Research on the Application of XR Technology in E-commerce Courses

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Abstract: The rapid development of global information technology has brought about significant changes in education delivery, particularly in the realm of e-commerce classroom effectiveness. To design and deliver effective teaching processes, the integration of information technology, including XR, is crucial. This paper aims to explore the practical application of XR technology, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), in e-commerce courses from the system architecture, technical architecture, scenario application to expansion. Specifically, this research investigates the integration of XR and e-commerce practical teaching scenes, the development of XR virtual e-commerce teaching platforms, and the utilization of XR technology for skill training. By incorporating XR technology, this approach offers an innovative and dynamic approach to presenting diverse and engaging teaching content to students. The integration of XR technology into campus classrooms enhances the learning environment, promoting students' motivation and self-directed learning.

1. Introduction

Today, the rapid development of information communication technology has led to the widespread application of virtual reality (VR) and augmented reality (AR) in the field of e-commerce. Research has explored various aspects of their application in e-commerce, including the prospects of VR technology [1], the impact of virtual reality on consumer learning [2], the enhancement of consumers' cognition, emotion, and behavior responses through VR and AR [3], the perspective of enhanced reality technology[4], the analysis of the technology-organization-environment model[5], user participation[6], advertising competition strategies [7], and e-commerce customization [8]. Further research is needed to investigate how these technologies can be applied in education and teaching, such as using VR technology in teaching practice [9].

The expansion reality (XR) technology, which includes AR, VR, and mixed reality (MR) technologies, provides broad development space for the "three religions" reform, as it is a cutting-edge technology in the development of information technology. VR technology refers to the virtualization and reconstruction of the real world through modern technologies, such as computers, that allow users to interact with things in a three-dimensional space in real time. AR technology integrates real scenes and virtual scenes, while MR technology creates a new visual environment by merging reality and the virtual world, where physical and digital objects coexist and interact in real time.

This article aims to explore the application of XR technology in e-commerce courses from various perspectives. It is worth noting that the existing teaching methods often lack innovative literacy and practical ability, and the textbooks are relatively outdated, with insufficient content updates and innovation. Therefore, the use of XR technology in teaching could address these limitations and enhance the learning experience.

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2. System framework design

2.1. System and structure

2.1.1. Resource classification

Resource classification is an important aspect of creating a successful e-commerce platform. To achieve this, a comprehensive subject classification tree should be constructed and integrated with the existing curriculum. According to the professional ability according to professional jobs, respectively build different technical direction course module, composed of 28 physical integration courses and training courses, including selection and purchasing module, platform operation module, digital technology module, operation promotion module, customer service module, laws and regulations, electricity skills development module, innovation module, interpersonal communication module and other nine modules(Figure 1). Resource classification helps to provide basic data design paradigms for creating VR, AR, and MR content and understanding learner behavior, which is crucial in designing effective VR learning environments.

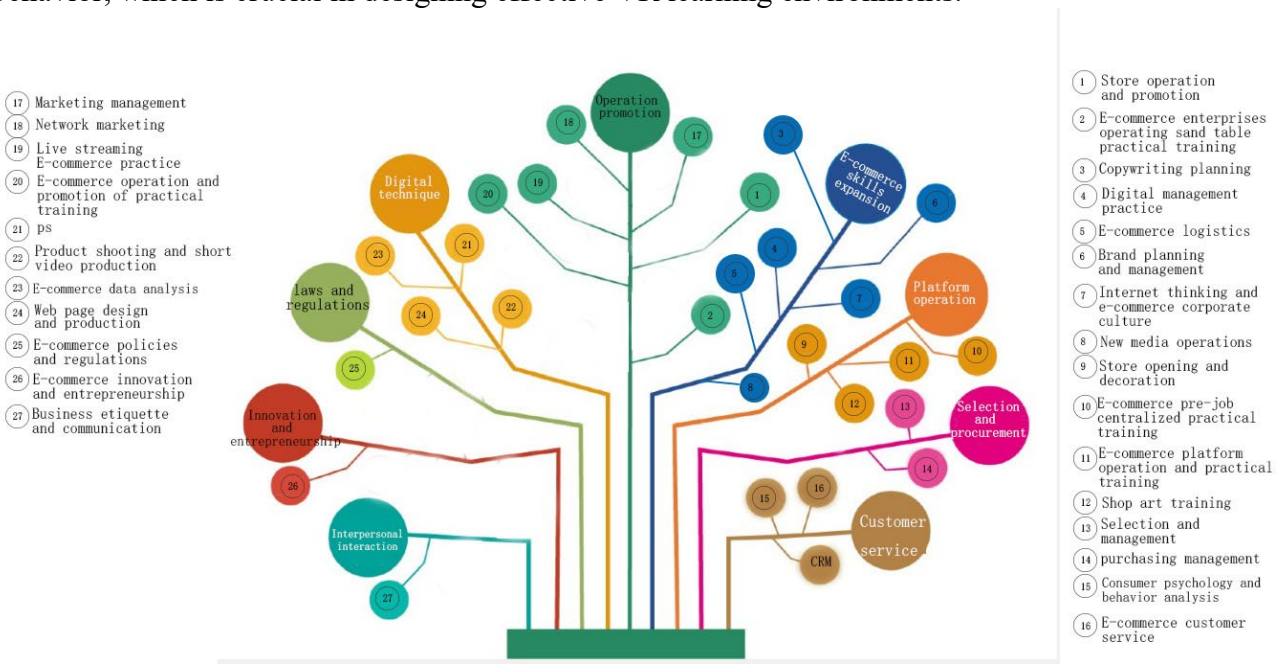

Figure 1 The subject classification tree.

For instance, if a course requires practical experience, we can use VR technology to create micro-lectures and enable students to engage in teaching practice. To evaluate the effectiveness of such courses, we can use quantitative analysis based on students' test scores, as well as qualitative analysis based on surveys and feedback from students about their learning experience.

Overall, resource classification is an important process that lays the foundation for designing effective VR, AR, and MR content, learner behavior design, and VR learning environment construction.

2.1.2. Content construction

The construction of content facilitates the essential preprocessing function of the electronic resources necessary for the XR learning environment. In the current situation of rapid development of VR/AR/MR hardware and insufficient educational resources, the system adopts the UGC (User Generated Content) design concept. This implies that every educator can participate in the construction and improvement of the XR curriculum resource library. The content construction is centered on abstract 3D scene representation and employs a collaboration-oriented visual manipulation architecture. It integrates the management and collaboration modules of models, scenes, personnel, and configurations, providing a complete and versatile solution.

The system supports non-relational data such as 3D models, materials, textures, shader programs,

skeletal animations, documents, voice, and video. However, it is necessary to digest and convert non-relational data into class-relational data, especially for voice and video. Key information must be extracted to form a connection relationship and classify subjects and courses according to the classification tree. This approach creates an XR teaching content ecosystem according to a unified plan.

Overall, this approach provides a comprehensive solution for creating electronic resources in the XR learning environment. It is an open system that encourages the participation of educators in constructing and refining the XR course resource library. By supporting non-relational data and converting it into class-relational data, the system is able to create a versatile and complete solution that can support a wide range of educational needs.

2.1.3. User (student) behavior

User (student) behavior is a crucial aspect of the system's goal to achieve teaching objectives through advanced human-computer interaction. Through autonomous interaction with the information environment, students gain knowledge and skills. To ensure effective interaction with different hardware, the system classifies and encapsulates students' interactive behavior according to course types and objectives, creating an abstract interactive layer and interface.

2.1.4. XR learning environment

The XR learning environment represents the core function of the system, integrating data from other parts to create an independent learning environment. A high-performance graphics engine enables quick response to tracking data from peripheral interactive hardware, such as high-speed head tracking and eye tracker data, to enhance the learning experience.

2.2. Technical architecture

The VR education solution uses the Unity3D virtual reality graphics engine combined with native web3D and HTML5 technology. Generally, the idea of a hierarchical architecture was adopted, and either unity3D or UE4 was chosen as the graphics engine for the desktop program. Unity3D and UE4 have the following advantages:

(1) Unity3D and UE4 have multiple programming languages, among which JavaScript, c# and C++ are the two most commonly used, and JavaScript language is easy to get started, which makes it easier for teachers to learn and participate in the development of VR educational content.

(2) Unity3D and UE4 support almost all cross-platform designs, and can provide 3D simulation development software with implantable capabilities for all platforms, realize the development of 3D games and virtual reality systems on mobile platforms, and support flash input formats. The establishment of the platform has important enlightenment and significance.

(3) Unity3D and UE4 can create high-quality 3D simulation systems and real visual effects, with highly optimized graphics rendering pipelines for DirectX and OpenGL, and low-end hardware can also run smoothly Lush crops, vegetation landscapes and real-time 3D graphics mixed with audio streaming and video streaming make educational resources better presented and knowledge content more interactive and attractive.

(4) Unity3D and UE4 can support larger scenes, more display objects and more dazzling display effects, occupying only a small space, and the teaching content of these features is better applied and popularized.

2.3. Scene application and expansion

2.3.1. Build a XR virtual e-commerce teaching platform

Utilizing computer visualization technology and the immersive and interactive characteristics of virtual reality technology, a VR e-commerce learning platform can be developed to support the delivery of teaching content, facilitate the teaching process, and evaluate student performance. This platform enables teachers to create authentic e-commerce projects and tasks, monitor students' progress in completing these tasks, and engage in virtual communication and discussion with

students. Moreover, various forms of interaction and group-based social surveys and practical projects can be conducted within the platform.

(1) Build an e -commerce virtual practice base for XR+virtual laboratories.

To address spatial constraints, the utilization of extended reality (XR) technology to develop a virtual training base for professional development has been proposed. This approach involves replicating the "work scene" of a company within the virtual training base. Within this space, a virtual laboratory can be created to facilitate experimental operations that are not bound by limitations of time and place. The virtual training base also serves as a platform for training in e-commerce planning, operation, and product design, through case analysis exercises. Additionally, the virtual training base allows for the design and operation of websites in collaboration with social welfare institutions or the provision of services related to products. This approach enhances self-directed learning opportunities for students, enabling them to learn at their own pace, while also fostering practical problem-solving abilities and facilitating effective experimental teaching.

(2) Form AR+ wisdom loose-leaf textbooks.

Drawing on the shifts in learning content and methods facilitated by "planning textbooks + AR smart live pages", a new integrated textbook system has been developed that combines paper textbooks with a multimedia platform, supported by digital teaching resources. Through the use of AR smart textbooks, teaching teams can independently develop mobile learning applications that leverage a range of multimedia elements, such as pictures, videos, and animations, to engage students' cognitive faculties and facilitate a transition from passive to active learning. Furthermore, through the use of AR's specialized real-time rendering 3D resources, students can access learning resources anytime to overcome conceptual challenges, complete tasks, and promote the transformation of knowledge into practical abilities. This interactive and technology-mediated approach can facilitate deeper engagement with the learning material, thus enabling students to explore the subject matter more meaningfully.

2.3.2. Use VR/AR/MR technology for skill training

Figure 2 VR logistics skills training.

Virtual training is a novel approach that utilizes virtual reality technology to simulate the practice of various skills. By employing real-time, dynamic, and realistic three-dimensional image displays, virtual reality technology is capable of simulating a diverse range of skill training scenarios. For example, virtual reality technology can be used to create work scenarios, such as simulated customer reception, sales staff training, recruitment interviews, and professional skills competitions. In these virtual simulations, learners can undertake various tasks and become familiar with the operation skills required for different positions and the competition requirements. Compared to traditional practical training rooms, virtual training offers several advantages, including reduced costs, enhanced training content, reduced risk, superior teaching environments,

and stronger interactive capabilities. Furthermore, virtual training can facilitate the acquisition and development of critical skills. At the same time, it can be applied to practical teaching, such as automated logistics system, intelligent logistics, etc. In the link of warehousing and distribution, wearing VR/AR helmet (glasses) can scan and identify barcode and other information, get familiar with the sorting process, optimize the sorting route, etc., so as to provide logistics efficiency (Figure 2).

3. Conclusion

The integration of XR technologies into e-commerce curricula is a subject of application-based research that involves optimizing and refining the current curriculum and teaching resources. This essay focuses on the use of digital technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) in the curriculum, aligning with the current "Three Education" reform aimed at fostering innovative talent through effective teaching materials and methods. The effective fusion between traditional e-commerce and digital technology is a valuable research topic with significant theoretical and practical implications for teaching. Moreover, as e-commerce courses share common characteristics with other professional courses, this research can serve as a reference point for integrating XR technology in management courses and other disciplines.

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