achieve professionally, exploring the application prospects of design renderings, sparking students' interest in the subject, and setting clear learning objectives.

The second part involves achieving the course knowledge content based on the learning objectives. This section utilizes a variety of teaching methods, including foundational knowledge lectures, project case studies, participation in real projects, discussions, and online learning.

The third part focuses on assessment and evaluation. This approach moves away from relying primarily on traditional final exams and emphasizes process-oriented assessment. Students are

evaluated based on their ongoing performance, practice assessments, teamwork, and the outcomes of their final project, providing a comprehensive and multifaceted evaluation [5].

Integrating modern information technology, such as digital tools and online platforms, can enhance students' learning experiences. For example, utilizing Virtual Reality (VR) technology for design simulations allows students to better understand three-dimensional spaces and design effects.

Compared to traditional lecture-based teaching methods, the outcome-oriented teaching model employs various teaching techniques and methods to stimulate students' interest and enthusiasm for learning. This approach also transforms the rigid and inflexible classroom environment.

4.3. Teaching Content Reform

Based on the OBE (Outcome-Based Education) philosophy, which is outcome-oriented and student-centered, course design is approached in a reverse manner. This involves restructuring the course content to align with desired outcomes, reforming teaching materials, and implementing modular design. According to the course objectives, the teaching content can be divided into four modules [6], which are software basic operation, modeling thinking and skills, visualization after rendering and real project practice.

Software Fundamentals: First, guide students to understand the course's position within their field and the application direction of professional skills. Familiarize them with the basic interface and tools of SketchUp, and ensure they master software operation skills. Next, establish an online resource repository. Using a blended learning approach, both online and offline, helps students quickly get started. The online repository will serve as a software operation manual that students can refer to anytime, reinforcing their foundational knowledge [7].

Modeling Thinking and Techniques, this module delves into SketchUp's modeling techniques, including the use of advanced tools and plugin modeling methods. The focus is on developing students' independent modeling thinking, allowing them to master various modeling techniques flexibly and apply them to new scenarios. Students will train through a series of small-scale model exercises, creating a progressive modeling practice library. This hands-on approach helps students consolidate their modeling skills through practical application.

Rendering and Visualization, in this module, students need to master rendering concepts and aesthetic skills. Regardless of the rendering engine used, the process involves composition, material adjustments, lighting and shadow adjustments, atmosphere creation, and post-processing with image editing software. By establishing a rendering model library, students can engage in targeted practice for different scenes and atmospheres. This approach enhances the visual effects of their work and helps improve their design presentation skills [8].

Real Project Practice and Discipline Competitions, through school-enterprise cooperation, arrange students to participate in real projects of enterprises in teams. It encourages students to apply the knowledge they have learned to actual design, and the core of this module is to cultivate students' ability to manage real projects, teamwork skills, and communication skills with customers. It can also be done through subject competitions, where relevant competition content related to the SketchUp course is selected to ensure that the competition aligns with the course objectives. Participate in the subject competition in a team format, and after the competition, whether the result is good or bad, teachers and students should conduct a detailed summary and reflection. This process is very important, as it can help students identify their weaknesses and make improvements.

By modularizing the teaching content and establishing a comprehensive resource library, the course structure is simplified and clarified. This approach helps students systematically grasp knowledge and skills, enhance their practical operation and innovative design abilities, and adapt to industry demands.

4.4. Evaluation and Assessment, and Establishing Feedback Mechanisms

In the teaching reform based on the OBE (Outcome-Based Education) philosophy, especially in the computer-aided design SketchUp course at application-oriented undergraduate institutions, assessment and feedback mechanisms play a crucial role. Effective assessment not only reflects students' learning outcomes but also provides a basis for continuous improvement of teaching. The following includes the assessment and feedback mechanisms for the course, including evaluation methods, feedback channels, assessment criteria, and how to use feedback for course improvement [9].

The OBE (Outcome-Based Education) philosophy is outcome-oriented and focuses on students' learning experiences and needs. It emphasizes process-oriented assessment to continuously monitor students' learning progress and understanding, primarily through classroom performance, periodic tests, project practice, and final evaluations.

Teachers observe students' participation, responses during Q&A, and engagement in group discussions in the classroom, providing real-time feedback. Such observations help to promptly identify students' difficulties in understanding basic concepts and applying skills, allowing for targeted guidance.

At the end of each teaching module, design targeted quizzes to test students' mastery of the knowledge learned.

Students are required to regularly report on project progress during real project practice. These reports should detail the project implementation process, problems encountered, and solutions. Teachers provide feedback and guidance based on these reports.

The final evaluation is conducted after the course ends to comprehensively assess students' overall abilities and the effectiveness of the course. Students are required to present and defend their final projects, with invited industry designers participating in the classroom for a joint assessment. This approach allows teachers to evaluate students' design ideas, presentation skills, and understanding of their own work.

In assessment and evaluation, teachers should provide timely and constructive feedback. Personalized suggestions should be given based on each student's performance to help them identify areas for improvement. Regular targeted feedback discussions should be held, allowing students to discuss their shortcomings or doubts with teachers. Students are encouraged to regularly record their learning process and difficulties, reflecting on their understanding of the content. This helps students self-monitor their learning progress and adjust their learning strategies in a timely manner [10].

Student-centered course improvements should be made based on feedback. Evaluation and feedback mechanisms are not only reflections of students' learning outcomes but also crucial for teachers to refine teaching content and methods. Teaching should be tailored to individual needs according to different evaluation and feedback results. For example, if certain concepts are difficult for students to grasp, teachers can adjust the course content to include additional explanations and exercises. If feedback indicates that some teaching methods are ineffective, teachers should consider adopting new methods, such as introducing more practical cases or using different teaching tools. If students show difficulties with real project performance in evaluations, the course should increase opportunities for internships and practical training. Based on students' assessment results, teachers can provide specific tutoring and training for students with weaker performance to enhance their skills and abilities.

The evaluation and feedback mechanism for the SketchUp course is a multidimensional and multilayered system aimed at comprehensively enhancing teaching quality and ensuring effective student development throughout the learning process. By combining process-oriented assessments

with summative evaluations, teachers can adjust their teaching strategies in real-time. Additionally, establishing various feedback channels helps build a good communication and collaboration environment among students, teachers, and peers, ultimately providing a more comprehensive and effective learning experience for students.

4.5. Establish a SketchUp course studio

Based on the importance and efficiency of the studio-based teaching method, establishing a dedicated studio with a student-centered approach can provide an environment better suited to students' learning needs, enrich teaching resources and learning tools, and enhance students' engagement and practical experience.

Through various course activities, the university ensures that students master the core functions and application skills of SketchUp software to achieve the expected learning results. The university provides technical support for subsequent professional design courses through reverse cultivation.

The studio is operated autonomously by students, with students teaching and supporting each other, serving as an incubator for application-oriented talents. It provides abundant practical opportunities for students to apply their knowledge in real projects, thereby enhancing their practical skills. The studio should have set opening hours to encourage self-directed learning and practice, while also facilitating resource sharing, including teaching materials and successful case studies.

The studio should be staffed with teachers and professional advisors with extensive teaching experience and practical backgrounds to guide students' learning and practice. The advisory team should include professional instructors, academic advisors, and industry experts. Professional instructors are primarily responsible for course planning and teaching, providing guidance on professional skills, and helping students overcome technical challenges. Academic advisors offer guidance on entrepreneurship and career development, assisting students in planning their learning and career paths. The University regularly invites industry experts to give talks and workshops to share practical experience and enhance students' understanding of the industry.

The studio should continuously adjust and improve its functions, course structure, and management methods based on student feedback and assessment results to adapt to industry developments and students' learning needs.

Establishing a SketchUp course studio based on the OBE (Outcome-Based Education) philosophy can provide students with an excellent learning and practice environment, helping them integrate theory and practice in the field of computer-aided design. By setting up well-structured courses, providing necessary facilities, and implementing effective teaching and guidance, the studio can not only enhance students' mastery of SketchUp but also promote their innovation skills, teamwork abilities, and professional qualities, laying a solid foundation for their future careers.

5. Conclusion

This study focuses on the teaching of computer-aided design (CAD) courses, particularly the SketchUp software, and explores the implementation effects and practical significance of the Outcome-Based Education (OBE) philosophy. By analyzing various issues in the current teaching model, such as the monotony of teaching methods, insufficient student engagement, and the disconnect between course content and industry development, we have identified the necessity of OBE-guided teaching reform and proposed a series of practical and feasible reform strategies.

Based on clear course objectives, we closely aligned the teaching content with industry needs and developed teaching goals centered on knowledge, skills, and competencies. This approach ensures that course design focuses more on actual learning outcomes and emphasizes students'

active participation in practice. By focusing on developing students' practical abilities, innovative thinking, and teamwork skills, we have not only enhanced their enthusiasm for learning but also stimulated their potential for self-exploration.

In the implementation process, the course reform focuses on applying various teaching methods to support different student backgrounds and needs. This includes diverse teaching formats such as foundational knowledge explanation, project case analysis, team collaboration, and interactive discussions. This flexible teaching approach advocates for students to apply their knowledge in real projects and encourages them to engage in additional learning and practice outside of the classroom.

By applying the OBE philosophy, the teaching reform of the SketchUp course provides an effective path to enhance students' overall qualities and practical abilities. This study not only offers important references for the reform of similar courses in the future but also lays the foundation for cultivating high-quality, application-oriented talents that meet industry needs. Moving forward, we look forward to continuing exploration and innovation in this field to bring sustained development and progress to educational practice.

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