

# Research on the Construction and Development of Interactive Micro-Course Resources Based on VR Technology

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**Keywords:** VR (Virtual Reality), Micro Course, Micro-Course Resources, Interactive VR Micro-Course Continuum.

**Abstract:** With the spread of 5G networks, VR (Virtual Reality) technology has been widely used. The VR technology could be introduced into micro courses to build micro-course resources based on virtual reality technology. It can make the courses content more innovative. Hence, integrating VR technology into micro courses will become an important research. In this study, a curriculum scenario such like real environment was constructed based on virtual reality technology firstly. Then, the concept of "interactive VR micro-course continuum" was innovatively proposed. Finally, the following conclusions were drawn: the VR micro courses provide users with personalized teaching methods, interactive learning processes and immersive learning experiences, and lay the foundation for the development of highly interactive virtual reality micro courses.


## 1 INTRODUCTION

Due to the vigorous development of the Internet and the sudden epidemic, innovative online course resources have become one of the most important research fields in recent years. Micro course is an extension of online course resources. Specifically, it is an online video course that aims at a certain teaching link or knowledge point and supports various learning methods. Micro course has the characteristics of prominent theme, clear direction, diverse resources, vivid situation, short and concise (Hu 2011). It is precisely because of the short time of micro course that students' attention is difficult to concentrate on course for a long time. In addition, the current micro course also lacks interaction and immersion. These problems need to be solved to improve the teaching effect of micro course.

Hu et al. further analyzed the proportion of research content in Chinese micro courses from different dimensions such as theory synthesis, design, development, application and evaluation. They pointed out that the proportion of micro-lecture design and development account for 33.63 % of micro-lecture research, indicating that there is still

much room for improvement in the construction and development of micro-course resources (Hu and Wen 2016). The VR technology integrated with artificial intelligence (AI) can provide a new breakthrough for the innovation of two-dimensional micro courses to three-dimensional immersive micro courses. According to a report released by the Chinese Information Center in 2021, VR technology is one of the key directions in the field of new generation information technology. The use of VR technology can create a highly immersive and interactive digital environment, which can provide users with an immersive interactive experience in cyberspace (Liu 2016). Similarly, the application of VR technology in traditional video courses is also a research hotspot. Figure 1 shows the number of papers on VR video courses over the years. As can be seen from the figure, when VR technology began to rise in 2016, there have been studies on VR video courses, and new research papers have been published every year since then. Therefore, this study integrated VR technology into micro course to construct a virtual interactive learning environment for learners, namely VR micro courses. The addition of VR technology can break the boundaries of educational video, help educators explore topics that are difficult to present in the traditional course, and

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can greatly enrich the course content (Guo 2010). Liu et al. indicated that VR micro courses would fundamentally reconstruct the representation of knowledge points, the change of plots and the creation of situations (Liu and Wang 2020). Therefore, integrating VR technology into micro courses to create VR micro courses will become an irresistible trend.

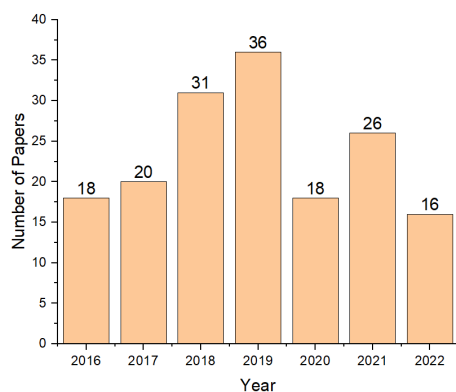


Figure 1: The number of papers on VR video courses

In order to solve the problems of insufficient interaction and immersion of current micro courses, this research reconstructed micro courses with the help of VR technology, which could effectively promote the develop of teaching resources. First of all, this study expounded the value and significance of interactive micro-course resources based on VR technology from three aspects of personalized teaching method, interactive learning process and immersive learning experience. Then, the specific process of constructing curriculum scenarios in the early, middle and late stages of VR micro courses is analyzed. Finally, the concept of “interactive VR micro-course continuum” was proposed and explained based on based on the development process of planar micro-course video to three-dimensional panoramic VR micro-course video, from limited interaction to advanced interaction of micro-course resources. The research results can provide reference for the innovative development of micro courses.

## 2 SCENARIO CONSTRUCTION OF VIRTUAL MICRO COURSE

In this section, a new type of VR micro course was developed, and the whole development and production processes were introduced in detail. Developing VR micro courses not only simply

transfer the course scene from two-dimensional to three-dimensional, but also focus on the course production steps and user experience design. This research took science, readability and purposefulness as the standards, and integrated the video course production methods and the inspiration of teaching interaction into VR micro courses, aiming to guide learners to immerse themselves in VR micro courses, and make them to reach the state of in-depth learning.

### 2.1 Preliminary Preparation

#### 2.1.1 Hardware

When making a VR micro course, it is needed to take a panoramic live shot of the scene. To take a panoramic picture, multiple cameras need to be used to take pictures at the same time for later picture synthesis, or use a panoramic camera directly. At present, mainstream panoramic cameras include Insta360, MAX, RICON, etc. The insta360 camera has the function of automatic synthesis, which can save production time. Hence, Insta360 camera was used to record panoramic course scene in this study. How to effectively output the completed panoramic scene requires the help of a display and a handle. According to the characteristics of VR micro-course, this study selects HTC VIVE head-mounted display and VR handle to provide the audience with the medium to experience VR micro course. The audiences used HTC VIVE head mounted display and handle to participate in VR micro courses. More convenient to watch learning videos and experience interactive processes in virtual space. for example the viewing angle of the VR micro course can be freely selected and audiences can interact with the virtual scene, which can make the audience feel that they are participating in a real course. This effectively improves the immersion and interactivity of micro courses.

#### 2.1.2 Software

The mainstream software for VR video development includes: Pr, Unity3D, Ins360 Studio, etc. Pr is a non-linear video editing software for graphic image design, 2D and 3D video clips. In the process of VR micro course production, the Ins360 Studio software synthesizes the set video into a 360-degree video, adjusts and modifies the video parameters. Use Pr software to process the video as required. Unity software is a world-leading industry software, which provides a powerful platform for creating 2D, 3D,

VR, AR, MR and other games and applications. Unity is one of the essential software in the production process of VR micro-course, and unity builds a bridge between the virtual world and the real world. Therefore, by using unity software to add the micro-course video recorded by teachers in the real world to virtual reality technology (VR), VR micro-courses with the characteristics of the times and new technologies can be created.

## 2.2 Production of VR Micro Course

### 2.2.1 Production Process

In this study, binary teaching as a case, according to the teaching case design courseware content. First, In this study, binary teaching as a case, according to the teaching case design courseware content. In this study, binary teaching as a case, according to the teaching case design courseware content. In the stage of learners' learning new knowledge, the teachers in the VR micro-course, as the imparters, impart new knowledge to students around the binary content; in the stage of cooperative exploration of learners, the teachers in the VR course act as guides to assist learners to actively participate in curriculum activities, strive to explore and think about problems, and cultivate innovative ability; in the stage of learners' summary evaluation, teachers in VR courses, as evaluators, should evaluate learners in a multi-dimensional and diversified way to avoid a single evaluation method. Evaluation should not only look at the results, but also pay more attention to the development of learners in all aspects, so as to stimulate learners' interest and enthusiasm in learning, and achieve good teaching and learning results for teachers' teaching in VR micro-courses and students' learning in VR micro-courses. Then, the shooting script of VR scene is designed, which controls the virtual camera's movement and rotation angle in the PC or Android system. In the VR micro course, the virtual camera needs to rotate around the target point to observe the scene from different angles, and it also needs to shift the camera to simulate the perspective of the experimenter walking in the virtual scene. The shooting scripts are coded in C# language, and then the scripts are written into the main camera. Finally, the apk file of VR micro course is export. Install the apk file on an android system or VR device to watch the VR micro course.

### 2.2.2 Function Design

To highlight the interactive function of educators

and learners in the VR micro course, the branching function of the VR micro course is designed based on mastery learning theory. In the VR micro course, the course is divided into several small units, the latter unit of learning based on the previous one, according to the level of students to master the real-time adjustment of learning content (Yang et al. 2020). The dialog box analysis function is added to the course, which can provide personalized course later content according to the learners' answers to questions. These functions can effectively help learners learn and understand the learning content.

## 2.3 VR Micro Course Teaching

We invited and organized students to participate in VR micro lesson experience. The course content included binary and related knowledge. Students learned these knowledge points in VR micro course and interact with educational games in VR micro course to deepen students' understanding.

The human-video interaction is a major feature of VR micro course, which can simulate the interaction between students and teachers in the actual course to the greatest extent. In the course questioning, this interaction can analyze the learning effect according to the students' answers and provide personalized teaching guidance (Yang et al. 2020). In VR micro courses, the combination of 3D virtual scenes and human-video interaction provides students with a more immersive, exploratory teaching experience that enhances the potential value of learning (Heng et al. 2020). With the characteristics of interactivity and immersion of VR micro courses, educational VR games can be added to the course. In the educational VR game, students can manipulate the virtual avatar and play different roles to complete the tasks set in the course, achieving the purpose of learning knowledge (Wang et al. 2015). Educational VR games can teach through play and effectively improve students' interest in learning.

## 3 THE ROLE OF VR MICRO COURSES

VR micro-course is the product of the integration of information technology and education and teaching. It seamlessly connects the teaching and learning of real classroom and virtual classroom, and provides learners with personalized teaching methods, interactive learning process and immersive learning

experience. Aims to use intelligent teaching methods to promote the improvement of teaching quality. The role of VR micro course is shown in Figure 2.

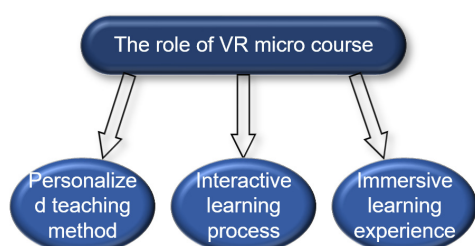


Figure 2: The role of VR micro courses

### 3.1 Provide Personalized Teaching

The traditional teaching video only seeks to copy the classroom teaching content and teaching methods to the network platform, relying on video to explain, without fragmented design and reconstruction of teaching content, unable to use network technology to achieve personalized teaching, and there are many problems affecting the teaching quality (Huang et al. 2015). The teaching process includes two stages of knowledge teaching and internalization, which are learner centered (Fan et al. 2012). The impartation of knowledge is a process in which the teacher takes the leading position to teach knowledge and the students receive knowledge. The internalization of knowledge takes students as the main body, which requires students to complete through practice or homework after receiving knowledge from teachers.

Personalized teaching respects the teaching of students' personality, and teaching should be carried out according to each student's personality, interest, specialty and needs, that is, what students need, teachers need to grant, and students in this teaching mode are completely in an autonomous learning state. In this study, VR technology is used to integrate personalized teaching into micro lessons. Teachers adopt different teaching methods and micro lesson making methods according to learners' cognitive level to teach students in accordance with their aptitude and individualize their teaching.

### 3.2 Provide Interactive Teaching Processes

The course resources on MOOC, Netease Cloud Classroom and other learning platforms are very rich, and learners are not limited by time and place to choose courses according to their own learning interests and needs. During the learning process, learners can adjust their speaking speed or send

bullet screen comments according to the content taught by the teacher. Although the course video provides some interaction, the depth of these interactions is shallow, and teachers and students cannot achieve effective two-way interaction. The VR micro course provides the function of interaction between teachers and students, and interaction between students and teaching content. This function is to judge learners' mastery of current knowledge, analyze students' needs and learning abilities, and adopt different teaching schemes, so as to reflect the interactivity of the learning process and achieve effective interaction of learners in the virtual course.

### 3.2 Provide Immersive Teaching Experience

The flow theory says immersion is about focusing on the current target situation and forgetting the real world (Fan et al. 2012). VR technology uses headstock displays to close users' vision and hearing, create virtual audio-visual, and create a sense of psychological engagement and situational learning for learners. Integrate the immersive experience brought by VR technology into the micro course, so as to increase the average retention rate of learning content. Immersion has three factors: condition, experience and result.

First of all, in the process of VR micro course production, two conditional factors are defined, that is, learners have clear learning goals in the experience process and the course will give immediate feedback on learners' interactive behavior. Then, in the experience factors, the learner's experience is increased by integrating the learner's action and perception, focusing on the learner's attention and giving the learner an absolute sense of control over the activity. Finally, the result factor is to achieve the staggered effect of immerse learners in space and time. Through these three factors, learners can be fully immersed in the learning process to achieve better learning results.

## 4 INTERACTIVE VR MICRO-COURSE CONTINUUM

From the traditional 2D course video with limited interaction to the advanced interactive VR micro course, the interaction between learners and course content is developed, which effectively improves learning efficiency.

Based on the development process of VR

micro-lecture, we put forward the concept of “interactive VR micro-course continuum”. In interactive VR micro-course continuum, the interaction level between learners and courses is divided into limited interaction, intermediate interaction and advanced interaction, and matches with the corresponding courses, forming a rich and complete system framework, as shown in Figure 3.

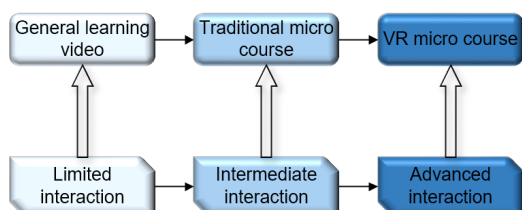


Figure 3: Interactive VR micro-course continuum

### 4.1 Limited Interaction

As a teaching assistant tool, traditional teaching videos provide learners with visual information, vivid video images and knowledge content in the learning process. Researchers analyzed the learning effect of teaching videos and learning basic theories, and found that traditional teaching videos did not pay attention to the interaction between learners and teaching videos. Usually, the learner can only adjust the video playback progress, this adjustment does not have any other response to the course content. It can be concluded that the interaction between learners and courses of traditional teaching videos is limited. Hence, the traditional teaching video is defined as the primary state of interactive VR micro-course continuum. Located on the left side of the interactive VR micro-course continuum

### 4.2 Intermediate Interaction

Compared with the primary interactive continuum, the intermediate interactive continuum added the function of human video interaction. Bullet screen is the earliest human-video interaction, which appeared in Japan’s video website in 2006 and then was applied to various online education platforms. When sending educational video bullet screen, user comments will be displayed on the interface, which have the characteristic of real-time and refined. For China’s micro courses, there are some meaningless interactions, and most micro course videos can only be played in a linear way, so students cannot interact effectively with the video. Simply integrating teaching videos into micro classes cannot improve the teaching effect, but teaching videos that allow

learners to interact randomly with the content can effectively promote teaching efficiency. In order to improve the learning effect, learners can interact with the course. In the intermediate interactive continuum, learners interact with the learning content through reading, listening, writing and other learning behaviors. Then, teachers and students solve the doubts in learning by asking questions for human-video interaction. Finally, the learners themselves renew their understanding of new knowledge and old knowledge video from the simple to the deep.

### 4.3 Advanced Interaction

In the advanced interactive continuum, in addition to the video screen, sound, operation buttons, bullet screen and other interactive methods, learners can also become the role in the virtual classroom and enter the virtual scene. Learners can get the learning experience like real courses, that is, learners and courses are highly interactive. In the famous video game Facade, players interact with virtual characters by typing words, thus promoting the development of story. The interactive technology of Facade games can be applied to VR micro courses, which can effectively promote the development of interactive methods in VR micro courses. In the virtual micro class environment, learners can walk freely in the scene and interact with the course content by controlling handle, which has achieved advanced interaction. Advanced interaction can not only make learners’ thinking diverge, expand their knowledge category, enrich their knowledge inventory, but also enable learners to improve their operation and practice ability with the help of virtual scenes.

## 5 CONCLUSION

To solve the problem of lack of immersion and interaction in traditional micro courses, this study proposes to combine VR technology with micro courses. The VR micro course was developed and students experienced VR micro courses. According to the development of course video interaction, the concept of interactive VR course continuum is proposed. The follow conclusions can be drawn:

- (1) On the basis of traditional micro courses, the VR micro-course is constructed by adding VR technology, and its construction process is introduced in detail.
- (2) In the VR micro course, the interactive function is designed and added. It can judge

students' learning effect and provide personalized teaching content according to their answers to classroom questions.

(3) The role of VR micro course is summarized: provide students with personalized learning style, interactive learning process and immersive learning experience.

(4) The concept of "interactive VR micro-course continuum" is proposed, which expounds the development process from the limited interactive traditional teaching video to the advanced interactive VR micro course.

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