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Research on the Construction of Virtual Reality Technology Course Evaluation System Based on OBE

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Abstract: *OBE (Outcomes-Based Education) is an education based on learning effectiveness. In essence, it defines the results of students' future learning with professional "core competence" and attaches importance to the cultivation and education of professional knowledge, skills, and attitudes. It is a curriculum activity and evaluation system driven by learning output. This paper is guided by OBE theory and combined with the characteristics of virtual reality technology course practical courses to formulate a feasible practical course evaluation system and preliminarily summarize the relevant elements for evaluating the quality of practical courses, enriching theoretical research in the field of professional practical course evaluation .*

Keywords: *Evaluation System, Outcome-Based Education, Virtual Reality Technology Course*

1. Introduction

Outcome-Based Education (OBE) is an educational approach that focuses on defining clear, measurable learning outcomes as the primary goals of an educational program or course. In OBE, the emphasis is placed on what students should know and be able to do at the end of their educational experience, rather than just covering a specific curriculum or completing a set number of courses.Therefore, William Spady defines OBE as is "Outcome-Based Education means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences. This means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction, and assessment to make sure this learning ultimately happens.OBE Focuses on student learning by Learning Outcomes，learning activities, assessment.OBE is a process that involves assessment and evaluation practices in education to reflect the attainment of expected learning and showing mastery in the area of program.M.I.T Manipal proposes the closed-loop design and course evaluation process of OBE (as show in Figure 1).

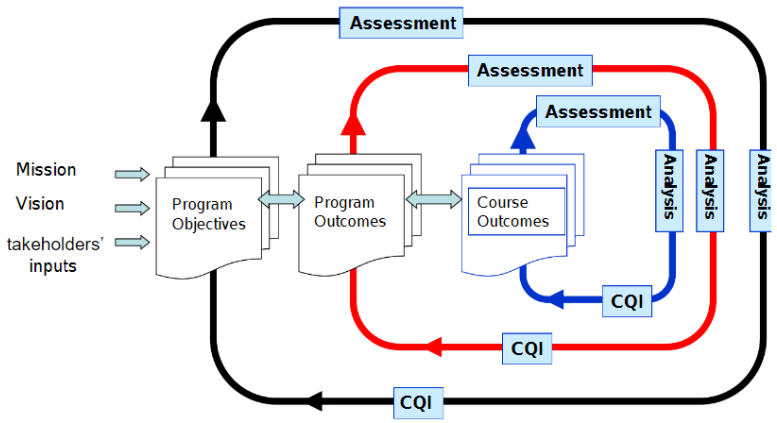

Figure 1: Closed-loop design of OBE.

Therefore, the authors designed the OBE mechanism, such as evaluating the learning process, diversification of evaluation methods, solving practical problems in the evaluation content, and

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establishing an effective evaluation mechanism. Based on the above strategies and combined with the core content of the course objectives, it is believed that the course assessment mode required by the OBE concept should have the following characteristics(as show in Figure 2).

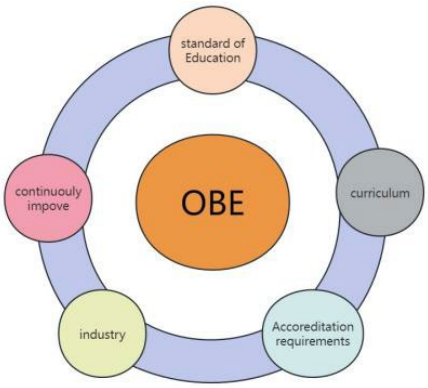

Figure 2:Correlation between OBE and educational courses

1) The evaluation system reflects the "Outcome-Base" characteristics, and the assessment content needs to be designed for the curriculum objectives, which can reflect the ability elements required by the curriculum objectives, so as to guide the teaching; In addition, the assessment method should be conducive to judging the achievement of course objectives, covering all students, and operable.

2) The evaluation system should be "student-centered" to design the evaluation content and method. The primary purpose of course evaluation is to promote students' learning and development, and motivate students with increased learning initiative and enthusiasm, rather than divide students into different grades; the evaluation system examines the level and ability to master and apply knowledge, to reduce the contingency in the assessment process.

3) The evaluation system can help students and teachers to "continuously improve" their learning ability or teaching level. In addition to evaluating students 'learning situation in each stage, it is more important for students to reflect on the immediate evaluation results, adjust and find suitable learning strategies, develop self-evaluation ability, improve independent learning ability and learning enthusiasm; and the feedback information can be used for the continuous improvement of teachers' teaching, enhance the communication between teachers and students, and form a virtuous circle of teaching-evaluation.

This article is based on the participation of the Software Engineering program in engineering education accreditation. Taking professional elective courses "Virtual Reality Technology" in the curriculum as an example, the article conducts research and reform on practical teaching. It also promotes the implementation of this research and reform in the school's assessment reform. In addition, this paper also focuses on the research and design of practical teaching evaluation system based on OBE concept, aiming to continuously improve and continuously carry out research on practical teaching reform, and verifies the rationality and effectiveness of practical teaching reform and curriculum evaluation system through practice.[1]

2. Design Scheme for OBE Practical Teaching Reform

2.1. Issues in Practical Course Evaluation

2.1.1. Insufficient Richness in Evaluation Content

The evaluation content of the Virtual Reality Technology practical course is not distinct from that of other traditional courses. Similar measurement standards are employed, leading to a lack of clear recognition that the evaluation content of practical courses should be based on the characteristics of the discipline and the curriculum. The core elements of the evaluation for practical courses in the Software Engineering program are not well understood. The core elements of the evaluation for professional practical courses are determined jointly by the attributes of the discipline and the course objectives.

2.1.2. Lack of Broad and In-Depth Participation of Evaluation Subjects

Practical course evaluation is closely linked to the needs of diverse subjects. Diverse subjects refer to

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the groups that make value judgments on practical courses. Influenced by the characteristics of the discipline and the features of practical courses, computer design-related practical courses encompass numerous experimental and training projects. The smooth execution of these projects inevitably requires the participation of various subjects, including educational administrators, curriculum experts, teachers, students, and employers from enterprises. These evaluation subjects represent their respective interests and have different value judgments on practical courses. [2]

2.1.3. Insufficient Evaluation Feedback

First of all, teaching managers failed to provide timely feedback on the evaluation results of practical courses, which resulted in teachers not being aware of the shortcomings of practical courses. Therefore, it was impossible for teachers to improve practical courses. Secondly, teachers have the highest proportion of using summative assessment methods in practical class evaluation, which means that they are more accustomed to using test scores to give feedback to students. This method of evaluation and feedback cannot allow low-scoring students to correctly understand their own performance. There are deficiencies in some aspects that prevent students from effectively improving their abilities.

2.2. Reform Plan Design Goals

Traditional education is subject-oriented, it follows the principle of professional setting according to the discipline, education mode tends to solve the certain, linear, static closed problem of scientific mode, knowledge structure emphasizes systematic and complete knowledge system, and teaching design pays more attention to the needs of the discipline, and to a certain extent, ignored the professional needs. Results-oriented education follows the principle of reverse design, and its "reverse" is relative to the "positive" of traditional education. Reverse design starts from the demand (including internal demand and external demand), and the demand determines the training objectives, the training objectives determine the graduation requirements, and then the graduation requirements determine the curriculum system.Positive design starts from the curriculum system, the reverse process to the graduation requirements, to the training objectives, and then to the requirements. However, at this time, the demand can generally only meet the internal demand, but not necessarily meet the external demand, because it is the result of education rather than the goal of education. Therefore, the traditional education industry, employers, and other external needs can only adapt to, but it is difficult to meet.

Introducing the OBE concept and flexibly carrying out practical teaching activities by being result-oriented, student-centered, and task-driven can enhance the effectiveness of practical teaching and stimulate students' interest in learning.

2.2.1. The OBE Concept Emphasizes Students Personalized Independent Learning

Each student can choose one question from the topics specified by the instructor or draw up a question of his own. The course design topic is required to be in line with engineering reality, and must have a certain level of difficulty and sufficient workload; the course design topic should be a complex and fully designed project system, which must be solved through analysis using in-depth engineering principles; the course design topic generally needs to involve Multi-faceted technologies, such as software engineering concepts, programming models, and encourage students to transform their participation in college student innovation and entrepreneurship training projects and college student science and technology competitions into course design topics; The design content is deeply open, combined with the ability of students, and some design content can be further deepened when completing basic design tasks. [3]

2.2.2. Practical Teaching Focuses on Cultivating the Spirit of Teamwork

Multiple students can work in teams to complete a course design topic.This not only cultivates students' ability to solve purely technical problems, but also cultivates students' comprehensive ability to adapt to the environment, communicate with others, cooperate with others, and coordinate all aspects of relationships.

2.3. Virtual Reality Technology Course Evaluation Process Based on OBE Concept

Through research on the training objectives and graduation requirements for software engineering majors, new course objectives and results are proposed for "Virtual Reality Technology" and the main teaching content is designed correspondingly, as shown in Table 1.

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Table 1: Course objectives and outcomes and corresponding teaching content.

Course objectives and outcomes	Corresponding teaching content
Goal 1: Be familiar with the basic concepts and terminology of virtual reality systems, master the development methods of virtual reality systems, understand the related software and hardware equipment of virtual reality, and virtual reality development methods.	(1)Basic concepts and terminology of virtual reality systems (2)the development methods of virtual reality systems (3)virtual reality development methods
Goal 2: Master virtual reality engine tools, commonly used development tools, and be proficient in using virtual reality software and hardware equipment for comprehensive case simulation, software and hardware construction, project implementation, and deployment and operation.	Unity software develops virtual reality product projects
Goal 3: Be able to write a curriculum design report that meets the requirements according to specifications. The format and requirements for writing a design report	Format and requirements of the design report
Goal 4: Be able to state and speak on design problems, express design ideas and plans, and communicate effectively with classmates and teachers.	(1)Communication and communication skills with classmates and teachers in the course design process; (2)Communication and communication skills in the defense process

2.3.1. Process Assessment Design and Implementation

The main purpose of the practical course teacher assessment is to assess the achievement of the course objectives. The assessment items include three parts of: process assessment, achievement assessment and defense assessment, and the weight of the total evaluation results is 0. 2,0. 4 and 0. 4, respectively. The allocation table of assessment objectives and assessment observation points are shown in Table 2.

Table 2: Allocation table of various assessment objectives and assessment observation points.

program objective	Process assessment	Results assessment	Defense assessment	Total evaluation rating	
	Target score	Target score	Target score		
Goal 1	50	20	30	process assessment*20% +results assessment*40% +defense assessment*40%	30
Goal 2	30	20	30		26
Goal 3	5	60	0		25
Goal 4	15	0	40		19
Total	100	100	100		100

Process assessment results, achievement assessment results and defense assessment results are 100 percent, and the overall evaluation results are approved by a five-level system, among which 90 or above is "excellent", 80-89 "good", 70-79 "medium", 60-69 "pass", and 60 below "fail". The achievement of practical course objectives is evaluated by using the achievement of total course objectives, as shown in equations 1 and 2.

$$\text{Goal achievement degree}=Sa/Ta \quad (1)$$

$$\text{Total of course goal achievement degree}=St/Tt \quad (2)$$

So Sa is actual average score of single-objective students, and Ta is the target's rated point value of single-objective.St is average score of total students, and Tt is the total of the target's rate point value.The target rating in the denominator of Equations 1 and 2 is shown in Table 2. Set the target values of "Virtual Reality Technology" sub-goal attainment and overall goal attainment to 0.65.

2.3.2. Student's Self-Evaluation Mechanism

After the practical course, students are organized to conduct self-evaluation of their learning effects, emphasizing self-comparison to see whether they have reached self-reference standards, thereby continuously improving students' learning initiative. Based on course objectives 1-4, students' self-evaluation is given, including course objectives, corresponding main teaching content, and students' self-

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evaluation values for the course objectives. The self-evaluation value adopts a 5-point scale. Students evaluate themselves based on their actual learning situation and mark "√" on the corresponding score. Taking the self-evaluation of the 2001 students of the software engineering major at Sanya University in the spring semester of 2022-2023 as an example, the statistical results of the self-evaluation goals of student learning effects are shown in Table 3.

Table 3: Students' self-evaluation target achievement degree statistics.

Statistics	Goal 1					Goal 2					Goal 3					Goal 4					total
Goal	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1	
The proportion	46.4	45.7	7.9	0	0	50	49	1	0	0	60.5	39.5	0	0	0	65.8	31.6	2.4	0.2	0	
Goal evaluation	0.87					0.89					0.92					0.93					0.90

The total score of students' self-evaluation of goal attainment is the average of the previous four goal attainments. It can be seen from Table 3 that the students' self-evaluation learning effect is generally excellent, and the target evaluation value is 0.90. This shows that the students believe that they can better design the project system according to the design requirements of virtual reality technology; they can better apply Unity software to Test and simulate the project system; be able to write a course design report that meets the requirements in accordance with the specifications; be able to speak on design issues, express design ideas and plans, and communicate effectively with classmates and teachers. Through the dual analysis of teacher assessment and student self-evaluation mechanisms, it can be seen that the "Virtual Reality Technology" practical teaching course based on the OBE concept has achieved the teaching objectives. [4]

3. Conclusions

As an advanced educational concept, achievement-oriented education has been in theoretical and practical exploration in the United States and other countries for many years and has formed a relatively complete theoretical system and implementation mode, which has proved to be the correct direction for higher engineering education reform. To make China's higher engineering education better adapt to the needs of the state and economic and social development, and meet the challenge of the new industrial revolution, we need to under the guidance of the achievement-oriented education concept, actively promote the education teaching reform, strive to realize the three changes, namely: from subject orientation to goal-oriented, from teacher center to student center and from quality control to continuous improvement.

The OBE concept is introduced into the practical teaching of virtual reality technology, with the cultivation of students' practical awareness and innovative thinking as the breakthrough, and the close combination of students' practice, compulsory training and target results, the practical teaching and learning content are studied, and the system is optimized to improve students' learning desire and learning motivation, and enhance the effectiveness, flexibility and scientificity of practical teaching.The evaluation of learning results is an important link in OBE education mode, by the teachers' assessment and student self-evaluation of dual evaluation mechanism, pay attention to the usual evaluation combined with the ultimate evaluation, pay attention to the combination of qualitative evaluation and quantitative evaluation, pay attention to the unified evaluation and personalized evaluation, realize the evaluation of regular, diversification and rationalization. According to the students 'learning situation, the curriculum will join in each link of curriculum design teachers and students "reflection link" , actively guide teachers and students critical thinking of curriculum design project, found the problem timely adjustment, to promote teachers to improve the teaching process and teaching methods, improve students' understanding of practice and related theoretical knowledge, and understanding, and to better achieve the goal of the course.

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