



The Impact of An Adoption Virtual Reality (VR) Integration in University

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Abstract

Virtual Reality (VR) technology is rapidly evolving and becoming increasingly widespread across various sectors, including education. Its integration into learning environments allows students to interact within immersive virtual settings, enriched with realistic and engaging content. VR's ability to simulate dynamic and complex visual concepts makes it particularly well-suited to enhance educational experiences and improve learning effectiveness. This study employs a qualitative approach through interviews with five advanced cognitive laboratory instructors, aiming to explore their perspectives and experiences regarding VR-based learning. The research investigates how VR technology influences student motivation, encourages active participation, and fosters deeper learning through interactive engagement. Several critical challenges must be addressed to optimize the effectiveness of VR-based instruction. These include physical adaptation to VR technologies, the seamless integration of theoretical and practical content, and the development of VR learning designs that account for gender-based preferences.

Keywords: Virtual Reality, University, Education, Student

1. Introduction

Virtual Reality (VR) technology is advancing rapidly and becoming increasingly prevalent across multiple sectors, including education. Its integration into learning environments enables students to engage with immersive virtual settings that feature realistic and interactive content. By simulating dynamic and complex visual concepts, VR is uniquely positioned to enrich educational experiences and enhance learning outcomes. Students are able to interact directly with instructional materials, which fosters deeper comprehension, strengthens cognitive processing, and promotes long-term retention (Mikropoulos & Natsis, 2011; Radianti et al., 2020).

The application of VR in education has revealed a variety of substantial benefits. For instance, Freina and Ott (2015) found that VR significantly boosts student motivation and engagement by delivering more interactive and stimulating learning experiences. Moreover, VR supports the visualization of abstract and intricate concepts in ways that are easier for students to grasp. Its safe and controlled virtual environments

also allow learners to experiment without the risks associated with physical activities, thereby deepening their understanding and retention of subject matter (Kesim & Ozarslan, 2012).

In higher education, the use of VR has initiated meaningful transformations in pedagogical methods and student interactions with course content. University students benefit from realistic, hands-on simulations—such as virtual laboratories and interactive case studies—that may be inaccessible or hazardous in real-world settings (Hamilton et al., 2021). These immersive learning experiences enhance problem-solving capabilities and critical thinking skills, while also increasing engagement and motivation. Beyond improving educational outcomes, VR prepares students to navigate real-world challenges with greater confidence and competence.

Nonetheless, the implementation of VR in educational institutions is not without obstacles. The high costs associated with VR hardware and software present significant barriers, particularly for schools with limited financial resources (Huang et al., 2010). Additionally, effective integration of VR into curricula requires substantial instructor training. According to Southgate et al. (2019), many educators feel underprepared and express a need for more comprehensive support to fully leverage VR technology. Overcoming these challenges is vital to realizing the full potential of VR in educational contexts.

To better understand the adoption of VR in education, it is important to explore the experiences and perspectives of instructors who have actively used this technology. Serdyukov (2017) emphasizes that the success of educational technology initiatives is strongly influenced by the readiness and competence of instructors. Their direct experiences provide valuable insights into practical applications of VR, as well as the difficulties encountered during implementation. Investigating these experiences offers a nuanced understanding of both the advantages and limitations of VR-based instruction.

Instructor expertise in VR is crucial, as educators serve as the linchpin in deploying the technology effectively. Hamilton et al. (2021) highlight that instructors who are well-trained and experienced in VR can significantly elevate student learning outcomes. Such educators skillfully utilize VR features to craft dynamic, engaging environments that foster deeper student involvement. They are also better equipped to navigate technical and pedagogical challenges that may arise during classroom use.

Moreover, Jensen and Konradsen (2018) found that instructors familiar with VR tend to be more inventive in their teaching strategies. These educators can design learning activities that capitalize on VR's strengths, such as interactive simulations and virtual experiments—experiences that traditional classrooms cannot easily replicate. Their proficiency allows them to deliver precise, personalized feedback, which helps students overcome academic hurdles and gain deeper understanding. As such, instructor experience with VR plays a pivotal role not only in enhancing student learning but also in advancing educators' professional growth.

2. Method

This study employs a qualitative approach to explore the experiences and perspectives of five instructors teaching in laboratories designated for advanced cognitive courses. A qualitative methodology was chosen because it allows for an in-depth examination of instructors' experiences, perceptions, and interpretations regarding the use of Virtual Reality (VR) in cognitive learning contexts.

The research subjects consist of five instructors who design and teach concepts related to VR as applied in laboratory settings. Data collection was conducted through semi-structured interviews and non-participant observation. These methods were selected to obtain a comprehensive understanding of instructor experiences. The data were analyzed using thematic analysis techniques.

3. Result and Discussion

3.1. Early Experience Using VR

The instructor's initial experience using VR in educational labs shows a feeling of pleasure and alertness. According to the Unified Theory of Acceptance and Use of Technology (UTAUT), the main factors influencing the acceptance of technology are performance expectations, business expectations, social influence, and facilitation conditions (Venkatesh et al., 2003). Instructors who feel happy and at the same time alert when they first use VR indicate that despite the positive perception of the technology's performance, there is still a need to better understand and master its use. More intensive training and support can help reduce these barriers, increase confidence, and ultimately increase instructors' acceptance of technology.

Furthermore, first-time VR experiences that involve interaction with highly realistic simulated environments, such as being in the depths of the ocean or climbing a tall building, provide a deep impression and perception to the user. This is in line with findings by Wang et al. (2020) who suggest that the immersive experience provided by VR can beguile visual perception and provide powerful new sensations. These interactions not only provide a deep impression but also prepare instructors to address the technical and pedagogical challenges that may arise during the use of VR in teaching.

The technical challenges relate to the aspects of the hardware, software, and infrastructure needed to operate VR. Meanwhile, pedagogical challenges are related to learning approaches and the role of instructors in integrating VR into the curriculum. As such, it is important to ensure that instructors feel comfortable and confident in using this technology, so that they can maximize their potential in an educational context and provide an optimal learning experience for students.

3.2. Teaching Experience Using VR

The experience of teaching using VR shows that this technology can open up students' insights and reduce fear of the subject being studied. According to the theory of experiential learning (Kolb, 2014), concrete experience and active reflection are key in the learning process. VR provides an environment that allows for direct interaction with the subject matter, which improves understanding and reduces fear of complex topics. This is in line with the findings that hands-on experiences and interactive simulations can make learning more engaging and effective (Fowler, 2015). With VR, students can experience firsthand the situations and concepts being studied, such as simulated scientific experiments or virtual trips to historical locations, which are difficult to achieve with traditional learning methods.

If most of the learning uses technology to make the instructor as a conveyor of information, then when using VR, the instructor can play the role of a facilitator of the learning experience. Instructors guide students to explore virtual environments, explore objects, and perform collaborative tasks in immersive spaces. Instructors can take students through various virtual environments and enter them in real time. Explaining abstract, hard-to-imagine concepts is easier for VR instructors to do than explaining conventionally.

Additionally, the use of VR in teaching allows instructors to create more dynamic and interactive learning scenarios. For example, VR simulations that involve scientific experiments or virtual trips to historic locations can help students understand difficult concepts in a more concrete and visual way. This allows students to more easily internalize the material being taught. Research by Hamilton et al. (2021) shows that the use of VR technology can increase student engagement and learning motivation, as it provides a more realistic and engaging learning environment. VR instructors can guide students to interact directly with 3D objects and perform dangerous and difficult experiments to perform in the real world. Exploring the underwater world and meeting animals that live in the water, or flying through the air in paragliding is not an easy thing to do in the real world, but through VR, it becomes easier and safer to live. Thus, VR is not only a teaching tool, but also a means to improve the quality and effectiveness of learning, encourage active engagement, and enrich the student learning experience.

3.3. Benefits of Using VR

The main benefit of using VR in education is increased student engagement and motivation in learning. According to Self-Determination Theory (Ryan & Deci, 2000), an engaging and interactive learning environment can increase students' intrinsic motivation. VR offers an immersive experience that is different from traditional learning methods, thereby increasing student engagement and motivation. Learning by entering the environment directly without any risk is a significant advantage of using VR. VR allows instructors to bring students into high-risk environments more safely without putting students at risk. The realistic and safe scenarios presented by VR (from visuals, audio to interaction) allow students to practice or explore many times without fear or to control the uncomfortable feelings they feel every time they explore the world of VR.

VR makes the learning process more meaningful and applicable. When VR is able to display a learning environment similar to the real world with various risks from various aspects, then the individual who learns can feel as if they are actually in a real situation, The VR gaming experience obtained becomes more real making the brain form stronger and more meaningful memories and learning. This is not only the case in theory, where students learn what to do, but also helps teach students what real situations are and why they should do it in real situations. Through VR, the learning process becomes more efficient and effective because students can apply the knowledge they have learned to real situations. Learning experiences that were initially just theoretical become more realistic through VR environments. Students are not only passively receiving information in learning but can be emotionally and cognitively involved.

Furthermore, VR allows students to learn through hands-on experience, which can make learning more meaningful and relevant. According to research by Hamilton et al. (2021), this immersive learning experience can improve students' problem-solving abilities and critical thinking skills, as they can directly see and interact with the concepts being learned. VR also allows students to perform simulations or games that may not be possible in a real-world environment, giving them the opportunity to explore and understand difficult concepts in a more practical and immersive way. This is in accordance with the results of interviews that show that VR can make learning more engaging and effective.

This immersive and interactive learning experience also strengthens information retention, in accordance with the Cognitive Theory of Multimedia Learning (Mayer, 2014), which states that learning involving multiple senses can improve comprehension and memory. With VR, students can experience a more vivid and well-rounded learning experience, which in turn can help them better understand and remember the material being taught. Reality in VR makes the learning process livelier, helps understand things more deeply, helps develop confidence and decision-making processes, and increases situational awareness.

3.4. Challenges and Disadvantages of Using VR

Despite its many benefits, the use of VR in education faces challenges such as VR sickness or motion sickness and adaptation to the VR environment. VR sickness or motion sickness is a feeling of nausea, dizziness and discomfort that occurs due to VR use or side effects of VR use. According to Cognitive Load Theory (Sweller, Ayres, & Kalyuga, 2011), the use of new technologies can increase students' cognitive load if not implemented properly. Physical side effects can interfere with the learning process and reduce learning effectiveness. Therefore, there needs to be greater attention to the use of VR, including ensuring a time limit for VR use so that the VR experience becomes comfortable for the body. Some college students report that they not only experience dizziness but also lose balance after using VR, which suggests that it is very important to pay attention to the duration and intensity of VR use during learning sessions.

In addition, adapting to VR technology requires a lot of time and resources. Instructors and students need to be trained to use VR effectively, and educational institutions must provide adequate technical support. Students who are not used to learning using VR may feel afraid of confusion or frustration at the beginning of learning. This is because several reasons such as the ignorance of students who are using VR for the first time often cause feelings of anxiety, such as not knowing how to operate VR tools (headset, controller, navigation), being confused about how to learn in a virtual environment that is different from conventional classes, and being afraid of making mistakes that can embarrass themselves (especially in front of friends or lecturers). In

addition, it is not uncommon for students to feel confused, mentally exhausted to have difficulty focusing when using VR due to cognitive overload.

Instructors have an important role in overcoming the weaknesses of using VR in the learning process, such as trying to help overcome the fear and confusion of students who are unfamiliar with using VR, overcoming technical problems and device interference that sometimes arise out of control, reducing the risk of cybersickness, designing or selecting VR content that suits the curriculum, accommodating diverse student learning styles, and having to be sensitive to the needs and needs of the students comfort. These things need to be examined further in order to provide a maximum learning experience to students. A study conducted by Radianti et al. (2020) shows that the successful implementation of VR in education is highly dependent on the readiness of the infrastructure and the support provided to users. Without adequate support, VR technology may not be able to be utilized optimally, and those challenges can reduce the benefits that should be obtained.

3.5. Gender Differences in the Experience of Using VR

It is known that there are differences in responses between male and female students to the use of VR, which shows variations in the learning experience. This is in accordance with research conducted by Makransky et al. (2020), there are gender differences in responding to immersive experiences from VR use. Women can become more expressive and aggressive when participating in virtual reality (VR) activities, such as when playing a boxing game. Understanding these differences is essential for instructors to create inclusive and responsive learning experiences that meet the needs of different groups of students.

Additionally, these gender differences can also affect how instructors provide feedback and support during VR learning sessions. A study by Lee et al. (2019) found that men and women may have different preferences when it comes to interaction and support during learning to use new technologies. When it comes to interacting, men tend to be more comfortable and active in exploring VR environments. Men prefer interactions that are exploratory and free, such as exploring virtual spaces independently. Meanwhile, women prefer targeted and task-oriented interactions. Women tend to feel more comfortable if there are clear clues or structures in the VR experience.

Judging from the preference for learning support, women generally value social and emotional support while using VR, such as having a companion or responsive assistance system around them, while men tend to focus more on the technical and performance features of the VR system itself, as well as the cognitive challenges offered in the virtual learning environment. Another thing that can also be seen is the emotional involvement between men and women when using VR technology, where men are more emotionally involved when learning to use VR involves competition, challenges, or other game elements. While women show higher emotional engagement when interactions in VR are accompanied by a meaningful social context or narrative. When instructors can understand these differences, then instructors can tailor the VR learning process to ensure that all students feel supported and motivated to actively participate in VR sessions.

3.6. The Relationship of Materials and Practices to VR

The lack of linkage between theoretical and practical material in the use of VR suggests that there is a need for better integration. According to experiential learning theory (Kolb, 2014), effective learning involves a cycle of concrete experiences, reflection, abstract concepts, and active experimentation. If the theoretical material is not closely related to VR practice, students may miss out on the opportunity to integrate their knowledge with practical experience. Therefore, it is important for instructors to design VR sessions that are not only engaging but also directly related to the theoretical learning objectives.

Effective integration between theory and practice can be achieved by developing learning scenarios that allow students to apply theoretical concepts in the context of VR. For example, in advanced cognitive courses, students may be given the task of designing a psychological experiment using VR, which is then followed by discussion and reflection on the results. According to research by Cook et al. (2019), this approach can help students to develop a deeper understanding of cognitive concepts and improve their ability to apply theory to real-world situations.

4. Conclusion

This study highlights the substantial potential of Virtual Reality (VR) in advanced cognitive education to deliver immersive and interactive learning experiences, thereby enhancing student engagement and motivation. However, several critical challenges must be addressed to optimize the effectiveness of VR-based instruction. These include physical adaptation to VR technologies, the seamless integration of theoretical and practical content, and the development of VR learning designs that account for gender-based preferences.

Moreover, the experience and expertise of instructors play a pivotal role in maximizing the educational impact of VR in higher education contexts. Guiding students in navigating virtual environments effectively, providing clear and contextually relevant instructions, and offering social and emotional support are essential instructional strategies. A balanced integration of social support, explicit guidance, and interactive elements has been shown to better meet the diverse learning needs of university students, reinforcing the importance of instructor preparedness and pedagogical sensitivity in technology-enhanced learning environments.

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References

- [1] Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: state of the art and perspectives. 11th International Conference ELearning and Software for Education, 1, 133-141. <https://doi.org/10.12753/2066-026x-15-020>
- [2] Fowler, C. (2015). Virtual reality and learning: Where is the pedagogy?. *British Journal of Educational Technology*, 46(2), 412-422.
- [3] Hamilton, D., McKechnie, J., Edgerton, E., & Wilson, C. (2021). Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. *Journal of Computers in Education*, 8(1), 1-32. <https://doi.org/10.1007/s40692-020-00169-2>
- [4] Huang, H. M., Rauch, U., & Liaw, S. S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers and Education*, 55(3), 1171-1182. <https://doi.org/10.1016/j.compedu.2010.05.014>
- [5] Kesim, M., & Ozarslan, Y. (2012). Augmented Reality in Education: Current Technologies and the Potential for Education. *Procedia - Social and Behavioral Sciences*, 47, 297-302. <https://doi.org/10.1016/j.sbspro.2012.06.654>
- [6] Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development* (2nd ed.). Pearson Education.
- [7] Lee, J., Park, S., & Bae, J. (2019). Gender differences in social interactions with robots: A review. *Frontiers in Robotics and AI*, 6, 11.
- [8] Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2020). Adding immersive virtual reality to a science lab simulation causes more presence but less learning. *Learning and Instruction*, 60, 225-236.

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- [9] Mayer, R. E. (2014). *The Cambridge handbook of multimedia learning* (2nd ed.). Cambridge University Press.
- [10] Mikropoulos, T. A., & Natsis, A. (2011). Educational virtual environments: A ten-year review of empirical research (1999-2009). *Computers and Education*, 56(3), 769–780. <https://doi.org/10.1016/j.compedu.2010.10.020>
- [11] Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers and Education*, 147. <https://doi.org/10.1016/j.compedu.2019.103778>
- [12] Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.
- [13] Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive load theory*. Springer.
- [14] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.