

The effect of VR on learners' engagement and motivation in K12 English education

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Abstract. This paper examines how virtual reality (VR) technology can be used in K-12 classrooms, specifically focusing on its potential impact on learners' engagement and motivation, with a particular emphasis on English language learning. The paper begins by providing an introduction to VR technology and its relevance in education, especially in the COVID-19 pandemic context. It reviews existing literature on learners' engagement and motivation, emphasizing the importance of these factors in the learning process. The study explores the initial step of VR technology in English instruction, highlighting the challenges faced in traditional language classes and the opportunities that VR presents. A case study on English VR teaching in middle school is presented, followed by a detailed case design for a cutting-edge VR learning platform tailored for young primary school English learners. The case study for K-12 students and design showcase how VR technology can be utilized to create engaging and immersive learning environments that foster comprehensive language skills development. The paper concludes by acknowledging the potential of VR educational games and embodied cognition theory in enhancing language learning outcomes and encourages further research in this area.

Keywords: K12; VR; English education; engagement; motivation.

1. Introduction

Lanier, the founder of VPL, conceptualized virtual reality (VR) technology in the early 1980s, leveraging computer technology as its primary component. VR technology, often referred to as spiritual realm technology or artificial environment technology, constructs a virtual world that enables user interaction, allowing individuals to immerse themselves in a developed virtual environment and experience a sense of presence. This technological advancement has gained significant relevance, particularly in recent times, due to the COVID-19 pandemic, which has placed added pressure on educators to deliver virtual teaching environments [1].

While augmented virtual reality (VR) have found more extensive applications in the realm of entertainment [2], their potential in the field of education is significant. As highlighted by recent research, previous studies have demonstrated how the use of VR technologies can enhance learning experiences by enabling students to interact with "natural phenomena" without real-world consequences [3]. In essence, the incorporation of VR in education opens up new avenues for learning. As a result, VR technology is gaining attention for its potential as a classroom learning tool.

The collection of learner-related behavioural data and multisensory interactions utilising VR technology enable learners to be fully immersed and present in VR learning environments. Through creating circumstances that are similar to those in the real world, virtual reality technology enables students to become fully immersed in the tasks they are expected to learn and complete. Therefore, the secret to virtual interactive learning's efficacy is immersion. Students' sense of presence has a direct impact on cognitive functions and an indirect impact on academic accomplishment, which indirectly affect students' academic success.

The majority of cases and experiments in this area are concentrated in higher education, particularly in engineering fields like mechanical and automotive engineering. There are more applications in science disciplines like chemistry, biology, and physics in the academic literature on topics connected to compulsory education than there are in humanities disciplines like English, language, and history. VR technology is typically used to create virtual laboratories or build scenarios

for contextual teaching. As an example, researchers like Cai and Chiang designed VR experiments to help pupils comprehend the makeup of molecules, atoms, and other chemical substances in the microcosm through natural interaction [4].

In terms of pedagogical practice, the VR research project team at the University of Nottingham in the UK has worked with students who have normal or physically challenged learning by creating virtual contexts with the help of VR technology to integrate with the subject matter to promote students' learning [5]. They have done this in collaboration with local primary and secondary schools. The player is transported into a cartoonish world while learning languages via a VR application called House of Languages. This software immerses the user in a cartoonish virtual world where they follow a small raccoon as he learns German, Spanish, and English. The player advances through levels to fulfil the associated learning assignments. The player enters a cartoonish virtual world where they follow a raccoon as he learns English, Spanish, and German. As they progress through the stages, they make choices and respond to questions using head control technology. Nearpod Education Technologies also developing over 100 VR programs serving tens of thousands of schools in the United States. The role of VR in high school education is also garnering increasing attention.

2. Literature review

2.1. Learners' engagement and motivation

2.1.1. Engagement

According to Shernoff [6], student involvement entails a higher level of focus, interest, and enjoyment in the job at hand. However, studies have shown that high school students often exhibit lower levels of engagement within the school setting compared to other aspects of their lives [7]. This finding underscores the importance of understanding the various elements of engagement. According to Mahatmya [8], engagement comprises three key components: behavioral, cognitive, and emotional. These dimensions collectively contribute to students' level of involvement and investment in the learning process. Recognizing the significance of engagement, particularly in science education, Wang [9] highlights that for high school students to succeed in science-related occupations in the future, it is essential to understand how they connect with and learn in scientific classes. Education professionals may create a more fulfilling and productive learning environment by considering the varied nature of engagement and its effect on students' educational journeys.

2.1.2. Motivation

Studies from the past showing a link between academic success and motivation indicate that motivation plays a critical part in the learning process. The idea of student engagement has evolved recently to include the significance of motivation.[10]. Within models of self-regulated learning, motivation is recognized as a defining characteristic of an individual's ability to regulate their own learning. A key component of this construct is self-efficacy, which refers to students' belief in their capability to succeed academically [11]. Motivation, in turn, acts as a catalyst for engagement, forming a symbiotic relationship where motivation supports and fuels active involvement in cognitive, emotional, and behavioral processes [11]. Thus, prior to commencing a task and throughout its duration, motivation and goals serve as fundamental drivers that underpin students' dedication and commitment to the learning process.

2.2. VR Learning and Learner Motivation and Engagement

Virtual reality's (VR) effects on learning, engagement, and motivation among learners has garnered attention, although the existing research lacks a unified view. Some studies suggest that integrating VR technology into teaching aids improves students' understanding of subjects, exam scores, and learning motivation, while also reducing costs and experimental risks [12]. The immersive VR environment and novel perception can enhance learners' emotional engagement. To assess the potential of VR integration in the classroom, a six-week experiment was conducted at Huntline High

School in Tennessee, USA. Results showed that using VR headsets allowed students to interact with virtual items, experience realistic learning environments, and increase their motivation to retain information [13]. In contrast to other technologies, mobile VR has a poor acceptance rate, according to a study by Sprenger and Schwaninger on the technical acceptance of e-learning and mobile VR over a three-month period [14]. Students prioritized exam preparation and found the lack of connection to exam topics and simplistic VR content disappointing. These findings underscore the importance of considering learner age group, study level, motivation, and learning style when deploying learning technologies.

These divergent findings emphasize the importance of conducting further research and taking a nuanced approach when integrating VR into educational settings to maximize its potential benefits for learners.

2.3. Emergence of VR technology in English teaching and learning

2.3.1. Status and problems of English language classes

With the acceleration of globalisation, the need for English language learning is gradually increasing, for example, Higher standards for students' English learning have been advocated in China as a result of the promotion of new curriculum reform and the publishing of the National English Curriculum Standards for General High School. [15]

However, English language classes suffer from low student engagement, especially when the teaching methods are outdated or not adapted to the needs and interests of the learners. This can lead to disinterest, passive learning, and limited progress. Kim looked into why eight elementary EFL (English as a foreign language) students were unmotivated to study English and discovered that teachers' unclear delivery was the main culprit [16]. However, the demotivation of senior high school pupils in EFL is not given enough attention. Senior high school is a crucial transitional year between junior high school's foundational English instruction and college's more advanced coursework. They face increased difficulties, including intense rivalry for admission to colleges, pressure from heavy learning loads, more difficult knowledge to learn, and significant psychological shifts.

2.3.2. The emergence of VR technology offers new perspectives on English language teaching and learning

Virtual reality (VR) educational games can give students a more realistic, secure, and engaging learning environment, as well as assist students in completing particular learning activities, which has attracted considerable interest from academics working in the subject of education both locally and abroad. According to Limniou and other academics, 3D immersive games can be used to pique learners' enthusiasm and attention. [17]. Sims contends that role-playing VR educational games can increase students' motivation and recall [18]. The collection of learner-related behavioural data and multisensory interactions utilising VR technology enable learners to be fully immersed and present in VR learning environments. This is accomplished by gathering behavioural data and engaging the learner in multisensory interactions through the use of VR technology. By creating circumstances that are similar to those in the real world, virtual reality technology enables students to become fully immersed in the tasks they must learn and complete. Therefore, the secret to virtual interactive learning's efficacy is immersion. Students' sense of presence has a direct impact on cognitive functions and an indirect impact on academic accomplishment, which indirectly affect students' academic success.

2.3.3. Research gap

While a substantial body of research has demonstrated encouraging outcomes in integrating virtual reality (VR) technology in education, recent research has revealed that a more nuanced and holistic strategy is required to properly use this technology for pedagogical goals. One major study direction is how to tailor virtual reality learning experiences to the differences between different groups of learners. Existing research emphasises the significance of learner age, education level, motivating variables, and individual learning styles. However, there has been few research on the design and

study of K-12 English language training. Furthermore, there is a scarcity of systematic and in-depth study on how these aspects interact with one another to influence instructional design, particularly implementation and efficacy.

3. Case Study

3.1. English VR Teaching in middle School——VR Life English

Students in junior high school can practise regular English dialogues by playing this VR instructional game. The researcher created some situations that were relevant to the students' daily lives and allowed them to practise dialogue there. Each student received instruction in English for Daily Life during the first week from the same English teacher using materials created by four junior high school English teachers. Students took turns playing the game during playtime from the second to the fifth week with the intention of examining the effects on learners' performance in this educational setting [19].

3.2. Case Design

Building on the insights gained from the case study of English VR Teaching in middle school, the findings underscored the significance of creating engaging and relevant learning experiences for language learners. Traditional methods often struggle to captivate the interest of young students, leading to disengagement and limited progress. Recognizing this, this study introduces a cutting-edge Virtual Reality (VR) learning design, carefully tailored for young primary school students at the commencement of their English language learning journey. Drawing inspiration from the case study's successful use of VR instructional games, the design embraces a multifaceted approach, integrating interactive gamification, collaborative learning environments, critical thinking exercises, and problem-solving activities. Informed by Behaviorism, Cognitivism, and Social Constructivism, this platform seeks to address the challenges of traditional language classes and encourages knowledge construction through rewarding achievements, immediate feedback, and social interactions acting as external motivators. By incorporating the learnings from the case study, this VR learning design aims to revolutionize language education, fostering a more comprehensive and engaging learning experience for young learners.

The learning content is carefully curated for primary school English learners, who can select appropriate levels based on their initial English proficiency or opt for a pre-study test. The content covers diverse aspects of language acquisition, including alphabetic knowledge, spelling, oral practice, and simple reading, aiming to foster comprehensive language skills development.

The design of the VR learning platform is intuitive and immersive. As students don VR glasses, they are greeted with an enticing front page featuring floating options such as "games," "virtual classroom," "pronunciation exercises," and the "achievement map." Progress is visually represented through an indicated level in the top left corner of the screen. By successfully completing learning activities and games, learners ascend through levels, unlocking new challenges and receiving rewards.

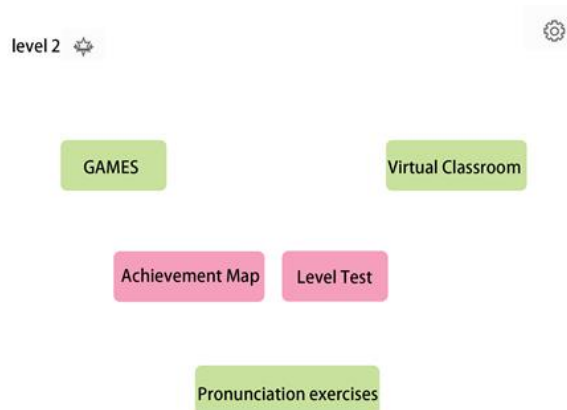


Fig. 1 front page.



Fig. 2 "Treasure Hunt".

The platform offers an array of engaging games. The Games Page offers two engaging and educational game options: "Treasure Hunt" and "Way Back Home." In "Treasure Hunt," learners embark on an adventure where they interact with animated characters who pose questions related to English language concepts. By answering these questions correctly, learners gather clues leading to a hidden treasure. Accumulating sufficient points from correct responses results in rewards and advancements through the game's challenges.

Similarly, in "Way Back Home," learners navigate a virtual pond, jumping from one lotus leaf to another by correctly choosing the meaning of English words displayed on the leaves. Successful leaps and accurate word choices earn points and progress opportunities, with three chances to re-answer questions if they make a mistake.



Fig. 3 "Way Back Home".



Fig. 4 "Virtual Meeting Room".

The Virtual Meeting Room offers a collaborative and social learning space for learners to interact with their peers. Here, they can engage in group activities, practice conversational English, work together on projects, and receive valuable feedback from both teachers and classmates. As learners explore the virtual environment, they have the freedom to choose their favorite meeting spot, fostering a sense of ownership and autonomy in their learning experience.

Furthermore, learners can improve their pronunciation through interactive exercises. The Pronunciation Exercises page focuses on honing learners' pronunciation skills. Learners are prompted to read sentences displayed on the screen, and the virtual classroom utilizes voice recognition technology to evaluate their pronunciation accuracy. Each pronunciation exercise is accompanied by different evaluation levels, earning learners varying points based on their performance. This interactive feature encourages learners to actively practice and apply their pronunciation skills while fostering self-assessment and continuous improvement.



Fig. 5 Pronunciation Exercises.



Fig. 6 Achievement Map.

The "Achievement Map" acts as a visual representation of progress, with points earned from games and learning activities propelling learners forward on the map and unlocking trophies that elevate their levels. Learners can also view their classmates' positions on the map if they have added them as contacts, fostering healthy competition and a sense of community.

The alignment of the VR learning design with Bloom's Taxonomy showcases its cognitive depth. Games cater to remembering, understanding, applying, and analyzing language concepts, while the virtual meeting room encourages application and evaluation through group work and feedback sessions. Pronunciation exercises embody application and evaluation by actively practicing pronunciation skills and receiving immediate guidance for improvement.

3.3. Case Summary

The case study and the case design above highlight the prevalent integration of embodied cognition theory in VR educational games. This theory asserts that VR technology can enhance embodied cognition, leading to more effective learning experiences. It is widely recognized by researchers that the combination of VR technology and embodied cognition is relatively new in the field of education. To ensure the reliability of data obtained from experiments involving VR educational games, many researchers actively engage in effective communication with teachers and provide adequate training beforehand. By doing so, they establish a solid foundation for conducting experiments and obtaining reliable results.

Virtual reality technologies have excelled in creating immersive learning environments in the context of learning the English language. VR educational games, specifically tailored to address specific topics, which has a great potential for assisting teaching and enabling effective English language communication. Consequently, it is crucial to delve deeper into the study of how to optimally utilize such VR educational games to enhance English language learning outcomes.

4. Conclusion

The integration of virtual reality (VR) technology into K-12 education has the potential to revolutionize the English language learning process for students. Through an exploration of existing research, we have found that learner engagement and motivation play a pivotal role in their educational process. The ability of VR technology to create immersive and interactive learning environments provides a unique opportunity to address the challenges faced in traditional language classrooms and to facilitate meaningful learning experiences. In addition, the case studies and case designs presented in this paper exemplify how VR educational games can be effectively utilized to facilitate language acquisition for young learners. VR learning platforms provide an engaging and motivating environment that promotes active student engagement and knowledge production by

integrating elements of gamification, problem-solving exercises, critical thinking exercises, and collaborative learning spaces.

At the same time, there is a need to further explore and refine the design and application of VR in K-12 English language teaching. Factors such as learners' age group, learning level, motivation, and learning style should be considered when designing VR learning experiences. In addition, continued collaboration between researchers and educators is essential to ensure the effective implementation of VR technologies in diverse educational settings. Through a thoughtful and research-driven approach, VR has the potential to revolutionize language learning, making it more engaging, interactive, and effective for K12 students.

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