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A Preliminary Study on Education and Teaching Based on the Concept of Metaverse—Take "Information Technology" as an Example

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Abstract. Based on the concept of the educational Metaverse, this paper combs the theoretical basis, development process and application scenario of the Metaverse. For the course of information technology, the blended teaching practice based on the concept of Metaverse is carried out, including the design of teaching process, the integration of teaching platform, the construction of resources and the setting of evaluation method. We have designed a teaching scheme based on the concept of Metaverse, including the integration of online teaching platform, resource construction and deployment, assessment design and so on. The teaching has been implemented in the advertising major from 2019 to 2021, and it is found that the teaching effect has been significantly improved.

Keywords. Metaverse Education; Blended Teaching; Computer general Education

1. Introduction

1.1. Educational Metaverse

Facebook changed its name to "Meta" in 2021, and announced that it would invest \$15 billion to support the creation of Metaverse content. Facebook is exploding the Metaverse all over the world. Microsoft defines Metaverse: A digital world that is persistently and stably connected to the real world[1]. Metaverse leads the intelligent reform of education. Educational Metaverse applies emerging information technologies such as Internet Plus, artificial intelligence, big data and blockchain to the field of education [2]. Metaverse creates digital world for teachers, students, administrators and other stakeholders, opens up formal and informal teaching places in the virtual world, and allows teachers and students to interact in virtual teaching places.

The educational Metaverse can break the boundaries of time and space, realize the upgrading of traditional education models. It can enrich teaching resources and highly simulate human-computer interactive learning. Another major advantage of Metaverse is to enhance students' imagination and creativity by constructing practical scenarios provided by virtual space[3]. Metaverse will change the cramming-style teaching, reshape classrooms, improve learning efficiency, and stimulate students' creativity[4].

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With the rise of the concept of Metaverse, it has become the direction of higher education to construct virtual experimental teaching platform and virtual laboratory by using new information technology. It has become an inevitable trend for the innovation and development of colleges and universities to solve the gap between knowledge learning and practical skills acquisition by Metaverse technology.

1.2. The significance of the educational Metaverse

The integration of virtual and real, online and offline features of the educational Metaverse will greatly expand the space-time boundary of teaching and learning. Virtual reality and other technologies are used to create futuristic learning experiences and immersive scenes. Through sharing and connection, the educational Metaverse can provide participants with a highly immersive and naturally interactive teaching environment that integrates virtual reality and promotes the visualization of learners' thinking. Educational Metaverse creates an immersive teaching interaction field for teachers and students, which can meet the needs of teachers and students in both real and virtual teaching. [5]. It makes people's cognitive world and the perceptual world of virtual and real symbiosis realize the reintegration [6].

1) Metaverse empowers a smart educational environment. Learners can edit and create scenes, products and even ideas in the Metaverse, and change the training mode of innovative education and innovative thinking. Real-world users will have ID identities in the Metaverse and be responsible for them, just like our health codes, one for each person; Therefore, all the activities of users in the Metaverse can be recorded, guided and evaluated through big data and blockchain. It can simulate all kinds of real teaching events, such as preparation of teaching activities, questions and answers between teachers and students, and violations of discipline in class.

2) Metaverse provides immersive educational resources. The Metaverse can provide a multi-modal environment for learners to feel multi-modal resources and generate immersive learning experience. Learners gradually go from initial participation to embodied experience and finally fully immersed in resource interaction. Educational resources can be co-built and shared by multiple parties (including learners, teachers, educational administrators, enterprises and governments).

3) *Metaverse realizes personalized learning activities*. Educational Metaverse can provide intelligent educational environment, diverse resources. It can meet the needs of personalized activities and enable learners to achieve personalized learning according to their own learning and cognitive style.

4) *Metaverse realizes intelligent teaching evaluation.* Through the long-term storage and real record of education big data, the learning portrait of learners is established. It is helpful to realize comprehensive, comprehensive and developmental intelligent teaching evaluation in the Metaverse, including multi-subject evaluation, multi-dimension evaluation, process evaluation, authenticity evaluation and precision evaluation.

1.3. "Information technology" Course

With the enhancement of our country's comprehensive national strength and the continuous improvement of the level of education and scientific research, more and more international students come to study in China. Information technology course is one of the basic courses that overseas students need to learn, which can improve students'

information literacy and cultivate students' ability to use digital tools for learning and interdisciplinary innovation. With the rapid development of information technology, it has been rapidly integrated into some traditional disciplines and has been widely used. The lack of information literacy will seriously restrict professional development of college students.

Information Technology is a required course of computer general education for overseas Chinese students. It mainly covers the basics of information technology and introduces new technologies and their applications for freshmen. The course setting 3 credits and 72 credit hours. Students come from all over the world, with relatively weak mathematical foundation, great differences in educational background and learning basis, and great difficulty in learning courses. In addition, during the COVID-19 pandemic, a considerable number of students could not return to campus, the urgent problem to be solved now is how to improve students' information technology ability through the reform of teaching mode and teaching content [7].

1.4. Our work

Taking the course of "Information Technology" as an example, this paper shows the course design based on the concept of the Metaverse, and carries out the teaching implementation. Through comparison, it has found that the teaching effect is greatly improved with the idea of Metaverse, especially the failure rate is greatly reduced.

The second part of this paper introduces the theoretical basis, development basis and application scenario of the Metaverse. The third part introduces the information technology course of Jinan University for overseas Chinese students from Hong Kong, Macao and Taiwan. Based on the concept of Metaverse, we present the teaching process design, teaching platform integration, resource construction and evaluation method. The fourth part shows the teaching practice effect of the 2019-2021 class, and obtains students' evaluation feedback in the form of questionnaire, so as to facilitate further teaching reform.

2. Related Work

2.1. Theoretical basis for Metaverse education

The educational Metaverse is not only reflected in the construction of intelligent environment, the innovation of expression form and the reengineering of operation process, but also the innovation of theoretical framework. The innovation of theoretical framework will promote the sustainable development of online education in the Metaverse. According to literature [8], the theoretical basis of the Metaverse, which is shown in Figure.1, includes the following aspects:

a) Learning theories. Study new learning theories, extensively absorb the research results of learning theories such as behaviorism, cognitivism, constructivism and connectivism, research new theories of contextual learning with embodied cognition as the core, and focus on the internal learning of learners.

b) Teaching theories. Study new teaching theories, explore the realization forms of "teaching-centered", "learning-centered" and "dominant-subject" theories in Metaverse, and constantly try to construct innovative teaching theory in embodied space.

c) Education model. Innovate research methods, which promote the transformation of research paradigms based on big data, focus on the scientific governance of learners' whole-process learning behavior data and biological data, and carry out multi-modal integration research and evidence-based educational research.



Figure 1 The theoretical framework of education in the era of smart education

2.2. Development History of Educational Metaverse

The development of the Metaverse is shown in Figure. 2. It requires the traction of giant companies and the efforts of the industry chain. It will not be able to show a revolutionary change in social life in a short period of time. The educational Metaverse is a typical application of Metaverse, and its development will also follow the principle of step-by-step. According to the characteristics of the education industry, it can be divided into four stages: desktop virtual reality, immersive virtual reality, digital twin and true educational Metaverse [6].



Figure 2 Development History of Educational Metaverse

3. "Information Technology" curriculum design based on Metaverse

3.1. Teaching activity design

The educational Metaverse smart learning space includes: resource ecology, social interaction, inquiry learning and evaluation system. The teaching design based on the concept of Metaverse needs to use modern learning theory, network environment and multimedia technology to plan the entire teaching system. The detailed planning of teaching design needs to be carried out in stages. According to the existing teaching experience and teaching research results, it is divided into four parts in Figure 3.



Figure 3 Instructional Design Process

3.2. Platform Integration

As shown in Fig. 6, we divide the Metaverse learning space into three levels: curriculum circle, campus circle and social circle. Metaverse platforms of campus circle for IT courses includes Rain Classroom, School Online, Tencent Classroom, course self-built platforms and WeChat public accounts.



Figure 4 Metaverse Learning Space

Jinan University has introduced the Rain Classroom Smart Teaching Professional Edition platform, which can organically integrate tools into daily teaching, optimize teaching resources, teaching process, and teaching full-cycle data analysis and teaching evaluation, etc., quantify learning situation to help teachers accurately teach, and realize wisdom-based teaching. Blended Smarter Teaching for Teaching Applications. Rain Classroom can realize the implementation of teaching activities in the three processes of pre-class, in-class and after-class, and can effectively record the basic data of students' learning anytime and anywhere, especially the "real-time monitoring" and "after-class homework" parts are very effective.

3.3. Resource Construction and Assessment Design

Including theoretical explanation videos, operation demonstration videos, group discussion topics, mock test question bank, work case bank, graphic materials, ideological and political exercises. According to the characteristics of the "Information Technology" course and the characteristic background of external enrollment, the main points of course resource construction have been designed. So far, a curriculum based on Rain Classroom, Tencent Classroom, School Online, the course's own platform, WeChat public account, etc. has been built. The course evaluation includes outcome evaluation and process evaluation, each accounting for 50%. Process evaluation contains online MOOC, Group work design, classroom performance and so on.

4. Teaching application effect

"Information Technology" has started to build and implement smart teaching based on Rain Classroom since 2018, and has achieved good teaching results. Here, the advertising major is used as an example to analyze the teaching effect.

4.1. Teaching Implementation

Since 2019, this course has started to carry out smart teaching based on Rain Classroom. The Platform is shown in Figure 5. So far, it has been deployed on platforms including Rain Classroom, Tencent Classroom, School Online, the course's own platform, and

WeChat official account. The major has carried out teaching implementation, including 1834 students in the grade 2020 and 1917 students in the grade 2021.

The teaching resources deployed on various platforms include: (1) Rain Classroom: 1 set of lecture slides (including 200+ practice questions), 7 sets of test questions, 56 videos, and 27 audios. (2) Online MOOC: 50 videos, 10 graphic units, 27 discussion topics, 18 homework units, 3 exam units, and 543 questions. (3) Tencent Classroom: 49 theoretical video explanations, 51 experimental video explanations and reference materials. (4) Course platform: simulation test system, syllabus, lecture notes, experimental materials, reference materials, etc.



Figure. 5 Online platform and tool usage

4.2. Analysis of final grades

Here, we mainly compare the final evaluation results of the 2019, 2020 and 2021 classes of the "Information Technology" course. There are 124 students in the 2019 class, 125 in the 2020 class, and 71 in the 2021 class. The class of 2021 has been divided into classes, so the class is smaller. The comparison of teaching effects is shown in Figure 6.Through the comparison, it is found that:

- With the continuous use of the online platform, the proportion of unqualified people is decreasing year by year.
- The grades of 2021 are relatively close to normal distribution, with the highest proportion of 70-80 points.



Figure 6 Comparison of scores before and after the use of smart classroom

4.3. Student research feedback

From grade 2020, the questionnaire for online learning space resources has been conducted, and 427 questionnaires have been received. The questionnaire link is https://www.wjx.cn/jq/94573394.aspx. Most students believe that online space resources can improve learning effects, without these network resources, it is almost difficult to complete homework. In the questionnaire, Figure 7 is generated directly from the official website of Questionnaire, where 1 means strongly disagree and 10 means completely agree. The question in is "The online learning platform is convenient to provide concise learning materials, such as videos, slides, test questions, etc.".



Figure 7 Online Learning Space Resources Questionnaire

5. Conclusion

Based on the concept of the meta-universe, this paper makes a preliminary exploration of the teaching of the course of Information Technology. The construction and implementation of online and offline mixed teaching resources are carried out through online learning tools such as Rain classroom, XuetangX online, course platform and WeChat official account. The teaching based on the concept of meta-universe can break the limitation and deficiency of information transmission between teachers and students, realize real-time communication between teachers and students, and enable teachers to master the learning effect of students in real time. Through the comparison of final grades of advertising majors, it is found that the teaching effect has improved significantly. In the future, we will continue to build and deploy resources based on various online teaching platforms, and make timely adjustments based on teaching effects and students' research feedback, so that Metaverse education concept will further improve the teaching effect of "Information Technology".

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