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Research Article

Online Class UI/UX Design Using Design Thinking Method in Virtual Reality Environment

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Abstract: Online learning has become an essential component of modern education; however, conventional online learning platforms often rely on two-dimensional interfaces that limit user engagement, interaction, and immersion. These limitations reduce learning motivation and hinder the creation of an effective learning experience, particularly for activities that require active participation. To address these challenges, this research focuses on the design of User Interface (UI) and User Experience (UX) for online learning implemented in a Virtual Reality (VR) environment. The objective of this study is to develop a user-centered VR-based online learning interface that enhances interaction, usability, and learning comfort. This research applies the Design Thinking methodology, which consists of five stages: empathize, define, ideate, prototype, and test. User needs and usability issues were identified through observations and interviews, followed by interface design and prototype development of a VR learning environment featuring chat rooms, whiteboards, slide presentations, and virtual representations of teachers and students. Usability evaluation was conducted using the Maze platform to measure user success rates in completing predefined tasks. The results show that 80% of users completed tasks through the expected interaction paths, exceeding the minimum usability threshold of 70%, while 20% of users failed to complete the tasks, indicating areas for improvement. These findings demonstrate that the proposed UI/UX design effectively supports user interaction and usability in a VR-based learning environment. In conclusion, this study confirms that integrating Design Thinking into the UI/UX design process contributes to the development of effective and user-centered VR-based online learning systems, while also highlighting the importance of usability evaluation for refining immersive educational interfaces.

Keywords: User Interface, User Experience, Virtual Reality, Online Classes, Design Thinking, Interactive Learning.

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1. Introduction

Education, particularly internet-based education, has experienced a significant transformation due to rapid developments in information and communication technology (ICT). Online learning has become a widely adopted educational approach, especially during the COVID-19 pandemic, as it enables students to access learning activities without limitations of time and location. Despite its flexibility and accessibility, online learning often encounters fundamental challenges, including low student engagement, limited social interaction, and difficulties in creating an engaging learning atmosphere (Smith & Johnson, 2020).

One of the primary causes of these challenges lies in the reliance on conventional two-dimensional learning interfaces, which restrict interaction and immersion. As a result, students may experience reduced motivation and focus during online learning sessions. Virtual Reality (VR) offers a potential solution to these issues by providing immersive and interactive learning environments that allow students to experience learning content in a more realistic and engaging manner (Brown, 2020). Through direct interaction with virtual objects, VR enables students to explore learning materials more deeply than traditional online learning platforms (Chen & Wang, 2018; Davis, 2019).

However, the effectiveness of VR-based learning environments is not solely determined by technological sophistication. The success of VR in education is highly dependent on the quality of User Interface (UI) and User Experience (UX) design. Poorly designed interfaces may increase cognitive load, reduce usability, and limit user comfort, ultimately diminishing the learning benefits offered by immersive technologies. Conversely, user-centered UI/UX design can enhance comfort, engagement, and efficiency, allowing students to focus on learning activities without experiencing difficulties in navigation (Li & Zhao, 2021). In this context, information system design should prioritize user needs to ensure accessibility and ease of use, particularly in online learning environments (Sutabri, 2014).

Although VR has been increasingly adopted in educational settings, many VR-based online learning platforms still lack a structured and systematic approach to UI/UX design that explicitly centers on user needs. This condition indicates a research gap in the development of VR-based online learning systems that integrate immersive technology with a formal, human-centered design methodology. Without such an approach, VR-based learning environments risk failing to achieve their full educational potential.

To address this gap, this study applies the Design Thinking methodology to the design of the User Interface and User Experience for online classes in a Virtual Reality environment. Design Thinking is an iterative, user-centered approach that emphasizes understanding user needs and preferences through stages of empathy, problem definition, ideation, prototyping, and testing (Martin et al., 2019). By adopting this methodology, the research aims to develop a VR-based online learning interface that supports interaction, engagement, and learning comfort while aligning with user expectations and learning behaviors (Hansen, 2021).

The novelty of this study lies in the integration of the Design Thinking methodology with UI/UX design for Virtual Reality–based online learning, combined with task-based usability evaluation using the Maze platform to measure user success rates. By incorporating a user-centered design approach with immersive learning technology, this research provides a structured framework for developing interactive and usable VR learning interfaces. The findings of this study are expected to contribute to the advancement of effective UI/UX design practices for VR-based online learning platforms and to serve as a foundation for future research in immersive educational systems.

2. Literature Review

2.1. UI/UX Design in Online Education

Designing the interface user (UI) and user experience (UX) of online learning platforms is very important to produce a useful learning experience. According to research, a simple, intuitive, and easy interface can increase understanding and involvement of students (Lee et al., 2021). Successful learning in online learning is greatly influenced by feature design like legible text, convenient navigation, and clear information (Nguyen & Lee, 2021). Cabero emphasized that understanding comprehensive system information can help develop a friendly UI/UX design for users and fulfill need user.

In addition, the approach of user-centered UI/UX design has its own implications important in overcoming common problems faced in online education, such as decreased desire for learning and difficulties in navigating the platform. Cabero's book use approach based on system information to build an interface with understand need user in a holistic way (Cabero-Almenara & Roig-Vila, 2022).

2.3 Virtual Reality in Learning

Virtual Reality (VR) has become an increasingly advanced technology relevant in education, particularly in online learning. Brown (2020) argues that VR allows students to experience and learn more interactive and immersive experiences, which is believed to increase motivation and understanding student to material. VR provides various features typical of a simulation environment that allows student feel material learning in a way more authentic (Chen & Wang, 2018).

Davis (2019) found that the use of VR in the classroom increases student involvement and enriches knowledge conceptually. This is consistent with findings of Garcia and Lewis (2020), who found that VR in education can help overcome constraint conventional online learning, which often fail involving visual and spatial senses student.

In addition, through VR-based methodology, students can access difficult simulations applied in education physical, such as virtual tours or laboratory investigations. Thompson

(2019) showed that VR can give experience learn more comprehensive with increase understanding through experience kinesthetic besides visual experience.

2.4 Design Thinking Method in UI/UX Design

Effective Design Thinking methodology in UI/UX development, in particular in framework education. Design Thinking helps designers understand the desires and aspirations of consumers through five phases: empathy, definition, ideation, creation of a prototype, and testing (Martin et al., 2019). This phase allow team to concentrate on the problem user in a way direct, productive, relevant, and appropriate way.

Design Thinking techniques are useful For develop attractive interfaces visually and friendly users in the UI/UX realm for VR- based online classes (Hansen, 2021). This allow student For concentrate in to obtain knowledge without facing navigation challenges.

Zhao and Morgan (2018) emphasized that Design Thinking is very important in digital education because reduce gap between developers and users. This method increases efficiency, interface, and grows experience personalized learning in accordance with need student.

2.5 Implementation of UI/UX in the Virtual Reality Learning Environment

Designing a virtual interface requires understanding deeply how people interact with a room's three dimensions. Due to the differences between the virtual interface and the conventional two-dimensional interface, problem design and user experience become more difficult (Li & Zhao, 2021). However, the design of the virtual interface may make students more involved and comfortable with the learning process.

An easy VR application can increase motivation in students, according to Foster and Green's study (2021). In addition, the method based on virtual reality (VR) allows student interact with more things and the environment than conventional online learning, which allows they Study together in a virtual environment (Harris & Walker, 2020). Chang (2020) claims that a friendly VR interface greatly reduces cognitive confusion and tension for users, especially those who are new to technology

3. Method

This study employs a qualitative design research approach focusing on the development and evaluation of User Interface (UI) and User Experience (UX) for online learning implemented in a Virtual Reality (VR) environment. The Design Thinking methodology is adopted as the main research framework, as it emphasizes user-centered design through iterative development stages (Martin et al., 2019). This approach is considered suitable for addressing usability and interaction challenges in immersive learning environments.

3.1. Research Framework

The research framework is structured based on the five stages of the Design Thinking methodology: Empathize, Define, Ideate, Prototype, and Test. Each stage is conducted sequentially while allowing iterative refinement based on user feedback. The overall research process begins with identifying user needs and problems related to online learning, followed by designing, developing, and evaluating a VR-based learning prototype.

3.2. Empathize Stage

The empathize stage aims to understand user characteristics, needs, and challenges in online learning environments. Data collection at this stage is conducted through observations and interviews with potential users, including students and educators who have experience with online learning platforms. Target speakers are students who have ever done online classes and are aged 19 to 26 years. The question in the interview is open and unbiased so that the source can tell their experience alone. There are 5 questions asked that is :

1. How was your experience during these follow-up online classes? What are they? What do you enjoy most, and what do you find most challenging?
2. What do you usually need to be able to focus and feel comfortable during online classes? How do you think VR can help or influence matter?
3. When you imagine online classes in VR form, what just comes to your mind? What features or experience like what do you think are ideal?

4. What method is best for you to accept bait, come back, or directions from the lecturer in the VR class? What will help you feel more connected with the lecturer?
5. What is the matter? Is there anything else you think is necessary? There is an experience Study VR class, so it can be useful and effective for students like you.

From the 5 questions above, what was asked? The resource person owns various answers, but can we taper to keypoint from the statement of the resource person? Most of them from the source person want the online classes become more interactive to support learning focus. And they want a feature for direct interaction, and board writing to be able to focus more and get "feedback" directly direct

3.3. Define Stage

In the define stage, insights gathered from the empathize phase are analyzed to formulate clear problem statements. In the research, we get some key points that we can apply to our research. From the results of the interview, several important key points can be concluded for designing online classes in virtual reality (VR), namely :

1. Lack of interaction during online classes.
2. It happens often distraction at the time affect focus on online and offline classes.
3. Atmosphere online classes are still not immersive enough.

From the results stages, we get 3 keypoints For do design online classes in a virtual reality (VR) environment. From the points that have been We get on stage. We can continue to the next process that is ideation.

3.4. Ideate Stage

The ideate stage focuses on generating design ideas and solutions to address the defined problems. Brainstorming sessions are conducted to explore various interface layouts, interaction mechanisms, and navigation structures suitable for VR-based learning. Design ideas are evaluated based on feasibility, usability, and relevance to user needs before being selected for prototype development. After important points in the design system are already collected, then at the stage This We Can start making features that can only be implemented in the system created in the research. One of method For do ideation is the HMW method do HMW? (How might we?) In stages, we look for solution What only one can finish problems at the "define" stage of the third key points that have been found. "How might we make the class more interactive and give students live feedback" after finding HMW? (how might we?) We continue study to formulate Features What only what is needed for designing online classes in virtual reality (VR). Several features are ideated at this stage. These are:

1. Chat room feature inside online classes and ask and answer.
2. Board features write.
3. Slide show feature.

After the features are already determined, so stages ideation can be continued to stages furthermore that is prototype design

3.5. Prototype Stage

Based on the selected design ideas, a VR-based online learning prototype is developed. The prototype includes essential features such as virtual classrooms, learning content interaction, and navigation controls. The prototype serves as a tangible representation of the proposed UI/UX design, allowing users to experience and interact with the system in a simulated learning environment. For this study, I use Figma for UI/UX design of online classes in virtual reality (VR). Some features that already exist were determined at the stage previously, like chat room features, board writing, and a slide show. The prototype will be created at this stage.

3.6. Usability Testing Stage

The testing stage aims to evaluate the usability and user experience of the developed prototype. User testing is conducted by allowing participants to interact with the VR learning prototype and perform predefined tasks. Feedback is collected through observation and user responses to assess usability aspects such as ease of use, clarity of navigation, comfort, and overall user satisfaction. The evaluation results are then analyzed to identify strengths and areas for improvement in the proposed design.

4. Results and Discussion

4.1. Result

This section presents the results of the UI/UX design and prototype development of the Virtual Reality–based online learning system using the Design Thinking methodology. The outcomes are discussed based on each design stage and the usability testing results.

4.1.1. VR-Based Learning UI/UX Prototype

The main result of this study is a VR-based online learning prototype designed to support interactive and immersive learning experiences. The prototype includes key features such as a virtual classroom environment, learning material interaction, and navigation controls tailored for VR usage.

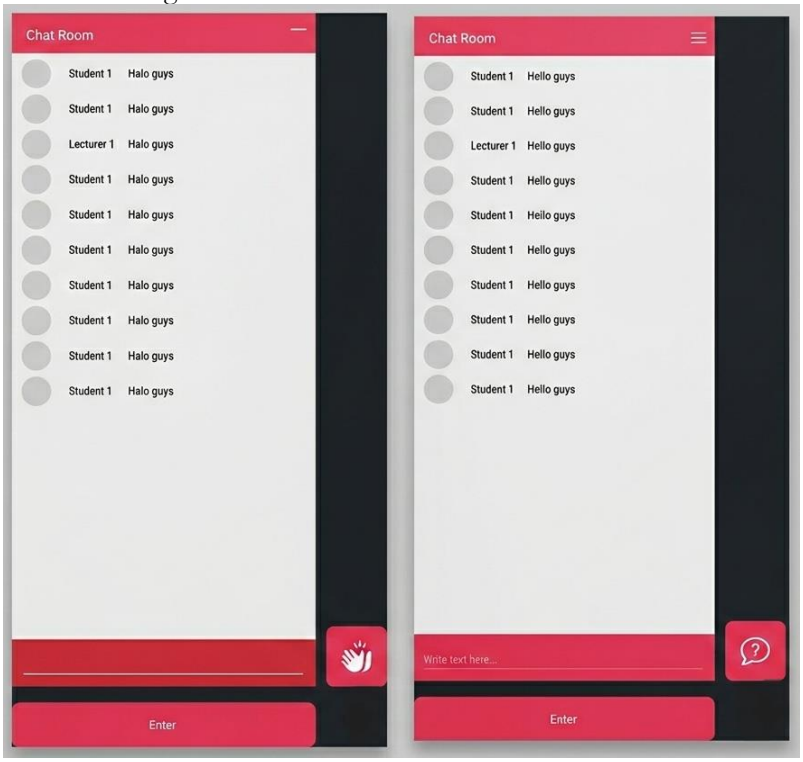

Figure 1. Chat room features.

Figure 1 illustrates the chat room feature within the Virtual Reality–based online learning environment. This feature enables text-based communication among users during learning sessions. The chat interface is designed to be easily accessible within the VR environment, allowing users to exchange messages without interrupting the learning flow. The presence of the chat room supports interaction and collaboration between students and instructors, which is essential for maintaining communication in online learning settings.

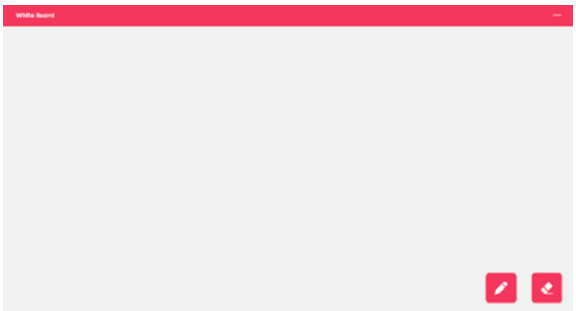

Figure 2. Whiteboard features.

Figure 2 shows the whiteboard feature implemented in the VR learning environment. This feature allows instructors to write, draw, or explain learning materials visually within the virtual space. The whiteboard is positioned to be clearly visible to users, simulating a

conventional classroom teaching tool. By integrating the whiteboard feature into the VR environment, the system supports interactive explanation and enhances understanding of learning content through visual representation.

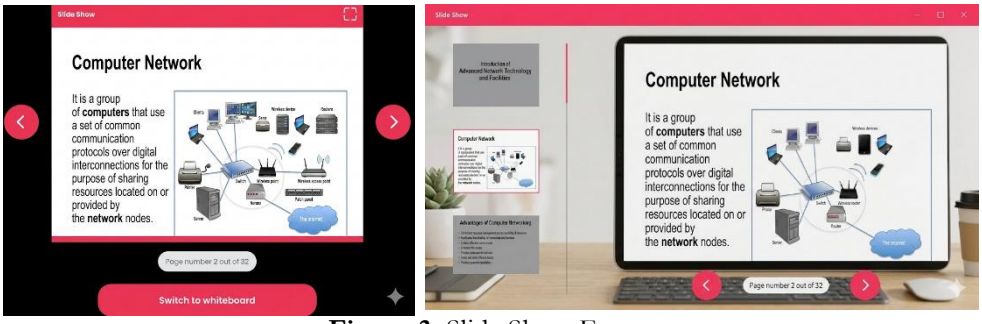

Figure 3. Slide Show Feature.

Figure 3 presents the slide show feature used to display learning materials in the form of presentation slides. This feature enables instructors to present structured learning content within the VR classroom. The slide display is designed to be clear and readable from the user's perspective, ensuring that students can follow the material effectively. The slide show feature supports organized content delivery while maintaining immersion in the virtual learning environment.

Figure 4. Appearance Student.

Figure 4 illustrates the visual appearance of students in the VR-based learning environment. Each student is represented by a virtual avatar, allowing users to perceive the presence of other participants in the virtual classroom. This representation enhances the sense of social presence and interaction among students, which is often lacking in conventional online learning platforms. The student appearance feature contributes to a more engaging and collaborative learning atmosphere.

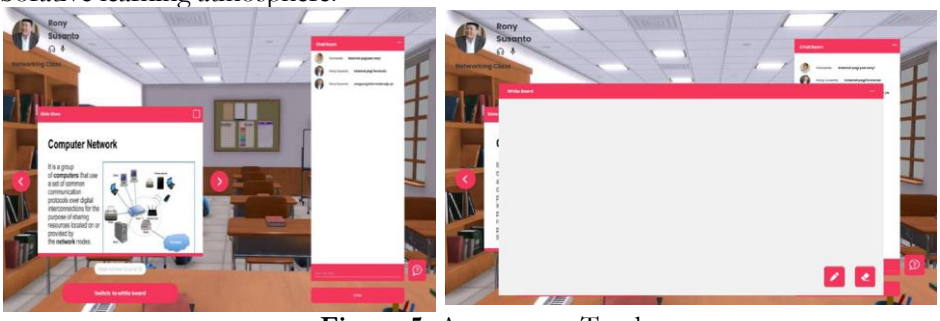

Figure 5. Appearance Teacher.

Figure 5 shows the visual appearance of the teacher within the VR learning environment. The teacher avatar serves as the main facilitator during learning sessions and provides a focal point for instructional activities. The presence of a teacher avatar helps simulate a real classroom environment, enabling students to recognize the instructor's role and follow explanations more naturally. This feature supports interaction and communication between teachers and students in the virtual learning space.

4.1.2. Usability Testing Results

There are several methods for conducting usability testing, one of which is usability testing using the Maze platform. Maze is utilized to evaluate user interaction with the proposed UI/UX design by measuring user success rates when completing predefined tasks. Through Maze, the success rate of users in navigating and using the designed interface can be observed. In this study, a design is considered acceptable if the average success rate reaches at least 70%.

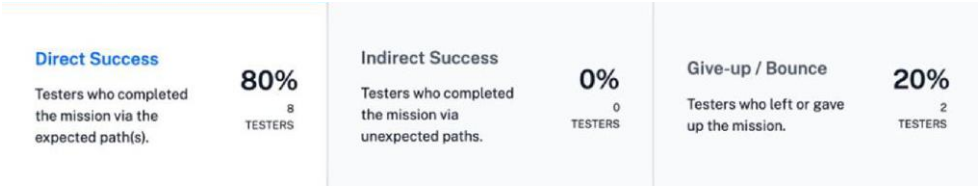

Figure 6. Results of usability testing using Maze.

Figure 6 presents the results of usability testing conducted using Maze. The results show that 80% of testers completed the given tasks through the expected paths (Direct Success), indicating that most users were able to understand and navigate the interface without significant difficulty. This result exceeds the minimum success rate threshold of 70%, suggesting that the proposed UI/UX design is generally usable and well-structured.

The results also indicate that 0% of testers completed the tasks through unexpected paths (Indirect Success). This suggests that users followed the intended navigation flow as designed, reflecting clarity in the interface structure and interaction elements. Meanwhile, 20% of testers gave up or exited the task before completion (Give-up/Bounce). This outcome indicates that a small portion of users still experienced difficulties, which may be related to initial adaptation to the VR environment or unfamiliarity with certain interface elements.

Overall, the usability testing results demonstrate that the proposed VR-based online learning UI/UX design meets usability standards and performs effectively based on user success rates. However, the presence of give-up cases highlights the need for further improvements, such as clearer interaction guidance or onboarding support, particularly for first-time users.

4.2. Discussion

4.2.1. User Specification Evaluation through Empathy Phase

In the empathy phase of the Design Thinking methodology, questionnaires and interviews were conducted with users to determine the requirements for VR-based online education. The recognized requirements are :

- **Increasing Learning Engagement**
  Student engagement in online learning generally declines due to the lack of direct physical interaction. Virtual reality environments are expected to solve this problem by providing an immersive and authentic educational experience (Garcia & Lewis, 2020; Hansen, 2021).
- **Navigation and User Ease**
  The results of the survey show that students need an intuitive interface, especially in the context of VR, which is characterized by greater interaction complexity than conventional settings. This is important so that students can focus on the lecture material rather than facing technological difficulties. Chen and Wang (2022); Sunda Ariana (2023).
- **Collaboration and Interaction**
  Virtual reality environments encourage increased social interactions between students and educators, creating a classroom climate similar to a physical environment (Smith & Johnson, 2020; Lee et al., 2021).
- **Problem Definition and Design Objectives**
  The main concern emphasized is the creation of a VR interface that is user-friendly, engaging, and encourages social interaction in an educational context. The main goal is to increase engagement and simplify navigation while providing a collaborative platform for social interaction that mimics real learning situations (Li & Zhao, 2021; Sutabri, 2014).

4.2.2. Conceptualization and Progress of Design Solutions

The resulting design concepts include :

- **Physical Class-Based Interface**
  The interface simulates a classroom, using elements such as virtual whiteboards and interactive tables to offer a more familiar experience for students. This method facilitates rapid student adaptation (Ariana, 2023; Harris & Walker, 2020).
- **Gesture Interaction Capabilities**
  In virtual reality, engagement can occur through hand gestures, such as raising a hand to ask a question or make a gesture. This feature increases student interest and participation in learning activities (Thompson, 2019).
- **Avatars for Collaborative Interactions**
  Virtual avatars increase the realism of student interactions, thereby enhancing the immersive learning experience (Nguyen & Lee, 2021).4.2 Problem Definition and Design Objectives

The main concern emphasized is the creation of a VR interface that is user-friendly, engaging, and encourages social interaction in an educational environment. The main goal is to increase engagement and simplify navigation while providing a platform for collaboration and social interaction that mimics the real learning environment (Li & Zhao, 2021; Makransky et al., 2021)

4.2.2. Conceptualization and Progress of Design Solutions

After the prototype was developed, initial testing was conducted with small groups of students and educators. The results of the testing revealed many important findings :

- **Increasing Student Engagement**
  Virtual reality settings increase engagement and stimulation in learning experiences, especially during simulation sessions and practical experiments (Davis, 2019).4.4
- **Prototype and Evaluation**
  After the prototype was developed, initial testing was conducted with small groups of students and educators. The results of the testing revealed many important findings:
- **Navigation Facilitation**
  Users felt that the real classroom-based interface facilitated their navigation and understanding of the functionality of current features (Makransky et al., 2021).
- **Pragmatic Cooperative Engagement**
  Avatars facilitate increased interaction between students and professors, fostering a learning environment similar to a traditional classroom (Lee et al., 2021).

6. Conclusion

This study has demonstrated that the application of the Design Thinking methodology effectively supports the development of a user-centered UI/UX design for online learning implemented in a Virtual Reality environment. By systematically applying the empathize, define, ideate, prototype, and test stages, this research addresses the limitations of conventional online learning platforms, particularly in terms of user engagement, interaction, and immersion.

The developed VR-based learning prototype, which includes features such as chat rooms, whiteboards, slide presentations, and virtual representations of teachers and students, provides an immersive learning environment that enhances social presence and interaction. The placement and design of these features are aligned with user needs identified during the design process, contributing to improved usability and learning comfort.

Usability testing conducted using the Maze platform indicates that the proposed UI/UX design achieves a user success rate of 80%, exceeding the minimum usability threshold of 70%. This result suggests that most users are able to complete learning-related tasks through the expected interaction paths. However, the presence of a 20% give-up rate indicates that

further improvements are required, particularly in providing clearer interaction guidance and onboarding support for first-time users in VR environments.

Overall, the findings confirm that integrating Design Thinking into the UI/UX design process plays a significant role in enhancing the usability and effectiveness of VR-based online learning systems. This study contributes to the field by bridging the gap between immersive learning technology and structured, user-centered interface design. Future research is recommended to involve a larger number of participants and incorporate quantitative learning outcome measurements to further validate the effectiveness of VR-based learning environments.

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