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Curriculum System Reform in the Industry-University Cooperative Education Model Based on OBE

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Abstract: Firstly, the Outcome-Based Education (OBE) theory and the industry-university cooperative education mode are studied, and then the current situation and existing problems of virtual reality education are analyzed. On this basis, taking the course "Virtual Reality Applications" of the digital media art major at Zhejiang Normal University as the object, industry-university cooperative education as the path, a curriculum system reform guided by the OBE is designed and implemented. This reform is output-oriented, result-based, reverse-designed to create a curriculum system. Through online and offline blended teaching and multi-evaluation, so that enterprises can participate in all stages of the process. Through this reform, the innovation ability of students will be improved, and the disconnection between talent training and industry demand will be avoided, so as to improve the quality of talent development.

Key words: OBE, industry-university cooperative education, curriculum system reform

1. Introduction

With the development and maturity of virtual reality (VR) technology, VR technology has been widely used in education, entertainment, medical and other fields. Content development and creativity based on virtual reality technology also show great market value and development potential. As an important course to train students to master VR technology and its application ability, the curriculum system reform of “Virtual Reality Application” is particularly important. This reform aims to develop VR content development talents who meet the market demand and industry norms through industry-university cooperative education based on the OBE theory. Under the background of industrial upgrading and employment market fluctuations, this reform has high theoretical value and practical significance, and also provides a reference for related courses in other colleges and universities.

1. 1 OBE Concept

The concept of OBE (Outcome-Based Education) was first proposed by Spady (1994) in 1981. He believes that OBE is that every activity design in the education system should be based on the final learner learning outcomes. The concept of OBE focuses on the expected outcomes of students in the learning process, and organizes various links in education and teaching around the expected outcomes (Wang, Hu, & Duan, 2019). OBE has the following implementation principles: clearly focus on the final output of learners; reverse design around the expected output; expand the opportunities for students to succeed and provide assistance; and have high expectations for students to succeed (Basim & Hazim, 2010). In recent years, it has been widely applied to the cultivation of engineering education talents, the reform of education and teaching, and the construction of specialties in colleges and universities. As an

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interdisciplinary subject, design has put forward new requirements for the cultivation of compound talents. The concept of OBE provides a new idea for the teaching reform of interdisciplinary courses.

1.2 Industry-university cooperative education mode

Industry-Academia Collaboration is an important measure for applied universities to adapt to the needs of new technology and economic development, carry out new engineering research and practice, and realize the cultivation of innovative and entrepreneurial talents (Zhong, 2017). "Industry" refers to enterprises, which provide funds, resources, technology, teachers and other support, participate in the whole process of students training, and share the results of students training. " Academia" is a university, which adjusts its school-running concept, specialty setting, curriculum system and teaching methods according to the needs of enterprises and the development trend of industry, so as to realize the deep docking with enterprises and share the achievements of talent training with enterprises. There is also a third subject, often a government agency, which serves as a bridge for industry-university collaboration and provides support and guarantee for the collaboration. Industry-university collaboration organically combines the different advantages of enterprises and universities, and is a cooperative behavior in which both schools and enterprises reorganize and share resources, technology and funds after balancing their own and common goals (Ye, 2020). Industry-university cooperative education refers to the deep cooperation between higher education institutions and relevant enterprises in talent development, scientific research, social services, and other aspects based on their established majors (Tang, Wen, & Peng, 2018).

1.3 Teaching reform under the mode of industry-university cooperative education based on OBE

Teaching reform based on OBE and talent training model of industry-university cooperative education are two hot spots of talent construction at present. Although the former focuses on the quality evaluation of talent development, the latter focuses on the path and mode of talent development, both of them emphasize the orientation of industrial development needs and the output of talent training. The mode of industry-university cooperative education based on OBE is a training mode which aims to improve learning outcomes and train high-quality students to meet the needs of society through deep collaboration between industry and universities. This training mode realizes the deep integration of academia and industry by defining training objectives, strengthening practical teaching, deep participation of enterprises, and encourage innovation, which provides a strong guarantee for talent development. Using the theory of OBE to guide the teaching reform under the mode of industry-university cooperative education, the reform objectives will be more clear and focused, and the reform plan will ultimately be designed and organized around the learning outcomes. OBE theory promotes the reform of cooperative education mode, and cooperative education also broadens the application scope of OBE theory.

2. Analysis of the Current Situation of VR Education

As a new information technology, VR technology has been successfully applied in entertainment games, education and training, cultural tourism, industrial production, medical health, emergency drills and other fields (yuan, Lv, & Feng, 2024). Due to the rapid development and high-speed integration of VR and artificial intelligence technology, the demand for content development based on virtual reality technology is also growing rapidly, the distribution pattern of industrial clusters is obvious, and the demand division is more clear, which puts forward new requirements for talent development in the field of VR.

2.1 VR education cases

From the situation of setting up virtual reality courses, many colleges and universities have set up corresponding courses, from undergraduates to postgraduates, from shallow to deep, from easy to difficult. Different universities have different emphasis on teaching content, and there are also some differences in specific teaching content (Liang & Sheng, 2013).

East Carolina State University takes the

application of VR in education as the starting point, focuses on the application of VR technology in education scenarios, and helps improve teaching efficiency and solve the problems of traditional education through the combination of hardware and software and interactive three-dimensional network application. The virtual reality course offered by Tampere University of Technology in Finland covers a wide range of contents, including distributed VR and augmented reality, in addition to the basic content of VR.

In China, both engineering majors and art majors offer courses related to virtual reality, but there are obvious differences. For example, both digital media technology and digital media art offer courses related to virtual reality, but their emphasis will be different. This difference is mainly reflected in the curriculum content and training objectives. Virtual reality courses for engineering majors pay more attention to the training of technology and engineering, aiming at cultivating technological innovative talents with solid theoretical foundation and skills. For example, Tsinghua University has opened the course of Virtual Reality Technology, which enables students to master the key technologies, development environment and platform construction of virtual reality through the study of basic theories, basic algorithms, development methods and mainstream systems of virtual reality. Virtual reality courses for art majors may focus more on the cultivation of creativity and artistic expression, aiming at improving students' creative skills and content innovation ability. For example, the course “Virtual Reality Application” offered by the digital media art major of Zhejiang Normal University enables students to plan, design and produce VR products that integrate artistry, technology and usability through the study of the basic theory, application frontier and development software of virtual reality. This paper takes the course of Virtual Reality Application in Zhejiang Normal University as an example to reform the curriculum system.

2.2 Current problems in VR education

As the core course of digital media art major, “Virtual Reality Application” plays a very important role in developing artistic innovation ability, strengthening practical creation ability and improving project development and team cooperation ability on the basis of students' understanding of cutting-edge technology and software operation. However, there are the following problems in the previous course teaching: (1) The teaching content of the course is not closely integrated with the industry or the actual industry, and the course content lags behind the development of technology. (2) The teaching form of the course is relatively single, students feel boring and abstract, only some students can actively participate in teaching activities, learning enthusiasm has not been fully mobilized, and the ability to solve practical problems is difficult to develop. (3) The evaluation system is obsolete, which can not timely and objectively evaluate the learning results and multiple abilities.

Through the in-depth analysis of the existing problems of virtual reality education, combined with the characteristics of digital media art professional training, the concept of OBE and mode of industry-university cooperative education are introduced into the reform of curriculum system, aiming at exploring the feasible path and transplantable scheme to solve these problems. The evaluation system based on OBE sets a benchmark and a clear goal for the curriculum construction of “Virtual Reality Application” course, while the industry-university cooperative education provides a method and endogenous power for curriculum reform.

3. Curriculum System Reform of “Virtual Reality Application”

With the support of the Ministry of Education's Industry-Education Cooperation and Cooperative education Project, the author fully investigates the relevant enterprises, and finally chooses Shanghai Sanmei Company as the object of this reform. Sanmei Company has the top R & D team in the VR industry, 100% of its employees have bachelor's degree or above, and more than 80% of its employees have master's degree or doctor's degree. It has the complete virtual reality product integration capability and technical solutions. The biggest characteristic of the course of Virtual Reality Application is its application and frontier, so the content and evaluation criteria of the course reform must come from the production

practice of enterprises. Make full use of the industry-university-research cooperation platform with Samadhi Company, deeply participate in course content design and teaching evaluation, and promote the integration of enterprise needs into talent development. The framework of curriculum system reform is shown in **Figure 3.1**:

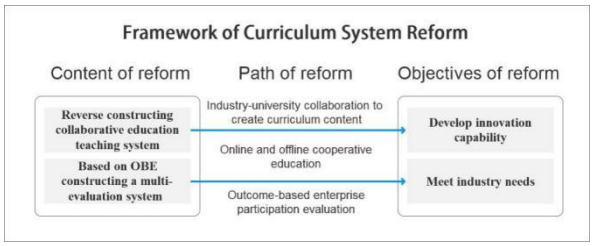

Figure 3.1 curriculum system reform framework (from self-drawing)

"Virtual Reality Application" curriculum system reform ideas: take the output as the guidance, take the achievement as the evaluation, reverse design the curriculum system, through online and offline blended teaching and multiple evaluation, so that enterprises can participate in the whole teaching process, and then realize the curriculum system reform under the mode of industry-university cooperative.

3.1 Reform objectives

(1) Improve students' ability of innovation

Enterprises participate in the formulation of teaching objectives and contents, and improve students' innovative thinking and practical ability through the joint guidance of subject competitions and project development by teachers and enterprises.

(2) Develop applied talents to meet the needs of industry

Through the reform of the curriculum system, this paper explores the feasible scheme and effective path to realize the cooperative education of production and learning. On this basis, this exploration will be more applied to other courses, and then the mode of industry-academia collaboration will be truly integrated into the training system of applied talents, rather than a superficial slogan, so as to train applied talents that truly meet the needs of industrial development.

3.2 Content and implementation of curriculum reform

Construct the curriculum system of “Virtual Reality Application”: based on the theory of OBE, introduce advanced technology and application cases of enterprises, set teaching objectives, create teaching content and come to evaluation through the industry- university collaboration, adopt online and offline teaching mode, and carry out multiple evaluation of students. In order to develop the multiple literacy and innovation ability to meet the needs of industrial development, and feedback the teaching achievement to enterprises, reflect problems with enterprises, and form a closed-loop of continuous improvement of curriculum quality. The reform content and path are shown in **Figure 3.2.**

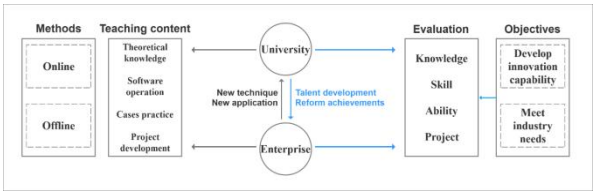

Figure 3.2 reform content and path (from self-drawing)

(1) Reverse teaching design

The reverse teaching design should be guided by the outcomes. Firstly, according to the current needs of the industry and the characteristics of students majoring in digital media art, the teaching objectives and results of the course "Virtual Reality Application" are developed together with enterprises. Then, based on the teaching objectives, the evaluation of the course is formulated, and the evaluation indicators for students' output is divided into four dimensions: knowledge dimension, skill dimension, ability dimension and project dimension. Then, according to the evaluation indicators, the modular design of the teaching content is divided into four modules: theoretical knowledge, basic operation, practical cases and project development.

(2) Creation teaching content through industry-university collaboration

Cooperate with Sanmei Company to develop a detailed course outline according to the needs of the industry and the orientation of the course, so as to ensure that the teaching content covers both basic theory and practical application. Then, the knowledge points of the teaching content are decomposed according to the achievement objectives, and the contents of the chapters are

re-integrated and adjusted. Combining excellent cases of enterprises with teaching practice, it is a typical case for qualified digital media art students to learn. According to the development of industry and technological progress, the course content is updated regularly to ensure the timeliness and frontier of the course content.

(3) Implementing online and offline collaborative teaching

According to the characteristics of the four modules of the teaching content, online and offline collaborative teaching is adopted. Basic knowledge and basic operation skills are mainly taught online through videos recorded by the school teaching team. After online learning, students now conduct online discussions and answer each other's questions independently. After summarizing the questions, teachers answer online questions. In this process, teacher-student collaboration and student-student collaboration are realized. Practical cases and project development modules rely on subject competitions and projects given by enterprises to carry out offline teaching, while enterprises will provide online guidance in the process to achieve collaborative teaching between schools and enterprises. Teachers and enterprise technicians jointly serve as tutors, focusing on cultivating students' ability to analyze and solve problems as well as teamwork, stimulating their interest in learning, improving their self-learning ability, achieving personalized learning, allowing students to improve and develop in self-learning, and increasing the vitality of teaching.

(4) Multiple evaluation based on OBE

It combines process evaluation with peak evaluation, online evaluation with offline evaluation, and comprehensively judges students' learning ability, aesthetic ability, innovation ability, practical ability and cooperation ability from knowledge dimension, skill dimension, ability dimension and project dimension through teacher-student mutual evaluation, student-student mutual evaluation and enterprise participation. The comparison of evaluation content and indicators is shown in Table 3.1.

Table 3.1 Comparison of Evaluation Contents and Indicators

Evaluation dimension	Evaluation content	Competency indicators
Knowledge dimension	Fundamentals of VR	Basic theory and knowledge in the field of VR
Skill dimension	Software skills	Knowledge and application skills of software
Competence dimension	Professional competence	Aesthetic attainment and creative thinking; International vision and cultural accomplishment; Professional norms and values
	Skill application ability	Analyze problems; Design solutions; Implementation of the solution
Project dimension	Project innovation and practice ability	Preliminary research and demand analysis; Project development and practice; Display design and publicity operation and maintenance
	Project management and partnering capabilities	Divide project tasks and objectives; Control project process and specification; Communication, cooperation and respect

Source: from self-drawing

(5) Feedback and continuous improvement

Establish a curriculum feedback mechanism, regularly collect opinions and suggestions from students, teachers and enterprises, and continuously improve and optimize the curriculum system and teaching methods. According to the students' learning results and evaluation feedback, we will work with enterprises to improve the course teaching content and cases. Summarize the experience in the curriculum reform, apply it to the new round of teaching, and continuously improve the quality of the course.

3.3 Achievements of curriculum system reform

After one year's implementation of teaching reform, some achievements have been made, the reform objectives have been basically achieved, and the quality of students training has been promoted. The main manifestations are: 1) The combination of curriculum objectives and career development makes students' learning objectives clearer and improves the learning effect of the course. 2) The combination of individualized teaching and diversified evaluation makes students more active in learning and enhances their interest in the course. 3) With the implementation of case teaching and project-driven, students get more opportunities to practice and improve their practical ability and innovative and entrepreneurial ability. 4) Teachers participate in enterprise practice and project research and development, strengthen communication and cooperation between teachers and enterprises, and improve professional skills and teaching level.

4. Conclusion

The design, implementation, and results of the curriculum system reform of "Virtual Reality Applications" are presented, which is in the mode of industry-university cooperative education based on the OBE. By involving enterprises in the entire process of teaching design, online and offline teaching, and course reflection at each stage, the teaching quality of the course and students' practical abilities can be significantly improved. In the future, with the s deepening of industry-academia collaboration and the improvement of collaborative education model, the reform of the "Virtual Reality Applications" curriculum system based on the OBE will be an effective way to adapt to the rapid development of the VR industry and train high-quality VR application talents. At the same time, this also provides useful reference and inspiration for the reform of other professional curriculum systems.

Conflict of Interest

The author declares that she has no conflicts ofinterest to this work.

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