

**Exploring the impact of Virtual Reality (VR) on
EFL primary school students' vocabulary
acquisition and general motivation**

by

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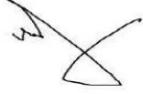
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**Master's Final Project
ORIGINAL WORK FORM**

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In Tarragona, June 13th, 2024.

Dedication

I dedicate this thesis to:

- My Supervisor, Dr. Mar Gutiérrez-Colon Plana, the symbol of guidance and advice, who provided invaluable insights and direction throughout this research project,
- My parents and sisters, who lead me through the valleys of darkness with the light of hope and inspiration,
- All my family who has not only made me stronger and better, but has also filled my life with an unimaginable sense of fulfillment and love,
- My friends whom I cannot force myself to stop loving,
- All the people in my life who were of direct or indirect support,
- My homeland, Morocco, the warmest womb,

Abstract

This study explores the impact of virtual reality (VR) on vocabulary acquisition and general motivation among primary school students. A quasi-experimental design was employed, involving two fourth-grade classes from a semi-private school in Tarragona, Spain. The experimental group received vocabulary instruction related to the VR Shark experience using CLASSVR glasses, Avantis Education Limited. On the other hand, the control group did not use VR glasses but received the same vocabulary instruction using the Grammar-Translation method (GTM). The study adopted pre- and post-tests to test vocabulary acquisition and pre- and post-questionnaires to assess motivation. The study findings revealed that students in the VR group showed significantly higher vocabulary test scores and increased motivation than the control group. Consequently, virtual reality (VR) can be an effective educational tool that enhances vocabulary acquisition and increases student motivation.

Keywords: Virtual Reality (VR), vocabulary acquisition, student motivation, VR glasses primary school education, quasi-experimental design, Grammar-Translation Method (GTM).

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Introduction

Since the 21st century, the internet has been widely used by people from different backgrounds, and digital technologies have gradually been integrated into different disciplines, such as medicine, engineering, tourism, business, architecture, and gaming, to name just a few. Recently, digital technologies have evolved dramatically in the field of education as well, and "instructional technologies have become a major instructional platform" for educators and learners (Borcih, 2017, p. 199). Therefore, it has become a necessity for schools to provide technologically advanced environments. At the same time, educators must get accustomed to interactive technological resources and tools to integrate them into instruction effectively. In the same vein, McGovern et al. (2019) argue that educators now have a golden opportunity to use such technology to foster meaningful and engaging learning for students, most of whom are already digital natives.

As part of technology in general and ICT in particular, virtual reality (henceforth VR) is one of the technologies that "has already started to make its mark across market sectors" (McGovern et al., 2019, p. 490). It has been adapted in several educational settings, ranging from kindergarten to tertiary education. As long as it is implemented appropriately and effectively, VR has the potential to benefit all stakeholders seeking evolution in education (Cramariuc & Dan, 2021). It will make learning more efficient, engaging, and interactive, while also enhancing students' language acquisition and motivation.

EFL learners have often struggled with the limited language input and traditional ways of teaching they have been exposed to in their schooldays. This has resulted in passivity and lack of motivation. Thus, it is imperative to incorporate interactive technologies that allow students to interact with other students, teachers, or even virtual people. Through VR, students and teachers may participate in activities "normally impossible to participate in real

life" (Cramariuc & Dan, 2021, p. 41). More than this, they may also visit distant or historical places in the past.

Research questions and hypotheses

This research study holds the potential to contribute to the field of education by exploring the impact of VR on the vocabulary acquisition and general motivation of primary school students in the region of Catalunya.

The main research questions are the following:

1. Does the integration of VR enhance vocabulary acquisition among primary school students?
2. Does motivation increase when VR is implemented in the EFL classroom?

The alternative hypotheses for the research questions are:

Ha 1: The integration of VR enhances vocabulary acquisition of primary school students.

Ha 2: Motivation increases when VR is implemented in the EFL classroom.

The null hypotheses are as follows:

Ho 1: The integration of VR does not enhance vocabulary acquisition of primary school students.

Ho 2: Motivation does not increase when VR is implemented in the EFL classroom.

Chapter 1: Theoretical background

This section is devoted to introducing VR within the field of education. It will first address the importance of VR in education, mainly its impact on the learning process of learners. It will also explore how VR helps facilitate vocabulary acquisition and boost motivation among students. Finally, the section aims to bring forth some theories and research studies on ICT, particularly VR and language acquisition and motivation.

1.1. The importance of ICT in education

Before exploring the importance of ICT in education, it is essential to know what ICT stands for and what it means. It stands for 'Information & Communication Technology' and has been adopted in many schools and universities instead of IT (Information Technology) (Rank et al., 2011). ICT is a "diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage information" (Sharma, 2016, p. 663). We no longer process information but communicate it with others through a wide range of technology.

Because of the evolution of social media and the internet over the past few decades, the world has become thoroughly associated with technology. Technologies such as artificial intelligence (AI), robotics, broadcasting devices (radio and television), augmented reality (AR), and virtual reality (VR) have become influential in our daily lives. Globalization and technological innovations have pushed many governments, policymakers, and officials to increase the use of ICT in many sectors, and education is no exception. Researchers and computer scientists have started seeking innovation in many domains, particularly education. Notably, the interest in ICT use in educational settings is growing worldwide. Also, countless research studies have shown that ICT integration in education "can spark the joy of learning and provide students with cognitive tools to process information, to reflect on what they

know, and to construct knowledge based on what they know" (Borich, 2017, p. 200).

Students must be engaged in problem-solving, decision-making, and inquiry learning tasks. This engagement could be achieved through efficient ICT integration. Apart from reading, writing, and numeracy, understanding and mastering ICT has become part and parcel of the education system. That is why, nowadays, many countries regard ICT as one of the main pillars of modern society.

When addressing the importance of ICT in education, we are more or less concerned with how ICT is critical to improving the quality of education. Most students today grew up with the internet; therefore some, but not all, are familiar with technology and how to use it. ICT can impact students' learning positively. It makes learning dynamic, interactive, and hence more attractive. Instead of staying in the pupil's seat (Scrivener, 2005), students' enthusiasm and eagerness to learn increase as they engage in a different world where they can control their learning (Dianti & Atmanegara, 2019). That is to say, motivation and engagement are more likely to increase when ICT is implemented in class. No matter how excellent or eloquent a teacher can be, it is never easy to keep a class motivated based solely on the teacher's knowledge of the subject matter or teaching style. Learners, particularly today's generation, have become accustomed to visual stimuli and multimedia presentation (Borich, 2017). Therefore, teachers must update their teaching with technological resources and use technology as a support tool to catch students' attention and keep them engaged and motivated throughout the learning process.

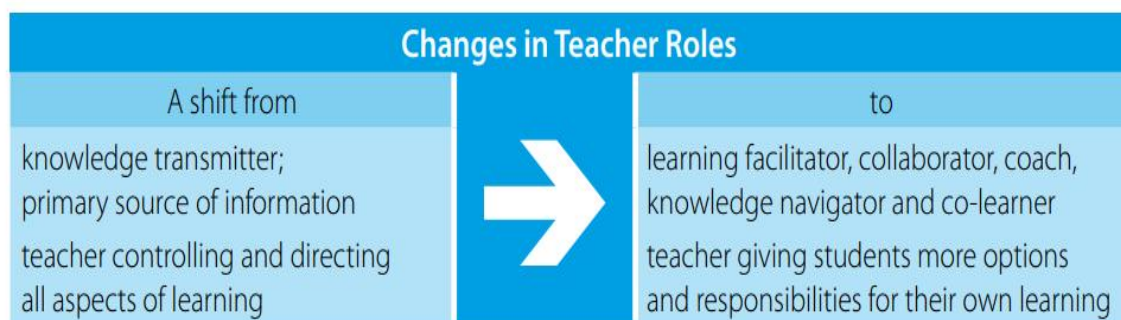
Additionally, technology, in general, helps develop students' cognitive abilities. Lajoie (1993) argued that ICT combines texts, sounds, visuals, and moving images, which support learners' cognitive processes, such as memory. It moves beyond "words on the page or the screen to embrace other modes of communication" (Rank et al., 2011, p. 2). Given this multi-modal nature of ICT, it caters to different learning styles and hence increases retention and

recall. In the same vein, Borich (2017) states that "the use of technology in the classroom can provide a media environment in which different learning needs can be met using multiple presentations of information, from different sources and at different levels of difficulty" (p. 201). ICT gives students opportunities to engage in cognitive activities in authentic environments and, therefore, are exposed to a richer experience.

Since ICT incorporates the concept of communication, it has been promising to enable communication, cooperation, and collaboration. Thanks to ICT, students learn and collaborate anywhere (Rank et al., 2011, p. 126). For instance, Web 2.0, such as social media, blogs, and podcasts, allows students to collaborate with peers virtually and engage in different activities anytime, anywhere. They can, for instance, share creative work, engage in dynamic forms of interaction, exchange information, and discuss issues. This ability to communicate and interact with other students from different continents makes learning more fun, collaborative, and effective. Interestingly, UNESCO suggested that implementing ICT in education has shifted teachers' and students' classroom roles (Resta & Patru, 2010, as cited in Anderson, 2010). Figure 1 depicts how ICT changes teacher roles:

Figure 1

Changes in teacher roles due to ICT integration in instruction



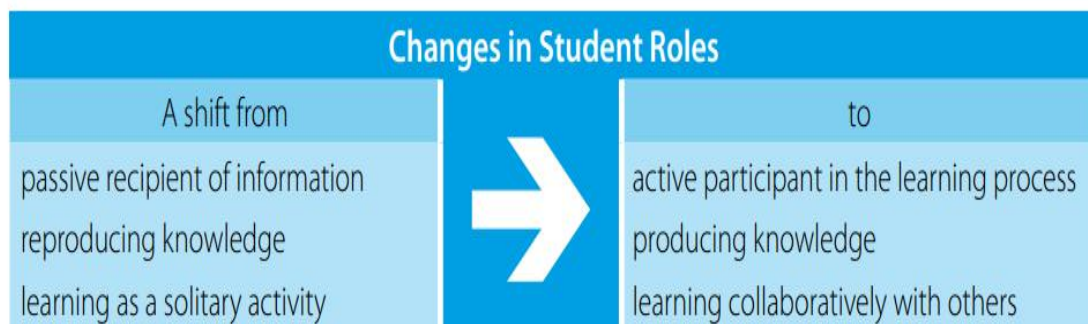
Source: Adapted from Resta and Patru (2010).

Anderson (2010) postulates that by implementing ICT in education, teachers are no longer "sages on the stage" but "guides on the side" (p. 6). Before, they were considered as

the know-it-all teachers who enjoy complete authority in class. This idea aligns with Scrivener's (2005) 'jug-and-mug' explanation approach, where teachers dominate classroom time. However, with the advent of technology, education has been revolutionized and has shifted from teacher-centeredness to student-centeredness. Teachers have become mere facilitators who orchestrate the whole learning process. They are now seen as team coaches who try and bring the best out of their players. Students, in this way, are furnished with more opportunities to control their learning and are also allowed practical experience in doing things through various technological means. This is clearly shown in Figure 2:

Figure 2

Changes in student roles due to ICT integration in instruction



Source: Adapted from Resta and Patru (2010).

Through ICT, students actively participate in the learning process by constructing knowledge, sharing ideas, and collaborating with others on a multitude of projects and activities. The teacher's role is to monitor the process inside and outside classroom doors and provide what help is necessary.

Recently, 'Metaverse' has emerged within the framework of ICT. It refers to a virtual shared space that provides an interactive environment for learners and integrates virtual reality (VR) and augmented reality (AR) in instruction (Onu et al., 2023). It is regarded as the "Internet of the future" since it has the potential to revamp numerous aspects of the education sector. AR and VR are similar technologies but have distinct differences. AR is more

immersive and encourages learners to interact with the real environment. Conversely, VR "completely immerses users in a simulated world filled with unreal, virtual objects" (Alizadeh, 2019, p. 22). Table 1 summarizes the main differences:

Table 1

Augmented reality and virtual reality comparison (from Alizadeh, 2019, p. 23)

	Augmented Reality	Virtual Reality
Are AR and VR the same?	No, AR enhances the existing real world by adding digital objects to it in ways that make users believe those objects actually exist	While VR takes users to a simulated environment completely separated from the real environment
Can the user interact with the real environment in AR and VR?	Yes, since digital objects are overlaid onto the real world and the user can experience both	No, since VR transposes users to a virtual environment entirely distinct from the real world
How can each be experienced?	Smartphone cameras, smartglasses such as the Microsoft HoloLens	Stand-alone, computer-powered, or mobile-powered VR headsets

Metaverse provides contexts for learning and social interaction and offers students immersive and interactive learning experiences. It is an environment where they can experience, observe, and immerse themselves in situations that are difficult or too expensive to afford in real life. The following sections will discuss the impact VR can have on learners' vocabulary acquisition and motivation.

No one denies the importance of ICT in education. Yet, ICT integration should be designed thoughtfully as ICT per se has never been "a fix to poorly designed instruction" (Borich, 2017, p. 200). According to Borich (2017), technological tools are just tools that do not teach but merely facilitate the teaching process. First, schools and academies are to provide the necessary equipment and resources for teachers and students to pave the way for better teaching and learning experiences. Second, teachers should be well-trained and

qualified enough to integrate ICT meaningfully into their instruction. Last but not least, students' awareness should be raised on using technological resources safely and sensibly, especially outside school time.

1.2. Virtual reality and its role in vocabulary acquisition

VR technology continues to grow and advance rapidly in education to "provide even more capabilities, which may eventually make possible the creation of new learning experiences and opportunities" (Chen, 2009, p. 72). According to the socio-constructivist theory, learning is contextual, and knowledge is constructed through environmental interactions. Learning occurs through an amalgamation of our background knowledge with new input to develop new understanding through interactive learning activities. In this regard, VR provides learning environments through experimentation and immersion.

Vocabulary acquisition plays a vital role in education as vocabulary is part and parcel of every mode of communication. Through effective use, VR can enhance foreign language vocabulary teaching and, most importantly, learning. EFL learners have often struggled with vocabulary acquisition because of limited contexts for communicating in English. However, when learning vocabulary through VR, students do not need to imagine situations but instead feel immersed in them (Monteiro & Ribeiro, 2020). Vocabulary acquisition is no longer an isolated process of the mind since the whole body system functions in interaction with the environment. Monteiro and Ribeiro (2020) stated that some studies have explored the potential impact of VR technology on vocabulary teaching and learning. They have validated that VR facilitates vocabulary retention and recall among students. It provides contextual vocabulary learning as they get immersed in authentic and real-life scenarios. In those studies, all participants in the VR-experimental groups scored better and higher in long-term memory vocabulary tests than their counterparts.

In the same context, Chen et al. (2021) argued that "VR enables learners to interact with multiple modalities of information" (p. 851). When students are exposed to authentic and contextual learning activities, the effectiveness of vocabulary acquisition can be enhanced. Thanks to VR, students can explore different environments and experiences that "simulate aspects of the real world that are inaccessible through direct experience" (Chen, 2009, p. 74). VR facilitates active interactions and allows for repeated practice, promoting targeted vocabulary acquisition.

Mayer (2001) introduced a cognitive information processing theory called the *Cognitive Theory of Multimedia Learning (CTML)*. The core idea of the theory is that people learn better from words with visuals and sounds than just words in isolation. For this theory to be practical, it should draw on three assumptions grounded in cognitive science. The first assumption is the dual-channel assumption, which states that people process information through auditory and visual channels. The second one is the limited capacity assumption which asserts that humans have a limited capacity in those two channels and, therefore, cannot simultaneously record a large amount of information. The last is the active processing assumption, which refers to learning as "an active process of filtering, selecting, organizing, and integrating information" (Monteiro & Ribeiro, 2020, p. 1313). The assumptions are best summarized in Table 2:

Table 2

Three assumptions of the CTML (from Mayer, 2001, p; 103)

Assumption	Description	Related citations
Dual channels	Humans possess separate channels for processing visual and auditory information	Paivio, 1986; Baddeley, 1992
Limited capacity	Humans are limited in the amount of material they can process in each channel at one time	Baddeley, 1992; Chandler & Sweller, 1991
Active processing	Humans engage in active learning by attending to relevant incoming material, organizing selected material into a coherent mental representation, and integrating mental representations with other knowledge	Mayer 1999b, Wittrock, 1989

In other words, humans possess different channels through which they process information. The latter enters the cognitive system first through the eyes and later through the auditory channel (Mayer, 2001). When vocabulary is presented in class, students are more likely to remember it well, as the instruction includes text with both visuals and sounds. However, the cognitive load of vocabulary presented in both above-mentioned channels should not overwhelm the learners' capacity, mainly if they are young. For instance, students' capacity will be challenged if the screen or the VR experience includes many visuals and sounds. Consequently, the technological tools will hinder learning instead of facilitating it. Lastly, students receive the input actively and engage in selecting, organizing, and integrating aspects of the new information within both channels. Constructivists believe learners learn actively when allowed free exploration and manipulation (Chen, 2009).

From Mayer's (2001) theory, we first understand that just adding pictures to words is only guaranteed effective if the three assumptions are considered. Thus, based on how the human mind works, Mayer (2001) presents those assumptions as guidelines for teachers who want to design instructional media. When teachers consider them, vocabulary acquisition will become more accessible than just presenting vocabulary traditionally. Second, Mayer's model is limited in that it does not take note of learners' different learning styles and individual preferences. The model will not be very efficient for students who are not visual or auditory, mainly if the VR device does not deliver a completely immersive experience (Monteiro & Ribeiro, 2020, p. 1321). VR technology should enhance vocabulary acquisition among learners by providing a high immersion that makes learners part of the virtual world. In this way, learners can have more memorable experiences, boosting their recall of the newly learned information.

In the same way, Palmeira et al. (2020) claim that through immersion, visualization, navigation, and interaction with the virtual environment, "the acquisition of FL vocabulary

assisted by VR could potentially be used as a powerful learning method" (p. 533). They argue that the VR experiences students are exposed to help them retain more vocabulary since students create a direct association between language and the sense of immersion. The studies discussed in their paper showed that the more students feel engaged and immersed in the experience, the more likely their recall of language will be. The idea they insisted on is that virtual environments that offer high immersion and interaction bring about practical learning experiences (Palmeira et al., 2020).

Additionally, Legault et al. (2019) suggested that our L1 acquisition occurs due to a rich perceptual and sensorimotor experience wherein we engage with objects in our surroundings and interact with our parents. This 'perceptual-visual-sensory' experience makes the acquisition of vocabulary effective and memorable. In this regard, VR provides a rich context for learners to acquire language in a natural, authentic, and embodied way. Legault et al. (2019) claim that "VR contexts enable users to manipulate or interact with the environment seamlessly as in real-life situations" (p.3). They add that virtual learning environments have been found to boost motor functions in humans during stroke rehabilitation more than traditional therapies. Some of the studies in their article examined the effect of learning through VR while comparing it to conventional methods. The studies indicated that those exposed to virtual learning environments showed faster vocabulary learning and achieved higher accuracy (Legault et al., 2019). What is interesting, VR can affect not only learning performance but can also bring about brain changes.

VR is considered to revolutionize vocabulary acquisition among learners by providing immersive, authentic, and contextual learning experiences. This technology enhances language learning by engaging learners in sensory-rich environments and thus facilitating more profound understanding and vocabulary retention. In brief, VR technology is a

promising tool that can transform conventional learning methodologies and make vocabulary acquisition more effective and engaging.

1.3. The impact of virtual reality on student motivation

From a cognitive standpoint, motivation is “the process of sustaining goal-directed behavior” (Schunk, 1991, p. 346). Simply put, learners set goals and strive to attain them by employing cognitive processes and behaviors such as planning, persisting, and staying disciplined. Within the learning framework, most learning entails students being motivated. When students are encouraged to learn, they work hard and engage in different processes requiring much effort, and they do not simply give up when they face challenging material. Furthermore, they consciously concentrate on their educational goals even during their spare time.

Hull (1943) differentiates between internal and external motivation. Internal motivation stems from innate behaviors that satisfy basic and biological needs. According to him, these are intrinsic actions that ensure survival. It can also be referred to as accomplishing activities we feel inclined to and enjoy doing. In this case, the value lies in doing the activity per se and not in the final result.

On the contrary, external motivation encompasses learned behaviors that are not directly related to fulfilling our primary biological needs but are mainly associated with external factors. For instance, the desire to work for money or to receive a luxurious gift are external factors that can motivate us to perform things.

The integration of VR in educational settings has become a hot topic among researchers in recent years. Drawing on the findings presented in the study by Chen et al. (2021), VR has shown promising results in boosting student engagement and motivation, particularly in English learning. Immersive and realistic VR experiences have thoroughly

improved students' perceptions of English learning. VR makes learning more beneficial for their future careers and increases their motivation. According to the same study, students in the experimental group described their learning experiences as enjoyable, motivating, and engaging because of VR applications. In this way, VR is not a passive tool that passes information, but it actively involves students in the learning process to make it more interactive and engaging. When students feel they have control over their learning process, they are more likely to be engaged and motivated. Students learn by doing (Scrivener, 2005), which is often more efficient than passive traditional methods. This active participation motivates students to engage in similar activities more and more (Rank et al., 2011).

One of the most powerful aspects of VR in education is its direct impact on students' professional competitiveness and confidence. Using VR technology helps students learn English better and gives them valuable job skills that are highly sought after in the workplace (Chen et al., 2021). This dual benefit of VR increases students' motivation and instills in them a sense of confidence. Learning becomes more worthwhile when students can directly see the effect of their learning efforts on their future careers.

VR experiences can also enhance student competence through the on-the-spot feedback they can provide. As students navigate and interact within a virtual space, they can see the results of their actions and decisions immediately and therefore learn from them (Lin & Wang, 2021).

Furthermore, VR creates a dynamic, immersive and motivating learning environment that makes language acquisition more accessible and efficient. By immersing students in authentic scenarios (Sherman & Craig, 2003), VR fosters general motivation and develops positive attitudes toward learning vocabulary. The engagement facilitated by VR, where students find the learning process enjoyable and directly connected to authentic language

uses, suggests that VR can enhance motivation and transform the learning experience (Lin & Wang, 2021).

Moreover, VR has the potential to transform traditional learning activities into new and exciting experiences that capture students' imaginations and stimulate their interest (Lin & Wang, 2021). For example, a VR experience that allows students to visit historical sites virtually can transform a conventional history class into an interactive and enjoyable exploration that students will always remember.

Last but not least, pressure and high-stress levels can hinder motivation. VR creates a more relaxed learning atmosphere that can stimulate motivation. By creating an environment where students feel less pressured, VR helps students explore, experiment, and learn without fear of failure (Borich, 2017).

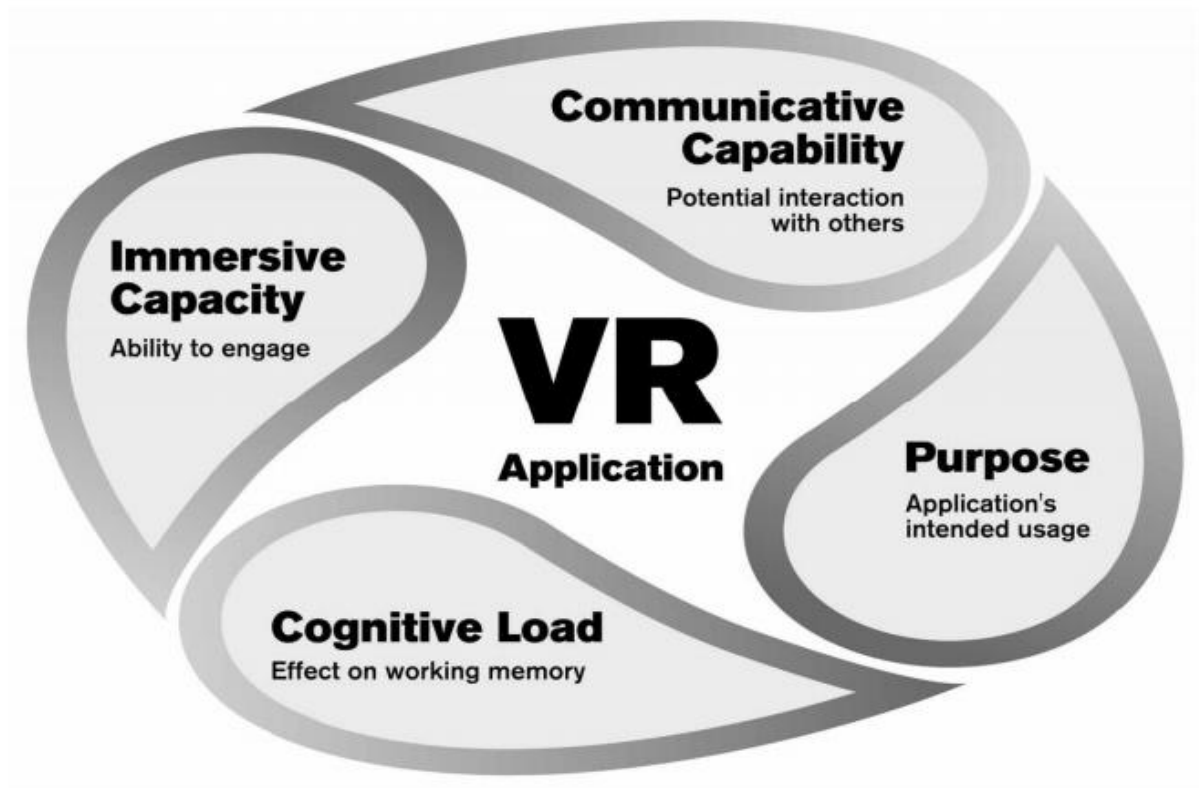
1.4. VR Application Analysis Framework

In recent years, VR technology has increasingly become adopted in various sectors. Regarding the educational sector, VR has become more accessible in schools and academies. What matters is that its integration should effectively address students' needs and bring about positive learning outcomes. As a result, Lege et al. (2020) devised the *VR Application Analysis Framework*. It is a structured approach designed to evaluate the suitability of VR applications in educational settings. To ensure that VR is used effectively, the framework emphasizes the importance of aligning new technologies with pedagogical objectives and learner needs to enhance the learning experience.

The *VR Application Analysis Framework* assesses VR applications through four key lenses: immersive capacity, cognitive load, purpose and communication capability, as illustrated in Figure 3:

Figure 3

VR Application Analysis Framework (Lege et al., 2020, p. 133)



1. Immersive capacity

This lens refers to the degree of immersion the VR application provides. The high immersive capacity allows users to move freely and interact naturally within the virtual environment, while the low immersive capacity involves passive experiences like 360-degree videos (Frazier et al., 2021). What is important is that effective VR applications should provide vivid and inclusive virtual environments that engage both the learner's mind and body (Lege et al., 2020). The latter divides the immersion capacity into three sub-types, introducing their indicators, as shown in Table 3:

Table 3

Immersive capacity levels and indicators (from Lege et al., 2020, p. 29)

Level	Common indicators of immersive capacity
• High	<ul style="list-style-type: none">• Six degrees of freedom (6DoF) of movement for users (longitudinal, vertical, lateral, yaw, pitch, roll).• 6DoF hand tracking for interaction.• High visual fidelity (refresh rates, resolution).• Visual consistency of 3D assets.• High interactivity with environment.
• Medium	<ul style="list-style-type: none">• Mix of high and low immersive capacity elements.• Medium interactivity with environment.
• Low	<ul style="list-style-type: none">• 3DoF of movement for users (yaw, pitch, roll).• 3DoF hand tracking or gaze-based interaction.• Visual issues (low refresh rates, resolution, distortion).• Uncanny valley (negative emotional reaction to 3D character appearance).• Low interactivity with environment.

2. Cognitive load

In simple terms, VR experiences should not overwhelm learners with unnecessary or too much cognitive load but make learning within their reach. They should also balance the richness of the virtual environment with students' ability to take in information. Lege et al. (2020) claim that when VR experiences have cognitive overload, students are exposed to rich media, which only impedes learning and does not facilitate it. That is why teachers who aim to integrate VR into their classes should consider the cognitive load that target VR experiences carry to ensure that learning will occur.

3. Purpose

The purpose lens states that VR applications must go hand in hand with the goals of the lesson. Applications should be selected only to meet the learning objectives and support meaningful language use (Frazier et al., 2021). This lens identifies four primary purposes for

VR applications: ‘entertain’, ‘inform’, ‘communicate’, and ‘design’. First, ‘entertain’ briefly means the VR experience should include entertaining activities such as games and puzzles. Second, ‘inform’ refers to the fact that VR applications should expose learners to a variety of topics like geographical locations or historical explorations so that they become aware and informed. Third, ‘communicate’ entails students to embody avatars to communicate with other users in virtual settings. Finally, ‘design’ means students need freedom and control to create art and other creative projects. Table 4 best summarizes the four purposes:

Table 4

The four purposes of VR applications (from Lege et al., 2020, p. 33)

Purpose	Types of applications
• Entertain	• Mental or physical challenge, games, movies
• Inform	• Tours, exploration, science
• Communicate	• Chatting, social spaces
• Design	• Creation, design, art, mind maps, memory palaces

4. Communicative capability

This lens examines the extent to which VR applications make communication and interaction more accessible to learners (Lege et al., 2020). Effective VR experiences facilitate authentic language use and allow learners to practice and develop their language skills with other users in real-life situations. Frazier et al. (2021) differentiate between high and low communicative capability of VR applications in the language classroom. According to them, VR applications with high communicative capability offer students the ability to communicate with other users using microphones in real time, referred to as synchronous voice chat, sometimes including text transcripts and other visual modes of communication.

On the other side, VR applications with low communicative capability offer only limited communication possibilities for their users, and therefore, the latter have single-user experiences (Lege et al., 2020). VR applications that can offer a mix of high and low communication capabilities may be described as medium.

Table 5

Levels of communicative capability and indicators (from Lege et al., 2020, p. 34)

Level	Common indicators of communicative capability
• High	<ul style="list-style-type: none"> • Synchronous voice and/or text chat • Generally no content filtration (possibility of objectionable content or harassment)
• Medium	<ul style="list-style-type: none"> • Asynchronous voice and/or text messages • Filtered interactions
• Low	<ul style="list-style-type: none"> • Solo or offline experience (no communication in VR)

By considering VR applications through the four lenses, educators and teachers can develop materials and activities that make VR accessible and beneficial for language learning. This framework makes VR a valuable tool in educational settings, and therefore, learning becomes engaging, effective, and appropriate.

1.5. Using virtual reality in primary education

Since VR technology has become characterized by its ability to create immersive, interactive, and three-dimensional environments, it has been integrated into the education sector at all levels. This section deals with integrating VR into primary education, precisely stressing its benefits and challenges.

In his comprehensive paper titled "Using virtual reality in primary education: A systematic review", Yünkül (2022) provides a detailed analysis of the topic. He presented

several studies on the benefits of VR in primary education. Tables 6 and 7 list some of the main results, which will be summarized in the following lines.

Table 6

Studies on the benefits of virtual reality in primary education (from Yüncül, 2022, p. 184)

Themes	Results	Articles
Success	As a result of the research, it was concluded that the use of virtual reality technology in teaching the subject of cell has a significant effect on the success of the students.	(Sarioğlu and Girgin, 2020)
	It shows a significant impact on students' learning outcomes.	(Wu et al., 2021)
	It has led to more efficient learning and understanding of mathematical concepts compared to traditional teaching methods.	(Demitriadou et al., 2020)
	VR practice has had significant effects on foreign learning.	(Chen et al., 2022)
	It showed that listening comprehension and retention were significantly higher with VR play than with video watchers.	(Tai and Chen, 2021)
	It helped them activate their prior knowledge and make appropriate inferences.	(Tai and Chen, 2021)
	It reduced anxiety and thus aided cognition.	(Tai and Chen, 2021)
	He revealed that he achieved high academic achievement and participation scores (cognitive, behavioral, emotional, and social).	(Liu et al., 2020)
Attitude	As a result of the research, it was concluded that the use of virtual reality technology in teaching the subject of cell has a significant effect on students' attitudes toward the lesson.	(Sarioğlu and Girgin, 2020)
	The virtual reality environment had positive effects on students with weaker learning attitudes.	(Wu et al., 2021)
	We found that all students using VR improved their attitudes towards science.	(Bill Brown, et al., 2021)
	In particular, students with lower self-efficacy levels may have participated more in VR environments and had more positive learning attitudes.	(Cheng and Tsai, 2020)

Table 7

Studies on the benefits of virtual reality in primary education from Yünkül, 2022, p. 186)

Themes	Results	Articles
Motivation	It showed that he began to see VR applications as complementary educational tools. SG practice had significant effects on cognition and creative motivation, It also increased their motivation to learn.	(Chen et al., 2022) (Chang et al., 2020)(Chang, Hsu, Kuo, et al., 2020) (Sontay and Karamustafaoglu, 2021)
Cognitive load	It has been shown that it is effective in increasing students' motivation to science lessons. VR practice had significant effects on foreign learning and related cognitive load.	(Chen et al., 2022) (Tai and Chen, 2021)
Entertainment and Satisfaction spatial thinking	It prevented excessive cognitive load. It has proven effective in making lessons fun. Students had fun experiences in learning with VR.	(Sontay and Karamustafaoglu, 2021) (Cheng and Tsai, 2020) (Yang et al., 2021)

The tables provide an overview of the different studies that dealt with VR's benefits in primary education. These studies show that VR has the potential to transform traditional teaching methods by offering a range of tools that enhance the student learning experience.

1.5.1. Benefits of VR in primary education

a) Success

VR in primary education can enhance students' learning and comprehension of complex concepts. For instance, the studies mentioned in table 6 show that VR helps students grasp mathematical concepts better than traditional teaching. This improvement is due to VR's immersive and interactive nature, which makes abstract mathematical ideas more concrete and easier. In the same way, VR is an effective tool for foreign language learning. VR enhances listening comprehension and retention when students are immersed in virtual environments where the target language is spoken. Moreover, it helps activate prior knowledge and reduces anxiety, which is crucial for language acquisition. Finally, VR affects students' progress in academic achievement and classroom participation (Yünkül, 2022).

b) Attitude

VR has demonstrated its potential by helping students develop positive attitudes toward science. This connection between classroom content and authentic applications is crucial in science subjects with complex and challenging concepts. VR allows students to visualize and interact with scientific phenomena in a virtual setting to grasp real-world applications of complex scientific concepts (see Table 6). For students who initially have lower self-efficacy and weaker learning attitudes, VR boosts their confidence and interest in the subject they aim to learn.

c) Motivation

The interactive and engaging nature of VR learning environments significantly increases student motivation. Unlike traditional teaching methods that often fail to maintain students' interest, VR makes learning enjoyable, fun, and engaging, which leads to better learning experiences. Yünkül (2022) stated that "it was seen that VR environments increased the motivation of the learners towards the lesson and were interesting and entertaining" (p. 187). In brief, motivation increases when lessons are dynamic and interactive. As a result, learning becomes more appealing and enjoyable.

d) Cognitive load and entertainment

Regarding cognitive load and entertainment, VR effectively creates a rich yet balanced educational experience (see Table 7). It reduces high cognitive load by having students interact with and manipulate virtual objects, which makes understanding abstract concepts easier. Consequently, students' cognitive capacities are not challenged, and learning is still fun and satisfying.

1.5.2. Challenges of VR in primary education

The integration of VR in primary education comes with several challenges. According to the study findings by Alalwan et al. (2020), several obstacles need to be taken into account to integrate VR into primary education effectively.

The primary challenge is the age appropriateness of VR content for primary school students. Given their young age and limited understanding of technology, some VR experiences may not be suitable for the age of the students involved. Therefore, it is crucial for teachers to carefully select and choose VR experiences that enhance their learning without causing any trouble.

Furthermore, not all students can take advantage of this learning mode even if they are used to technology. Many students, especially low achievers, might struggle to effectively engage with VR content, which may lead to frustration and disengagement. In this respect, Borich (2017) argues, "Although your students may already be users of digital technologies, they have not always used them as learning tools. Therefore, you should design appropriate learning tasks to model how your students can use the technologies" (p. 217). Hence, teachers must familiarize them with VR technology to make classes more accessible and practical.

Another challenge is controlling VR's content. Students might encounter unrelated or inappropriate material, which could reduce VR's educational value and lead to distractions and misuse. Educators and technology experts should carefully design relevant and safe experiences for students.

Additionally, health issues associated with too much VR use are another concern. Excessive VR use can cause eyestrain, headaches, and addiction (Alalwan et al., 2020). This negative impact on primary school students' physical and mental health makes us question the long-term effectiveness of VR as a regular teaching tool.

Time constraints are another obstacle that sometimes makes integrating VR into primary education ineffective. In the same study by Alalwan et al. (2020), teacher participants expressed concerns about the limited time available for science lessons. Given this constraint, we understand that incorporating VR could sometimes waste time, and teachers cannot cover the necessary syllabus content. As a result, while it might be useful for occasional lessons, VR cannot be seen as a practical tool for long-term use within primary education.

Finally, most primary schools lack the technological infrastructure required for VR. For example, there is limited Wi-Fi availability, internet breakdowns, and even lack of VR tools, which hinders the effective use of VR in classrooms. That is why stable and good technological infrastructure is essential for VR applications, and without it, the implementation of VR can lead to frustrating experiences for teachers and students. One of the teacher participants in the Alalwan et al. (2020) study reported the following: "It is impossible to use VR in every lesson. We have to compete with other teachers to borrow computer labs and use them in turns. The lab contains a few places for the students to use. Only certain areas have an internet connection" (p. 4).

In conclusion, VR in primary education can be effective in many aspects. VR can enhance learning results, stimulate positive attitudes toward learning, and make education more interactive, engaging, and entertaining. However, its integration into primary education faces various challenges and obstacles. By revisiting VR in primary education specifically and education at large, we could create more immersive, practical, and enjoyable learning experiences for students. All stakeholders should join efforts to overcome the above-mentioned challenges and ensure that VR is implemented effectively and leads to fruitful learning outcomes.

1.6. Virtual reality in education: Learning theories

1.6.1. Constructivism

Constructivism, which primarily has a psychological and philosophical perspective, has also been applied to language teaching and learning. It stems from the works of notable theorists like Jean Piaget and John Dewey (Chen, 2009). It is a learning theory that emphasizes that learners should construct their understanding and knowledge through hands-on experiences and interactions with their environment. Simply put, it asserts the active role of learners in building and shaping what they learn and understand through direct interaction with the world (Bruning et al., 2004). Schunk, H. D. (1991) states that “constructivist environments should create rich experiences that encourage learning” (p. 261). In this regard, VR is an innovative technological tool that immerses learners in diverse environments and helps foster active engagement in the learning experience. Accordingly, teachers must develop materials and tools that deeply engage students.

Constructivist learning in VR entails creating virtual environments that grant students opportunities to explore, experiment, and engage with concepts meaningfully. Learners can engage in exploratory learning by navigating and manipulating virtual objects, with immediate feedback on their actions (Chen, 2009). Schunk (1991) argues that “A key assumption of constructivism is that people are active learners and develop knowledge for themselves. To understand material well, learners must discover the basic principles” (p. 231). This approach prioritizes learner-centeredness and active participation. Unlike old-fashioned teaching methods, VR technology offers immersive experiences that mimic real-world situations so that students can put their knowledge into practice (Marougkas et al., 2023). For instance, experiential learning allows students to experience scientific experiments in virtual labs to grasp and remember the material well.

Table 8*Constructivism and virtual reality (from Chen, 2009, p. 79)*

Constructivist Learning Principles	Technical Capabilities of Virtual Reality
Understanding is tracked by experience	<ul style="list-style-type: none"> • Can provide virtual experience instead of words or pictures. Virtual experience has natural semantics that provide meaning to the learner without any explanation
Instruction cannot be designed - learners construct their own knowledge	<ul style="list-style-type: none"> • Virtual environment is designed without a specified sequence - permits any kind of interaction the system is capable of
Rich sources of information	<ul style="list-style-type: none"> • Virtual environment in itself naturally contains needed information • Can also be complemented with other computer-supported collaborative learning tools to provide other relevant information (e.g., World Wide Web)
Cognitive tools - intellectual devices used to visualize, organize, automate, or supplant information processing	<ul style="list-style-type: none"> • Can act as visualization tool, modeling and design tool, dynamic modeling tool, and automation tool
Conversation and collaboration tools - access to shared information and knowledge building tools to help learners collaboratively construct socially shared knowledge	<ul style="list-style-type: none"> • Can provide a shared space for a group of learners, either co-located or at a distance, to collaboratively construct knowledge through synchronous and/or asynchronous communication • Can incorporate virtual bodies (embodiments) to improve the realism of the collaboration process.

Chen (2009) introduced the idea that VR enhances students' problem-solving skills through VR representations. According to constructivists, since learning is contextual and can never be separated from our lives, learning environments should present problems that reflect authentic contexts to make learning relevant and engaging. VR technology is an excellent example that provides three-dimensional, visual, and tactile representations of problems that can simulate real-world environments. In this respect, learners learn better as they directly link the VR experiences to real-life scenarios. Not to forget that their problem-solving capacities develop.

Building on the last idea, effective constructivist learning environments should provide rich sources of information and cognitive tools to support learners in building their knowledge and gradually developing their mental abilities. VR is an excellent cognitive tool since it helps learners visualize complex and abstract concepts. Therefore, students' cognitive abilities start to develop, facilitating deeper understanding. What is essential is that

the cognitive load of constructing mental images should be minimized. This is very important, mainly when dealing with younger students who may have difficulties using much cognitive effort to understand complex concepts.

1.6.2. Social constructivism

Following in the footsteps of constructivism, social constructivism is a learning theory that stresses the role of social interactions and cultural contexts in knowledge development (Marougkas et al., 2023). Rooted in the ideas of theorists like Vygotsky (1978), social constructivism states that learning is a social process where individuals build on their previous knowledge to create new ones through collaboration and interaction with others. As Youngs (2019) puts it, language learners “are their own best teachers and can rely on their previous knowledge of the world” (p. 19). Put differently, knowledge construction occurs within social contexts and interactions with peers, teachers, and our surroundings.

The theory also stresses the idea that learners need scaffolding and a supportive environment to reach their *Zone of Proximal Development (ZPD)*, (Vygotsky, 1978). *ZPD* refers to the set of tasks that learners should perform with the support of a more knowledgeable person until they can perform independently. That is why guided instructions, scaffolding, and teacher assistance are crucial for students.

In the classroom, social constructivism is not just a theory but a practical approach that emphasizes collaborative learning and active engagement with the material. Teachers are not mere knowledge providers but facilitators who guide students in constructing their understanding. This approach can be implemented through group work, peer tutoring, and discussions (Youngs, 2019). The role of the teacher is to provide scaffolding that supports students' learning through asking questions, giving constructive feedback, and gradually

reducing assistance as students become more proficient. Students are thus encouraged to express themselves, learn through collaboration, and build on shared knowledge.

When social constructivist principles are applied to VR, the latter offers unique opportunities for students in the language classroom. VR can support collaborative learning by providing shared virtual spaces where learners can navigate synchronously or asynchronously. These environments can incorporate avatars and other embodiments that enhance the sense of presence and interaction among learners. This sense of collaboration is vital for learners within the realm of education. Schunk, H. D. (1991), drawing on Vygotsky's (1978) theory, postulates that "social interactions are critical; knowledge is co-constructed between two or more people" (p. 243).

VR environments can replicate social interactions and collaborative experiences where learners are engaged with the material and each other in immersive ways. For instance, students can participate in virtual classrooms and meet and interact with peers from different locations. VR also allows for role-play scenarios, where students can collaborate, negotiate, and interact with peers virtually, mirroring real-life situations (Marougkas et al., 2023). For example, in a VR-based history class, students can work together to explore a historical site and later discuss their observations with others. This immersive context can enhance engagement and motivation and make learning more dynamic. It will also make language acquisition more accessible and increase student retention .

When combined with VR technology, social constructivist principles can create engaging, interactive, and collaborative educational experiences. However, to successfully implement it in class, teachers must design the VR applications carefully and provide the necessary scaffolding to make the learning more effective.

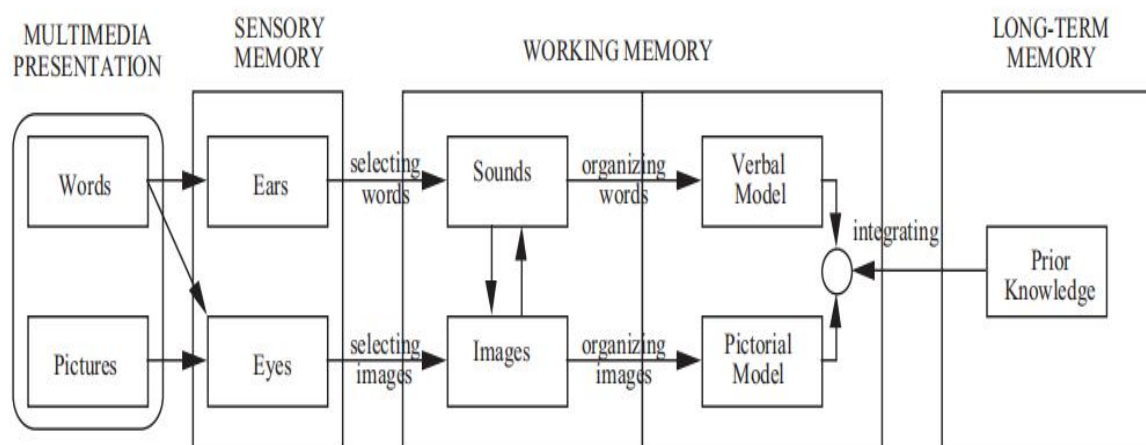
1.6.3. Cognitive Theory of Multimedia Learning (CTML)

As addressed earlier, the *Cognitive Theory of Multimedia Learning (CTML)* was devised by Mayer R. (2001) and states that students learn better from multimedia materials designed to assist the cognitive processes involved in learning (Marougkas et al., 2023).

Mayer (2008) postulates that effective multimedia learning is achieved through dual channels, visual and auditory, and active processing. As shown in Figure 4 below, the flow of information is presented through the dual channels and is then processed in sensory memory through the eyes and ears, selected and organized in the working memory, and finally integrated with prior knowledge in the long-term memory. Texts and visuals are processed through different pathways and put together to provide meaningful learning and increase retention. What is important is that the cognitive load presented in each channel should not overwhelm students' cognitive capacities, mainly if they are very young, as "there is a limit to the amount of information (verbal and visual) each channel can process" (Rudolph, 2017, p. 3). This is what Mayer (2008) refers to as limited capacity.

Figure 4

Mayer's (2001) CTML (Rudolph, 2017, p. 4)



These *CTML* principles help create and design instructional multimedia that facilitates the learning experience by preventing cognitive overload and ensuring meaningful

engagement with the material. Rudolph (2017) asserts that technology designers should first be trained in cognitive theories of multimedia learning so that they design sound “instructional multimedia pieces that will generate meaningful learning” (p.2).

VR can be relevant to *CTML* (Mayer, 2001) since it provides multimedia elements such as texts, images, and interactive simulations. In so doing, VR offers immersive educational experiences. Its advantages in education lies is its immersive and simulated environment, where students can interact with and manipulate virtual objects. Learners are then allowed to construct meaningful connections between concepts and attain the knowledge they can apply in practical contexts. This hands-on interaction, as long as it is within the reach of students’ cognitive capacities, supports the key principles outlined in *CTML*.

1.6.4. Flow theory

Flow theory, as developed by Csikszentmihalyi (1990), refers to the state of complete immersion, engagement, and enjoyment in challenging activities “that stretch our physical or mental abilities” (Brophy, 2010, p.8). Within EFL classrooms, VR can facilitate this flow state by providing immersive and interactive environments that increase student engagement and motivation and improve vocabulary acquisition. In this respect, students concentrate only on the activity without thinking about anything else, such as success or failure. Flow states most often occur when we engage in hobbies or free-time activities (Brophy, 2010). The immersive nature of VR can offer students the conditions for flow states to occur, which leads to enhanced learning experiences. As a consequence, students become more motivated to learn and acquire language effectively.

1.6.5. Experiential learning theory

Proposed by Kolb (1984), experiential learning theory emphasizes the importance of practical and active learning experiences. The theory asserts that learning is most effective

when it involves a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. As Kolb (1984) suggested, students fully internalize knowledge and skills when engaging in these four phases. They need to take an active part in the learning process, reflect on what they have learned, form new ideas, and finally put everything into practice. Experiential learning aims to enhance deep comprehension and long-term retention of information and skills by facilitating the construction of knowledge through direct experience (Marougkas et al., 2023).

More than that, experiential learning can significantly enhance learning motivation in classroom contexts. VR provides immersive environments that allow students to engage directly with the material and reflect on their learning experience by simulating real-world experiences. Students will effectively acquire language, with VR increasing their motivation to gain new knowledge.

To conclude, the implementation of VR in education is deeply rooted in many learning theories that emphasize its importance in enhancing vocabulary acquisition and motivation among primary school students. Constructivism and social constructivism stress the inclusion of immersive and interactive environments that foster collaborative experiences and social interactions and allow students to develop their cognitive abilities. The *Cognitive Theory of Multimedia Learning* sheds light on the importance of multimedia elements in VR, which facilitate effective information processing and retention. Flow theory illustrates the way VR can bring about a state of deep engagement and enjoyment, and therefore, the learning results are enhanced. Finally, experiential learning theory highlights the value of direct and practical experiences provided by VR that boost students' comprehension and motivation. Considering these factors, the theories provide a sound framework for understanding how VR can positively affect vocabulary acquisition and motivation in primary education.

1.7. Previous research studies on virtual reality and vocabulary acquisition and student motivation

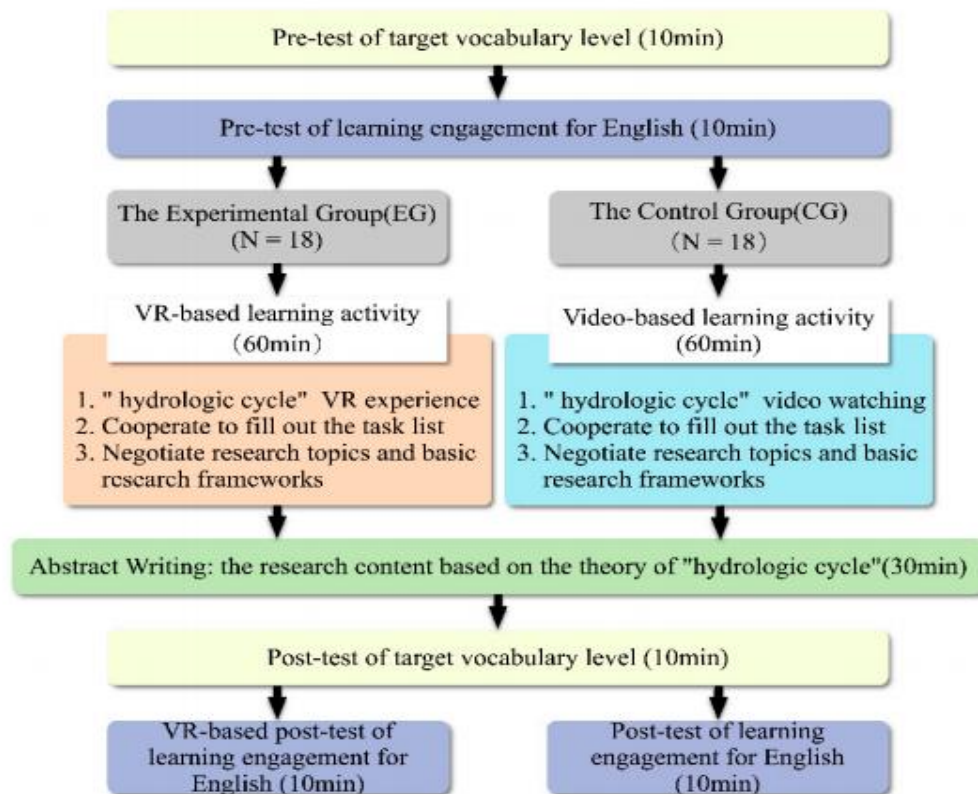
This section introduces previous research studies on VR's impact on vocabulary acquisition and student motivation within classroom settings. By presenting various studies, it aims to investigate VR's effectiveness as a tool for enhancing language learning and boosting student motivation. It is of note that the studies included in this section deal with different samples, such as university students (Li et al., 2022) & Chen et al. (2021) and intermediate school students (Alfadil, 2020). Even though the students in those studies are somehow older than the current study's sample, the results may still help us understand how VR might help younger students acquire new words and stay motivated. As a matter of fact, this study may fill a gap in research on how VR impacts vocabulary acquisition and motivation in young learners, mainly within the Catalan context.

Li et al. (2022), in their paper "An experiential learning-based Virtual Reality approach to foster students' vocabulary acquisition and learning engagement in English for Geography", discussed how VR could increase vocabulary acquisition and learning engagement among geography students. The study was conducted at Zhejiang Normal University. It involved 36 students enrolled in an English for Geography course divided into a VR-based learning experimental group and a video-based learning control group.

As depicted in Figure 5, the study followed a pre-test and post-test research design. The VR approach stems from Kolb's (1984) experiential learning theory, which entails the four stages mentioned earlier. Students in the VR group used headsets to interact with a VR environment, simulating the 'Hydrologic Cycle' VR resource. The goal of this immersive experience was to transform abstract geographical concepts into concrete and practical learning experiences to foster deeper cognitive and behavioral engagement in students.

Figure 5

Research design (Li et al., 2022, p. 6)



The study (Li et al., 2022) brought about promising results. Students in the VR group scored higher in the post-test and acquired vocabulary incidentally. Also, their engagement levels were higher. These findings suggest that VR has the potential to enhance learning outcomes and is also a promising tool for presenting complex and abstract concepts in English for Specific Purposes (ESP) courses and EFL settings in general.

Another study by Chen et al. (2021) explored the impact of integrating VR technology into problem-based learning (PBL) contexts. It mainly focused on the impact of VR on problem-solving skills, vocabulary acquisition, and motivation of undergraduate EFL learners majoring in engineering. The study comprised 84 students randomly assigned to either an experimental group using VR-assisted PBL or a control group using traditional PBL methods. The experimental group first watched a PBL scenario through VR technology,

and then created problem-solving VR videos in which they role-played the solutions. On the other hand, the control group were provided the same PBL scenario but did not use VR technology.

The study followed a quasi-experimental design for data collection; quantitative data was collected through a test and a questionnaire, and qualitative data through an individual interview with the participants.

Regarding the results, the experimental group outperformed the control group in vocabulary acquisition and demonstrated higher motivation to learn English, mainly because of its relevance to their future careers. In this context, one student illustrated in the study: “In this course, I not only experienced a new and interesting way to learn English but also applied it to solve real problems in workplace situations” (Experimental Group, S5) (Chen et al., 2021, p. 856). The immersive nature of VR can facilitate vocabulary acquisition and motivation among participants by offering contextualized and authentic learning experiences.

Chen et al. (2021) concluded that VR-assisted PBL can be a valuable approach for EFL learners by making language learning more engaging and relevant to their needs and professional careers.

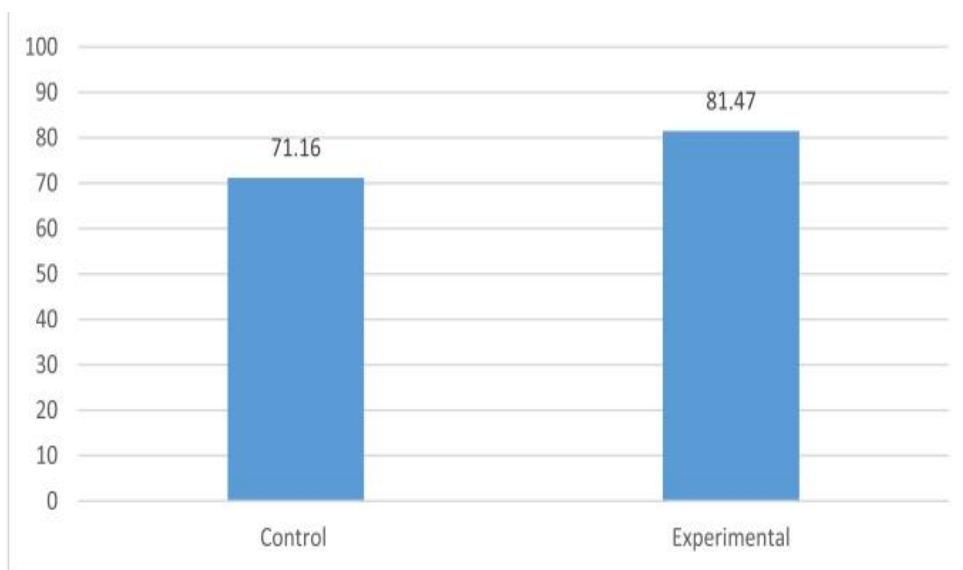
Another study to be introduced is Alfadil's (2020) where he investigated the impact of VR technology on English as a Foreign Language (EFL) learners' vocabulary acquisition. His research study involved 64 intermediate school students aged from 12 to 15. They were divided into an experimental group (n= 32) where they used the VR game "House of Languages" and a control group (n= 32) employing conventional vocabulary learning methods.

Alfadil's (2020) study followed a quasi-experimental design with pre- and post-vocabulary tests. The results were positive since the experimental group scored better on the vocabulary acquisition test than the control group. As illustrated in Figure 6, the experimental

group reached a mean post-test score of (81.47), while the control group scored (71.16). This suggests that the degree of achievement of students who experienced VR was enhanced: “it will not only improve vocabulary acquisition, but also enhance the degree of achievement” (Alfadil, 2020, p. 12).

Figure 6

Mean level of vocabulary acquisition for students in experimental and control groups (Alfadil, 2020, p.9)



The study findings showed that VR technology effectively enhances EFL vocabulary acquisition by providing an immersive and engaging environment. Students in the VR group were highly attentive and enthusiastic, which contributed to their improved vocabulary acquisition. These findings line up with previous studies on VR technology, which also showed positive effects on learning outcomes.

In a nutshell, the above-mentioned studies highlighted the positive impact of VR technology on students' vocabulary acquisition and motivation across different educational levels. While the studies' samples are primarily university and intermediate school students, the positive study findings are highly relevant to our current study's sample, which is primary school students. The studies by Li et al. (2022), Chen et al. (2021), and Alfadil (2020)

demonstrate that VR can offer immersive, engaging, and rich learning experiences that facilitate understanding and recall of vocabulary. All those findings support our alternative research hypotheses that VR integration enhances vocabulary acquisition of primary school students (**Ha 1**) and that motivation increases when VR is implemented in the EFL classroom (**Ha 2**). As mentioned before, this addresses a research gap regarding the impact of VR technology on primary school students in the Catalan context.

Chapter 2: Method

2.1. Research design

The study followed a quasi-experimental design with pre- and post-questionnaires and pre- and post-tests. The participants were primary school students studying at a semi-private school, Carmelites, in the center of Tarragona. Two fourth-grade classes were involved in the current study, and there was no random assignment as student participants remained in their actual classes. This design was chosen to compare the effects of different instructional interventions within a natural classroom setting. The two groups received somehow different treatments, as the experimental group was taught through VR, whereas the control group traditionally learned the vocabulary. Table 9 presents the research design adopted in the current study:

Table 9

Research design of the current study

Groups	Pre-treatment	Treatment	Post-treatment
Experimental group (4th grade, Class A)	- Pre-questionnaire to gather student perceptions about the use of technology, mainly VR, in education. - Pre-test to assess vocabulary baseline knowledge.	- 3 sessions of VR Shark vocabulary teaching.	- Post-questionnaire to measure changes in motivation and student attitudes. - Post-test to assess vocabulary acquisition and see improvements in student scores.

	- Pre-questionnaire to gather students' background information.	- 3 sessions of Shark vocabulary teaching, using the Grammar-Translation method.	-Same post-test to assess vocabulary acquisition and see improvements in student scores.
Control group (4th grade, Class B)	- Same pre-test to assess vocabulary baseline knowledge.		

The current study was approved by the URV ethics board, the Ethics Committee for Research in People, Society and the Environment (CEIPSA). The study was attributed the following reference: **CEIPSA-2024-TFM-0033**.

2.2. Sample

Each class comprises 26 students. Most students are bilingual students whose native languages are Catalan and Spanish. Based on the pre-questionnaire, most students speak Catalan as a native language. Class A, which is the experimental group, comprises 10 males and 16 females aged nine and 10 years old. Class B, the control group, consists of 14 females and 12 males, almost the same age as the first class. In terms of their English level, most students have an A1 CEFR level of English, with very slight differences. Some students have already attended language academies to learn English. The rest have never attended a language academy or studied at a language center before. For instance, the experimental group consists of 10 students who have already attended and are still attending language schools. Conversely, the control group comprises 15 students who also attend language academies. Tables 10 and 11 summarize the sample in detail:

Table 10*Experimental group data*

	Number	Age	Languages students speak			Studied in a language academy before	
Experimental		10	Catalan				
		9 years old	years	Catalan	Spanish	and	Yes No
	26	old			Spanish		
	22 students	4	15	4	7	10	16
		students	students	students	students	students	students

Table 11*Control group data*

	Number	Age	Languages students speak			Studied in a language academy before	
Control		10	Catalan				
		9 years old	years	Catalan	Spanish	and	Yes No
	26	old			Spanish		
	22 students	4	4	7	15	15	11
		students	students	students	students	students	students

2.3. Materials

My study was based on using the *CLASSVR* platform by Avantis Education Limited, and the set of VR goggles available at the CRAI library of the Universitat Rovira i Virgili (URV). Before the interventions, the experimental and control groups participated in a

vocabulary session using slideshows focused on shark-related terms. The slideshows included vocabulary and images from the VR Shark experience to ensure all participants started with a similar knowledge base. Here are two picture samples from the slideshows, and one of the headset:

Figure 7

The Great White (taken form the VR Shark experience)



Figure 8

A school of fish (taken form the VR Shark experience)



Figure 9

CLASSVR premium headset (<https://www.classvr.com/es/>)



Concerning data instruments, after obtaining consent from all stakeholders, a pre-questionnaire (see Appendix C) was conducted for the experimental and control groups, plus a post-questionnaire (see Appendix D) only for the experimental group. All these questionnaires were delivered at school. Moreover, both groups were administered pre- and post-tests (see Appendix E) before and after the classroom interventions to test vocabulary acquisition.

2.4. Procedures

The VR and the Grammar-Translation Method (henceforth GTM) interventions revolved around introducing fourth-grade primary school students to vocabulary related to sharks, particularly the ‘Great White’. They took place at the aforementioned school and lasted three sessions spanning from 12th to the 19th of April. The sessions were conducted during normal English classes. The experimental group received the VR experience and was

taught the sessions using a communicative approach. The control group, on the other, was introduced the same vocabulary using GTM.

Before starting both interventions, the experimental group completed a pre-questionnaire (see Appendix C), which included background information questions and others primarily related to motivation and learning. The control group only completed the pre-questionnaire so that the researcher could gather some background information.

In addition, a pretest (see Appendix E) was administered to both groups, consisting of matching and multiple-choice questions. Questions were mostly related to specific vocabulary on sharks. After the VR and GTM interventions, the two groups sat for and completed a post-test (see Appendix E) with the same questions as the pretest. Finally, only the experimental group participated in the post-questionnaire (see Appendix D), which was mainly dedicated to measuring changes in motivation and student attitudes. The control group did not participate in the post-questionnaire since the study does not aim to test motivation among its participants nor does it aim to compare it to that of the experimental group.

Taking everything into consideration, we discovered that VR intervention has improved the experimental groups' vocabulary acquisition, changed their motivation attitudes, and brought about positive results.

Chapter 3: Results

The results and statistics will be presented in this section, but they will be further interpreted and discussed in the discussion section.

Since the sample consists of 26 students, less than thirty and more than 10, a Shapiro-Wilk test was performed on the pretests of both the experimental and control groups to determine whether they followed a normal distribution. This initial test is crucial to decide whether to opt for parametric statistical tests or non-parametric ones.

As shown in Table 12, the results of the Shapiro-Wilk test showed that the p-value for the experimental group was 0.071 and 0.209 for the control group. Given that the p-values are greater than 0.05, we conclude that the p-value of Shapiro-Wilk is not significant and that the data is normally distributed. Thus, a repeated measures ANOVA was conducted to compare the pretests and post-tests of both groups to determine whether the difference in the testing was significant.

Table 12

Shapiro-Wilk Test

Descriptive Statistics

Descriptive Statistics		
	ExpPre	ControlPre
Valid	26	26
Missing	0	0
Mean	12.538	13.846
Std. Deviation	4.465	2.679
Shapiro-Wilk	0.928	0.948
P-value of Shapiro-Wilk	0.071	0.209
Minimum	4.000	7.000
Maximum	19.000	18.000

Furthermore, Table 12 indicates both groups' mean pretest scores and standard deviation before undertaking the intervention. It is crucial to highlight that the tests were scored out of 20. Regarding the experimental group, the mean pretest score is 12.538, and the standard deviation is 4.465. Hence, the group has a higher standard deviation and a wider variation in the pretest scores. In other words, there is more variability in scores among the students.

On the other hand, the control group has a higher mean score of 13.846 and a lower standard deviation of 2.679. The latter suggests more consistency in the performance levels among the control group students. In the following lines, we will explore the impact of the VR intervention, particularly on the experimental group, to determine its direct implications on participants.

3.1. Virtual reality and vocabulary acquisition

The study aimed to explore VR's impact on vocabulary acquisition among primary school students by comparing the performance on vocabulary tests before and after the VR and GTM interventions. As mentioned earlier, a repeated measures ANOVA was conducted to analyze the data. The analysis was performed on the pretest and post-test scores of students in both the experimental group, who received the VR intervention, and the control group, who was taught using the GTM.

Table 13*Repeated Measures ANOVA*

Repeated Measures ANOVA ▼

Within Subjects Effects ▼

Cases	Sum of Squares	df	Mean Square	F	p	η^2
Group	4.654	1	4.654	0.277	0.603	0.004
Residuals	419.846	25	16.794			
Testing	408.038	1	408.038	116.634	< .001	0.372
Residuals	87.462	25	3.498			
Group * Testing	20.346	1	20.346	3.278	0.082	0.019
Residuals	155.154	25	6.206			

Note. Type III Sum of Squares

Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
Residuals	351.385	25	14.055		

Note. Type III Sum of Squares

The repeated measures ANOVA showed a significant impact of the VR intervention on vocabulary acquisition among students in the experimental group. Thanks to VR technology, the experimental group outperformed the control group in the post-test, though the latter performed better in the pretest. The p-value was less than 0.05: < 0.01 which indicates a statistically significant difference in vocabulary test scores before and after the intervention. Consequently, the experimental group demonstrated significantly higher scores in the post-tests compared to the control group.

In addition, the repeated measures ANOVA showed a significant difference between the groups and between the testing, $F(1,25) = 116,634$, $p = <.001.$, with a large effect size: 0.372. In simple terms, the significant effect size shows differences in scores between the two groups. This variance in student scores was mainly due to the VR intervention and not by random chance. As a result, we can assume that the differences are statistically significant.

Table 14 provides a detailed view of students' progress, mainly the experimental group who learned vocabulary through VR technology.

Table 14

Descriptives

Descriptives

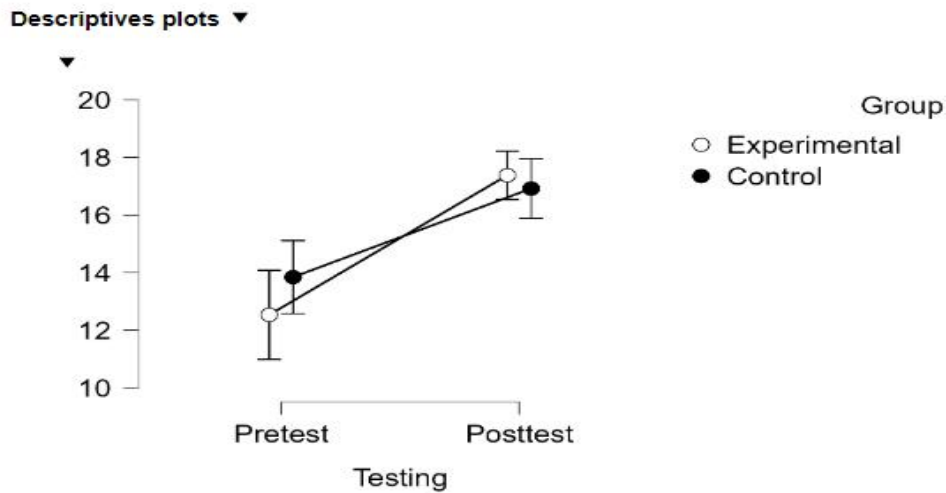
Descriptives						
Group	Testing	N	Mean	SD	SE	Coefficient of variation
Experimental	Pretest	26	12.538	4.465	0.876	0.356
	Posttest	26	17.385	2.593	0.509	0.149
Control	Pretest	26	13.846	2.679	0.525	0.193
	Posttest	26	16.923	2.591	0.508	0.153

The experimental group initially had a mean pretest score of 12.538 (SD = 4.465, SE = 0.876) with a coefficient of variation of 0.356, showing a relatively high score variability. This group improved significantly in the post-test, with the mean post-test score rising to 17.385 (SD = 2.593, SE = 0.509). The coefficient of variation decreased to 0.149, reflecting a more consistent and harmonious performance among participants.

On the other hand, the control group, who did not undergo the VR intervention, started with a higher mean pretest score of 13.846 (SD = 2.679, SE = 0.525) and a lower coefficient of variation of 0.193. Their post-test scores also improved but to a lesser extent, getting a mean of 16.923 (SD = 2.591, SE = 0.508), with the coefficient of variation slightly increasing to 0.153. In brief, the increase in scores from the pretest to the post-test was more apparent in the experimental group than in the control group, as shown in the following descriptive plot:

Figure 10

Descriptive plot diagram showing the difference between the performance of the experimental and control groups.



Since the testing was significant, it was necessary to perform a post hoc test to determine whether the test scores of the experimental and control groups are different. The repeated measures ANOVA revealed a statistically significant difference in mean test scores between the two groups, $F(1,25) = 116,634$, $p < .001$, with a large effect size: 0.372.

Table 15

Post Hoc test comparisons - Groups

Post Hoc Tests

Post Hoc Comparisons - Group

	Mean Difference	95% CI for Mean Difference			t	Cohen's d	95% CI for Cohen's d		P _{Tukey}
		Lower	Upper	SE			Lower	Upper	
Experimental Control	-0.423	-2.078	1.232	0.804	-0.526	-0.133	-0.641	0.376	.

Note. Computation of Cohen's d based on pooled error.

Note. Results are averaged over the levels of: Testing

Note. Tukey corrected p-values are not appropriate for repeated measures post-hoc tests (Maxwell, 1980; Field, 2012).

Post Hoc Comparisons - Testing

	Mean Difference	95% CI for Mean Difference			t	Cohen's d	95% CI for Cohen's d		P _{Tukey}
		Lower	Upper	SE			Lower	Upper	
Pretest Posttest	-3.962	-4.717	-3.206	0.367	-10.800	-1.244	-1.670	-0.818	.

Table 16*Post Hoc test comparisons - Groups & Testing*

Post Hoc Comparisons - Group * Testing

		Mean Difference	95% CI for Mean Difference			t	Cohen's d	95% CI for Cohen's d		P _{Tukey}
			Lower	Upper	SE			Lower	Upper	
Experimental, Pretest	Control, Pretest	-1.308	-3.914	1.299	0.941	-1.390	-0.411	-1.226	0.404	0.512
	Experimental, Posttest	-4.846	-6.530	-3.162	0.611	-7.932	-1.522	-2.303	-0.741	< .001
	Control, Posttest	-4.385	-6.855	-1.914	0.883	-4.963	-1.377	-2.295	-0.459	< .001
Control, Pretest	Experimental, Posttest	-3.538	-6.009	-1.068	0.883	-4.005	-1.111	-1.975	-0.248	0.002
	Control, Posttest	-3.077	-4.761	-1.393	0.611	-5.036	-0.966	-1.604	-0.329	< .001
Experimental, Posttest	Control, Posttest	0.462	-2.145	3.068	0.941	0.491	0.145	-0.657	0.947	0.961

The Tukey post hoc test showed that the mean difference in test scores between the experimental and control groups was not significantly different (95% CI = -2.078, 1.232), with a mean difference of -0.423. However, the mean difference between pre-test and post-test scores was significantly different (95% CI = -4.717, -3.206), with a mean difference of -3.962. As illustrated in Table 16, the first line in the post hoc analysis shows both groups are the same at the beginning of the study. The last line of the analysis shows that both groups are the same at the end of the study. Therefore, according to this analysis, there is no difference between the groups. Nevertheless, both groups improved regardless of the intervention. Still, the alternative hypothesis that the integration of VR enhances vocabulary acquisition of primary school students is accepted since the experimental groups improved significantly from the pre-test to the post-test.

While the repeated measures ANOVA showed significant effects, the post hoc test showed no statistically significant difference in mean test scores between the experimental and control groups, which may likely be due to the sample size or the intervention design and implementation.

3.2. Virtual reality and student motivation

Since the integration of VR technology in education has increasingly been explored for its potential to enhance student engagement and motivation, the study also explores the impact of VR on student motivation in primary education. The analysis is based on data collected from the experimental group through pre- and post-questionnaire responses. The questionnaires targeted students' motivation and attitudes toward using VR to learn English vocabulary. Table 17 and Figure 11 illustrate the main aspects addressed in both questionnaires:

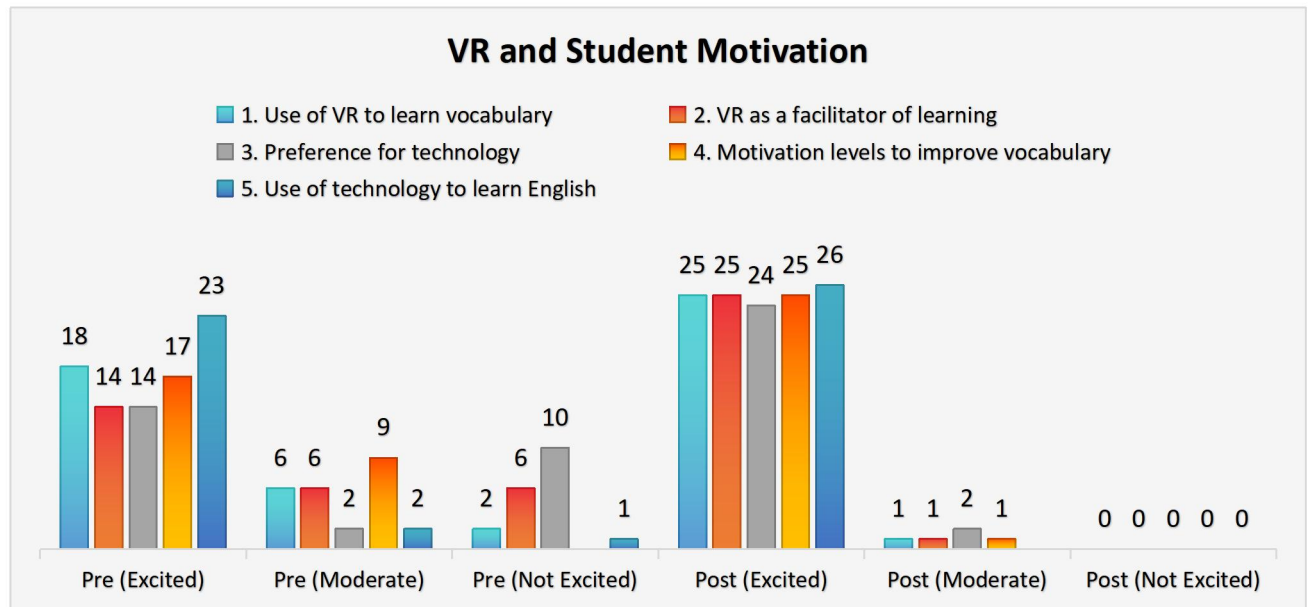
Table 17

Pre- and Post-questionnaires student responses

Aspect	Pre (Excited)	Pre (Moderate)	Pre (Not excited)	Post (Excited)	Post (Moderate)	Post (Not excited)
1. Use of VR to learn vocabulary	18	6	2	25	1	0
2. VR as a facilitator of learning	14	6	6	25	1	0
3. Preference for technology in learning	14	2	10	24	2	0
4. Motivation levels to improve vocabulary	17	9	0	25	1	0
5. Use of technology to learn English	23	2	1	26	0	0

Figure 11

Virtual reality and student motivation column



❖ **Use of VR to learn vocabulary:**

The pre-questionnaire responses indicated a positive attitude toward using VR in learning vocabulary, with 18 students reporting excitement, six showing moderate interest, and two not excited. However, after the VR intervention, there was a noticeable increase in student attitudes, with 25 students reporting excitement and only one showing moderate interest.

❖ **VR as a facilitator of learning:**

Before the intervention, 14 students were excited about VR's role in facilitating learning, six were moderately excited, and six others were not. Post-questionnaire results showed a considerable increase in positive perceptions, with 25 students excited about VR's role in facilitating learning and only one remaining moderately excited.

❖ **Preference for technology in learning:**

In the pre-questionnaire, student attitudes toward technology use in learning were varied. 14 students preferred the use of technology, two stayed neutral, and 10 showed no interest. After the VR intervention, the preference for technology in learning increased significantly, with 24 students expressing excitement and only two keeping a moderate standpoint.

❖ **Motivation levels to improve vocabulary:**

Furthermore, the VR intervention positively impacted students' motivation to improve their vocabulary. Initially, 17 students were excited about enhancing their vocabulary learning, and only nine held moderate views. After the intervention, the number of excited students increased from 17 to 25, with only one remaining moderate.

❖ **Use of technology to learn English:**

Referring to Figure 11, 23 students were excited about using technology to learn English. This number slightly increased to 26, suggesting that after experiencing the VR intervention, all participants had a positive attitude toward using technology in language learning.

To further elaborate on the descriptive results regarding the impact of the VR intervention on student motivation, a paired sample t-test was conducted.

Table 18*Paired Samples T-test for the pre- and post-questionnaire*

Paired Samples T-Test								95% CI for Cohen's d	
Measure 1		Measure 2	t	df	p	Cohen's d	SE Cohen's d	Lower	Upper
Pre (Excited)	-	Post (Excited)	-5.600	4	0.005	-2.504	0.482	-4.367	-0.608
Pre (Moderate)	-	Post (Moderate)	2.902	4	0.044	1.298	0.858	0.031	2.495
Pre (Not excited)	-	Post (Not excited)	NaN ^a						

Note. Student's t-test.

^a The variance in Post (Not excited) is equal to 0**Descriptives**

Descriptives					
	N	Mean	SD	SE	Coefficient of variation
Pre (Excited)	5	17.200	3.701	1.655	0.215
Post (Excited)	5	25.000	0.707	0.316	0.028
Pre (Moderate)	5	5.000	3.000	1.342	0.600
Post (Moderate)	5	1.000	0.707	0.316	0.707
Pre (Not excited)	5	3.800	4.147	1.855	1.091
Post (Not excited)	5	0.000	0.000	0.000	NaN

The results from the pre-questionnaire ($M = 17.200$, $SD = 3.701$) and the post-questionnaire ($M = 25.000$, $SD = 0.707$) show that students had higher motivation after the VR intervention, and the difference between the questionnaires is significant $t(4) = -5.600$, $p = .005$ with a large Cohen's d effect of -2.504 . Therefore, we reject the null hypothesis favour of the alternative hypothesis.

Chapter 4: Discussion

This section discusses and interprets the results in light of the research questions and the corresponding hypotheses.

4.1. The impact of virtual reality on vocabulary acquisition

The results of the current study reveal that VR has significantly enhanced vocabulary acquisition among primary school students. The repeated measures ANOVA (see Table 13 in Chapter 3) showed a statistically significant improvement in the experimental group's vocabulary post-test scores after the VR intervention compared to the control group, with a p-value less than 0.05: < 0.01 . This significant difference in test scores shows that primary school students learn better with VR technology than traditional teaching methods for vocabulary acquisition. As a result, the null hypothesis (**H₀₁**), which states that the integration of VR does not enhance vocabulary acquisition, is rejected in favor of the alternative hypothesis (**H_{a1}**).

Furthermore, the experimental group showed an increase in mean post-test scores, rising from 12.538 (SD = 4.465) to 17.385 (SD = 2.593). Along with the decrease in the coefficient of variation from 0.356 to 0.149, the improvement in test scores suggests that the group not only performed better in the post-test but also demonstrated more consistency among students. On the other hand, the control group, who did not experiment with VR, showed less improvement from a mean pre-test score of 13.846 (SD = 2.679) to a post-test mean of 16.923 (SD = 2.591), with the coefficient of variation slightly increasing from 0.193 to 0.153. These findings emphasize the potential of VR in enhancing vocabulary learning and making it more engaging, fun, and effective.

Despite showing a significant difference between pre-test and post-test scores within each group (95% CI = -4.717, -3.206), the post hoc test showed no significant difference

between the experimental and control groups' test scores (95% CI = -2.078, 1.232).

Accordingly, we understand that while both groups improved, the small sample size or the intervention's design might have influenced the results. However, the overall improvement in the experimental group's scores strongly supports the impact of VR on primary school students' vocabulary acquisition.

4.2. The impact of virtual reality on student motivation

Regarding student motivation, it was assessed through pre- and post-intervention questionnaires focusing on students' attitudes toward learning English vocabulary through VR. The pre-questionnaire results showed that 18 students were excited, six were moderately interested, and two were not excited about using VR for learning vocabulary. After the intervention, these numbers increased to 25 excited and only one moderately excited, but none of the students showed any lack of excitement. This apparent change in students' attitudes emphasized the increase in student motivation.

The paired samples t-test results also indicate a significant difference between pre- and post-questionnaire student attitudes. The pre-questionnaire mean was 17.200 (SD = 3.701), and the post-questionnaire mean rose to 25.000 (SD = 0.707). The difference was statistically significant ($t(4) = -5.600$, $p = 0.005$), with a large effect size (Cohen's $d = -2.504$). This significant difference suggests a strong positive impact of VR on student motivation. Also, the p-value indicates that the change in students' motivation attitudes toward VR did not happen by random chance. This shift in students' attitudes strongly supports rejecting the null hypothesis (**H₀₂**), which states that motivation does not increase when VR is implemented in the EFL classroom, in favor of the alternative hypothesis (**H_{a2}**).

4.3. The impact of virtual reality on education

The study suggests that VR may have broader educational applications beyond vocabulary acquisition and motivation. The statistically significant improvements in vocabulary acquisition testing reflect VR's potential as a promising and effective educational tool. Its immersive and interactive nature can transform traditional teaching methods by providing students with engaging experiential learning opportunities (Kolb, 1984).

The pre- and post-questionnaire data further highlight the role of VR in enhancing student engagement and motivation. Before the VR intervention, 18 students in the experimental group were excited about using VR to learn vocabulary. However, the number increased to 25 students after the intervention. Student showed positive attitudes in other aspects, such as VR as a facilitator of learning, preference for technology in learning, motivation to improve vocabulary, and the use technology to learn English (see Figure 11 in Chapter 3). These results indicate that VR enhances learning outcomes and positively affects students' perceptions of learning and technology integration in education.

Additionally, the findings of the current study successfully answered the research questions. The integration of VR has significantly enhanced vocabulary acquisition among primary school students, as supported by the repeated measures ANOVA and post hoc test results (see Tables 13, 15 and 16 in Chapter 3). As a result, the alternative hypothesis (**Ha1**) is accepted. Moreover, the increase in motivation levels after the VR intervention, as shown by the paired samples t-test and questionnaire results (see Tables 17 and 18 in Chapter 3), supports the acceptance of the alternative hypothesis (**Ha2**). These results suggest that educational institutions should consider implementing VR into their curricula to maximize its benefits and improve teaching and learning experiences in different aspects. However, careful consideration should be implemented to benefit from VR's potential.

Overall, the findings of the study stress the positive impact of VR on vocabulary acquisition and student motivation in primary education. The significant improvements in test scores and the shift in motivation levels support VR's potential to enhance students' learning experiences. VR can improve learning outcomes by providing immersive and interactive learning experiences, boosting student motivation, and fostering engaging learning environments. Importantly, the research questions have been answered positively. As a result, the alternative hypotheses have been accepted, and the null hypotheses have been rejected.

Limitations

The current study brought about positive results. However, it faced some limitations. The first limitation to mention is the small sample size. The study findings would have been more reliable with a larger sample. Consequently, the small sample size has likely affected the credibility of the results and conclusions.

The second limitation is the time constraints. The VR intervention was limited to three sessions within students' regular English classes to avoid disrupting the teacher's schedule. Also, the intervention coincided with some student exams. Therefore, this short duration of the VR intervention may not perfectly reflect long-term effects or provide solid results.

The final limitation is the lack of familiarity with VR technology, both on the researcher's part and among the primary school students. This unfamiliarity may have affected the design and implementation of the VR experiment, affecting its overall effectiveness, as shown in the post hoc test conducted (see Tables 15 and 16 in Chapter 3).

Conclusion

The current study explored the impact of VR on vocabulary acquisition and motivation among primary school students in light of previous research studies. The results showed significant improvements in vocabulary test scores and enhanced student motivation after the VR intervention. The study findings revealed the potential of VR as a promising educational tool.

The findings from the vocabulary acquisition analysis showed that students who used VR scored significantly higher on post-tests than their pre-test scores. The experimental group's mean score increased from 12.538 (SD = 4.465) to 17.385 (SD = 2.593). This demonstrates improved performance and greater consistency among students. On the other hand, the control group, who did not use VR, showed less improvement, with scores rising from 13.846 (SD = 2.679) to 16.923 (SD = 2.591). These results indicate that VR has the potential to enhance vocabulary acquisition more effectively than traditional teaching methods.

Regarding student motivation, the data from pre- and post-questionnaires showed a significant increase in positive attitudes toward learning English vocabulary through VR technology. Before the VR intervention, 18 students were excited, six were moderately interested, and two were not excited about using VR. After the intervention, the numbers increased to 25 excited students and only one student showed moderate interest. Moreover, the paired samples t-test confirmed the positive attitude change by demonstrating a significant difference between pre- and post-questionnaire means (17.200 to 25.000), with a p-value = 0.005 and a large effect size (Cohen's $d = -2.504$). In this regard, we understand that VR significantly helps boosting student motivation.

Due to its immersive and interactive nature, the study also pointed out that VR can be applied to aspects beyond vocabulary acquisition and motivation. VR offers engaging

experiential learning opportunities that can transform traditional educational methods.

Students' increased motivation and positive perceptions of learning with VR suggest that it can effectively facilitate learning and enhance student engagement at different levels.

Despite the promising results, the study faced several limitations. The first one was the small number of participants which made the results less reliable. Second, because of the limited time, the VR sessions were short and might not show long-term effects on students. Finally, neither the researcher nor the students were very familiar with VR technology, which could have affected the experiment's effectiveness.

To sum up, this study supports the integration of VR into primary education as a tool to enhance vocabulary acquisition and student motivation. The significant improvements in vocabulary test scores and the positive change in student perceptions toward learning vocabulary through VR suggest that it is a promising tool to be implemented in educational settings. Therefore, further research studies should consider large sample sizes and extended intervention periods. Also, more VR familiarity is recommended to maximize VR's long-term impacts on education. All stakeholders should consider these factors when implementing VR to improve teaching and learning experiences across different subjects and student groups.

References

- Alalwan, N., Cheng, L., Al-Samarraie, H., Yousef, R., Alzahrani, A. I., & Sarsam, S. M. (2020). Challenges and Prospects of Virtual Reality and Augmented Reality Utilization among Primary School Teachers: A Developing Country Perspective. *Studies in Educational Evaluation*, 66, 100876. <https://doi.org/10.1016/j.stueduc.2020.100876>
- Alfadil, M. (2020). Effectiveness of virtual reality game in foreign language vocabulary acquisition. *Computers & Education*, 153, 103893. <https://doi.org/10.1016/j.compedu.2020.103893>
- Alizadeh, M. (2019). Virtual Reality in the Language Classroom: Theory and practice. *CALL-EJ*, 21–30. https://www.academia.edu/40411061/Virtual_Reality_in_the_Language_Classroom_Theory_and_Practice
- AlSaleem, B. I. A. (2023b). The efficiency of metaverse platforms in language learning based on Jordanian young learners' perceptions. *Arab World English Journal*, 14(1), 334–348. <https://doi.org/10.24093/awej/vol14no1.21>
- Anderson, J. (2010). *ICT transforming education: A regional guide*. UNESCO Bangkok, Asia and Pacific Regional Bureau for Education. <https://doi.org/10.3217/978-3-85125-609-3-01>
- Beck, D., Peña-Rios, A., Ogle, T., Allison, C., Morgado, L., Pirker, J., Richter, J., & Gütl, C. (Eds.). (2018). *VR and unlearning: Empowering transformation. Proceedings from the Fourth Immersive Learning Research Network Conference (iLRN 2018 Montana Workshop, Long and Short Paper, and Poster)*. Verlag der Technischen Universität Graz. <https://doi.org/10.3217/978-3-85125-609-3-01>
- Borich, G. D. (2017). *Effective teaching methods: Research-based practice* (Ninth ed.). Prentice Hall.

- Brophy, J. (2010). *Motivating students to learn* (3rd ed.). Routledge.
- Bruning, R. H., Schraw, G. J., Norby, M. M., & Ronning, R. R. (2004). *Cognitive psychology and instruction* (4th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.
- Chee, Y. S. (2001). Virtual reality in education: Rooting learning in experience. In Proceedings of the International Symposium on Virtual Education 2001, 43-54. Symposium Organizing Committee, Dongseo University
- Chen, C. J. (2009). Theoretical Bases for Using Virtual Reality in Education. *Themes in Science and Technology Education*, 2(1), 71-90. Retrieved March 19, 2024 from <https://www.learntechlib.org/p/148622/>.
- Chen, C., Hung, H., & Yeh, H. (2021). Virtual reality in problem-based learning contexts: Effects on the problem-solving performance, vocabulary acquisition and motivation of English language learners. *Journal of Computer Assisted Learning*, 37(3), 851–860. <https://doi.org/10.1111/jcal.12528>
- Chen, W., Zhang, J., & Yu, Z. (2023). A bibliometric analysis of the use of the metaverse in education over three decades. *International Journal of Information and Communication Technology Education*, 19(1), 1–16. <https://doi.org/10.4018/ijicte.322101>
- Chu, S.-T., Hwang, G.-J., & Hwang, G.-H. (2023). A goal-oriented reflection strategy-based virtual reality approach to promoting students' learning achievement, motivation and reflective thinking. *Sustainability*, MDPI, vol. 15(4), 1-13. <https://doi.org/10.3390/su15043192>
- Cramariuc, G., & Dan, M. (2021). Integration of Virtual Reality in the Instructive-Educational Process in Primary Education. *Revista Romaneasca Pentru Educatie Multidimensionala*, 13(1Sup1). <https://doi.org/10.18662/rrem/13.1sup1/384>
- Csikszentmihalyi, M. Flow. In *The Psychology of Optimal Experience*; Harper & Row: New York, NY, USA, 1990.

- Dianti, R., & Atmanegara, Y. (2019). ICT impact on EFL secondary students' English achievements. *Proceedings of the Eleventh Conference on Applied Linguistics (CONAPLIN 2018)*. <https://doi.org/10.2991/conaplin-18.2019.91>
- Fainholc, B. (2008). Teaching and learning in the knowledge society. *Encounters in Theory and History of Education*, 6. <https://doi.org/10.24908/eoe-ese-rse.v6i0.624>
- Frazier, E., Lege, R., & Bonner, E. (2021). Making Virtual Reality accessible for language learning: Applying the VR application analysis framework. *Teaching English With Technology*, 21(1), 131–143.
<http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-c298241b-f65d-45ce-834f-63c7e13df4dd/c/ARTICLE7>
- Hull, C. L. (1943). *Principles of behavior: An introduction to behavior theory*. New York: Appleton-Century-Crofts.
- Iwaizumi, E., & Webb, S. (2022). Vocabulary: A guide to researching instructed second language vocabulary acquisition. In L. Gurzynski-Weiss & Y. Kim (Eds.), *Instructed Second Language Acquisition Research Methods*, (pp. 181–206). University of Western Ontario.
- Kolb, D.A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*; Englewood Cliffs: Prentice-Hall, NJ, USA, .
- Lajoie, S.P., & Derry, S.J. (Eds.). (1993). *Computers As Cognitive Tools* (1st ed.). Routledge.
<https://doi.org/10.4324/9780203052594>
- Legault, J., Zhao, J., Chi, Y.-A., Chen, W., Klippel, A., and Li, P. (2019). Immersive virtual reality as an effective tool for second language vocabulary learning. *Languages*, 4(1), 1-33. <https://doi.org/10.3390/languages4010013>

- Lege, R., & Bonner, E. (2020). Virtual reality in education: The promise, progress, and challenge. *The JALT CALL Journal*, 16(3), 167–180.
<https://doi.org/10.29140/jaltcall.v16n3.388>
- Lege, R., Bonner, E., Frazier, E., & Pascucci, L. (2020). Pedagogical Considerations for Successful implementation of virtual reality in the language classroom. In *Advances in educational technologies and instructional design book series* (pp. 24–46).
<https://doi.org/10.4018/978-1-7998-2591-3.ch002>
- Li, Y., Ying, S., Qu, C., & Guan, J. (2022). An Experiential Learning-Based Virtual Reality approach to foster students' vocabulary acquisition and learning engagement in English for Geography. *Sustainability*, 14(22), 15359. <https://doi.org/10.3390/su142215359>
- Lin, Y., & Wang, H. (2021). Using virtual reality to facilitate learners' creative self-efficacy and intrinsic motivation in an EFL classroom. *Education and Information Technologies*, 26(4), 4487–4505. <https://doi.org/10.1007/s10639-021-10472-9>
- Madini, A. A., & Alshaikhi, D. (2017). Virtual reality for teaching ESP vocabulary: a myth or a possibility. *International Journal of English Language Education*, 5(2), 111.
<https://doi.org/10.5296/ijele.v5i2.11993>
- Marougkas, A., Troussas, C., Krouska, A., & Sgouropoulou, C. (2023). Virtual reality in education: A review of learning theories, approaches and methodologies for the last decade. *Electronics* 2023, 12(2832). <https://doi.org/10.3390/electronics12132832>
- Mayer, R. E. (2001). *Multimedia learning*. Cambridge: Cambridge University Press
https://openlibrary.org/books/OL7753908M/Multimedia_Learning
- Mayer, R. E. (2008). Applying the science of learning: Evidence-based principles for the design of multimedia instruction. *The American Psychologist*, 63(8), 760–769.
<https://doi.org/10.1037/0003-066x.63.8.760>

- Mayer, R. E. (2014). Cognitive Theory of Multimedia Learning. In *Cambridge University Press eBooks* (pp. 43–71). <https://doi.org/10.1017/cbo9781139547369.005>
- McGovern, E., Moreira, G. J., & Luna-Nevarez, C. (2019). An application of virtual reality in education: Can this technology enhance the quality of students' learning experience? *Journal of Education for Business*, 95(7), 490–496.
<https://doi.org/10.1080/08832323.2019.1703096>
- McGovern, E., Moreira, G. J., & Luna-Nevarez, C. (2020). An application of virtual reality in education: Can this technology enhance the quality of students' learning experience? *Journal of Education for Business*, 95(7), 490–496.
<https://doi.org/10.1080/08832323.2019.1703096>
- Monteiro, A. M. V., & Ribeiro De S., P. N. (2020). Virtual Reality in English vocabulary teaching: An exploratory study on affect in the use of technology. *Trabalhos em Lingüística Aplicada*, 59(2), 1310–1338.
<https://doi.org/10.1590/01031813756931620200716>
- Ogle, D., & Beers, J. W. (2008). *Engaging in the Language Arts: Exploring the power of language*. <https://ci.nii.ac.jp/ncid/BB02889330>
- Onu, P., Pradhan, A., & Mbohwa, C. (2023). Potential to use metaverse for future teaching and learning. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-023-12167-9>
- Palmeira, E. G. Q., Martin, V. B. S., Gonçalves, V. B., Moraes, Í. A., Júnior, E. a. L., & Cardoso, A. (2020). The Use of Immersive Virtual Reality for Vocabulary Acquisition: a Systematic Literature Review. *Anais Do XXXI Simpósio Brasileiro De Informática Na Educação (SBIE 2020)*, 532-541. <https://doi.org/10.5753/cbie.sbie.2020.532>
- Rank, T., Millum, T., & Warren, C. (2011). *Teaching English using ICT: A Practical guide for Secondary school teachers*. <http://ci.nii.ac.jp/ncid/BB08535261>

- Resta, P. and Patru, M. (Eds). 2010. *Teacher Development in an E-learning Age: A Policy and Planning Guide*. Paris, UNESCO
- Roda-Segarra, J., Mengual-Andrés, S., & Martínez-Roig, R. (2022). Using virtual reality in education: A bibliometric analysis. *Campus Virtuales*, 11(1), 153-165.
<https://doi.org/10.54988/cv.2022.1.1006>
- Rudolph, M. (2017). Cognitive Theory of Multimedia Learning. *Journal of Online Higher Education*, 1(2), 1–15.
- Schunk, D. H. (1991). *Learning theories: An educational perspective*. Macmillan Publishing Co, Inc.
- Scrivener, J. (2005). *Learning Teaching*. MacMillan.
- Sharma, Y. K. (2016). Importance of ICT in education. *International Journal of Advance Research in Science and Engineering (IJARSE)*, 5(08), 662–669.
- Sherman, W. R., & Craig, A. B. (2003). Understanding Virtual Reality—Interface, application, and design. *Presence*, 12(4), 441–442.
<https://doi.org/10.1162/105474603322391668>
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wang, Z., Guo, Y., Wang, Y., Tu, Y., & Liu, C. (2021). Technological Solutions for Sustainable Development: Effects of a Visual Prompt Scaffolding-Based Virtual Reality Approach on EFL learners' reading comprehension, learning attitude, motivation, and anxiety. *Sustainability*, 13(24), 13977. <https://doi.org/10.3390/su132413977>
- Youngs, B. L. (2019). SLA Theories and Practices in CALL. In Editor1 & Editor2 (Eds.), In *Engaging Language Learners through CALL: From Theory and Research to Informed Practice*. (pp. 7-50). Equinox Publishing.

Yünkül, E. (2022). Using Virtual Reality in Education: a bibliometric analysis. *Journal of Educational Theory and Practice Research*, 8(2), 177–193.

<https://doi.org/10.38089/ekvad.2022.110>

Appendix A

Consent form



UNIVERSITAT
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Full de consentiment informat

Títol de l'estudi: ¹ Exploring the impact of Virtual Reality on EFL primary school students' vocabulary acquisition and general motivation.

Dades de contacte de l'investigador principal: ² mounjid-medamine@outlook.fr / 672564138

Grup de recerca, si escau: The department of English and German studies

Jo ³ amb DNI

- He llegit el full d'informació al participant sobre l'estudi del qual se m'ha entregat una còpia.
- He pogut fer preguntes i resoldre els meus dubtes sobre l'estudi i la meva participació.
- Comprenc la meva participació a l'estudi d'acord amb allò expressat al full d'informació al participant sobre l'estudi i de les respostes a les meves preguntes, així com els riscos i beneficis que comporta.
- Accepto que la meva participació és voluntària i dono lliurement la meva conformitat per participar a l'estudi.
- Conec que em puc retirar en qualsevol moment de la participació a l'estudi sense que això em pugui causar cap perjudici.
- Estic informat sobre el tractament que es realitzarà de les meves dades personals.
- Dono el meu consentiment per a l'accés i utilització de les meves dades en les condicions detallades al full d'informació al participant sobre l'estudi.

Sí No

- ⁴ Dono el meu consentiment per a la difusió de les meves dades personals junt amb la publicació dels resultats de l'estudi.

Sí No

- Un cop finalitzada la investigació, és possible que les dades obtingudes siguin d'interès per a altres estudis relacionats. En relació amb això, s'ofereixen les següents opcions:

NO autoritzar l'ús de les seves dades en altres projectes d'investigació relacionats.

SÍ autoritzar l'ús de les seves dades en altres projectes d'investigació relacionats.

- ⁵ Un cop finalitzada la investigació, és possible que hi hagi mostra sobrant. En relació a aquestes, s'ofereixen les següents opcions:

La **destrucció** de la mostra sobrant.

¹ Del projecte de recerca, Tesi Doctoral, TFG o TFM. Si existeix, incloure també el codi o referència de l'estudi.

² Indicar les dades de contacte de l'investigador principal; nom, telèfon, correu electrònic i ubicació física.

³ Indicar el nom i cognoms del participant.

⁴ Només si en els resultats de l'estudi que es publicaran apareix el nom de les persones o dades que permetin identificar la persona, així com la seva imatge o la seva veu sense tècniques d'anonimització.

⁵ Si no hi ha tractament de mostres biològiques es pot eliminar.



UNIVERSITAT
ROVIRA I VIRGILI

La seva **utilització en futurs projectes** d'investigació biomèdica relacionats amb el mateix tema

⁶ I per expressar aquest consentiment, el participant signa en data i lloc aquest full de consentiment:

Signatura del participant

⁷ I per expressar aquest consentiment, el representant legal del participant signa en data i lloc aquest full de consentiment:

Nom del representant legal.....

Relació del representant legal amb el participant

Signatura del representant legal

⁶ Si el participant pot prestar lliurement el consentiment utilitzar aquest redactat fins a la següent nota el redactat del qual es pot eliminar.

⁷ Si el participant no pot llegir o escriure, és menor de 14 anys o per qualsevol altre motiu no pot prestar lliurement el consentiment és necessari que el seu consentiment el presti el tutor o representant legal. En aquest cas utilitzarem aquest redactat i eliminarem el corresponent a la nota anterior.

**Projectes de recerca / Tesis doctorals / Treballs de Fi de Màster
/ Treballs de Fi de Grau de la URV**

Informació bàsica de protecció de dades

Informació bàsica sobre protecció de dades (format tabular)

INFORMACIÓ DE PROTECCIÓ DE DADES PERSONALS	
Responsable	El responsable del tractament de les seves dades personals és la Universitat Rovira i Virgili amb CIF Q9350003A i amb domicili fiscal al carrer de l'Escorxador, s/n, 43003 de Tarragona.
Finalitat	Participar en l'estudi del Treball Final de Grau o de Màster ⁸ en els termes que es descriuen al full d'informació al participant. En el cas que l'estudi prevegi la publicació, difusió i reutilització dels resultats obtinguts incloent dades personals, les dades personals seran utilitzades per a aquesta finalitat sempre que l'interessat hagi atorgat el seu consentiment.
Drets	Pot exercir els drets d'accés, rectificació, supressió, portabilitat, limitació o oposició al tractament, mitjançant un escrit adreçat al Registre General de la URV a la mateixa adreça del domicili fiscal o mitjançant la seva presentació al Registre General de la Universitat, presencialment o telemàtica, segons s'indica a https://seuelectronica.urv.cat/registre.html .
Informació addicional	Pot consultar informació addicional sobre aquest tractament de dades personals denominat <i>Treballs de Fi de Grau o de Màster de la URV</i> ⁹ i els seus drets al Registre d'Activitats del Tractament de la URV publicat a https://seuelectronica.urv.cat/rgpd on també s'hi pot consultar la Política de Privacitat de la URV. Així mateix, pot consultar aquesta informació al Full d'informació al participant sobre l'estudi. Addicionalment, pot adreçar als nostres delegats de protecció de dades qualsevol consulta sobre protecció de dades personals a la direcció de correu electrònic del dpd@urv.cat .

⁸ Indicar "el projecte de recerca" en el cas que es tracti d'un projecte de recerca, "l'estudi de la Tesis Doctoral" en el cas que es tracti d'una tesi doctoral o "l'estudi del Treball Final de Grau o de Màster" en el cas que es tracti d'un TFG o TGM.

⁹ Indicar en cursiva "Projectes de recerca de la URV", "Treballs de Fi de Grau o de Màster de la URV" o "Tesis Doctorals de la URV" segons correspongui

Appendix B

Sample participant information sheet



**UNIVERSITAT
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SAMPLE PARTICIPANT INFORMATION SHEET

I have received this Information Sheet.

TITLE OF THE STUDY¹

Exploring the impact of Virtual Reality on EFL primary school students' vocabulary acquisition and general motivation. (Matser's Thesis)

PRINCIPAL INVESTIGATOR / DOCTORAL STUDENT / STUDENT²

Mohamed Amine Mounjid (Master student / researcher)

E-mail: mohamedamine.mounjid@estudiants.urv.cat

Mar Gutiérrez-Colon Plana (Supervisor)

CENTER

[Department of English and German studies] – Universitat Rovira i Virgili (URV)

SOURCE OF FUNDING³

[None]

INTRODUCTION

We are writing to inform you about the research study in which you are invited to participate.

This study has been approved by the Ethics Committee for Research in People, Society and the Environment (CEIPSA)⁴ of the Universitat Rovira i Virgili.

¹ Of the research project, doctoral thesis, bachelor's thesis, graduate thesis or master's thesis. If it exists, also include the code or reference of the study.

² Indicate the contact details of the principal investigator: name, telephone, e-mail and physical location.

³ Eliminate this mention if there is no financing fund.

⁴ Indicate the appropriate research ethics committee (IISPV Drug Research Ethics Committee, Animal Research Ethics Committee or Research Ethics Committee on People, Society and Environment, as appropriate). If it has not been approved by any committee, because the approval does not correspond, then this mentions must be eliminated.

Appendix C

Pre-questionnaire (English)

The impact of Virtual Reality on student vocabulary acquisition and motivation

This pre-questionnaire is meant to investigate whether the implementation of VR tools do enhance vocabulary acquisition and boost motivation among Catalan primary school students.

The pre-questionnaire is done as part of a Master's research project at URV, Tarragona.

Thanks for agreeing to participate in this pre-questionnaire, which is conducted for academic and research purposes. All yours answers and personal data will be kept secure and confidential. The questionnaire will take you 5 minutes to complete. Again, thanks for your time and consideration.

Background Information:

1. What is your full name?

.....

2. How old are you?

.....

3. What is your gender?

-Male

-Female

-Prefer not to say

4. Apart from your mother tongue, which languages do you speak at home?

- Catalan

- Spanish

- Catalan and Spanish

- Others Which one(s)?

5. Do you attend any English evening classes or any language academy?

-Yes

-No

6. Do you watch any cartoons, social media videos (Instagram, TikTok) or programs in English?

-Yes

-No

7. Have you tried using virtual reality (VR) glasses before?

-Yes,

-No

Motivation-based Questions:

8. Are you excited about using virtual reality to learn vocabulary in English?

-I am not excited at all

-I am moderately excited

-I am extremely excited

9. Are you confident that using virtual reality will facilitate learning English vocabulary?

-I am extremely confident

-I am moderately confident

-I am slightly confident

10. Are you interested in learning new English vocabulary?

-I am extremely interested

-I am moderately interested

-I am slightly interested

11. Do you enjoy learning English?

-Yes

-No

12. Which one do you prefer most: learning English through technology (VR, tablets, mobile phones, laptops) or through traditional methods (like books, whiteboard, worksheets)?

-Traditional methods

-Technology

13. Do you like trying out new ways of learning English like VR for instance?

-Yes

-No

14. How motivated are you to improve your English vocabulary?

-Extremely motivated

-Moderately motivated

-Not motivated at all

15. Do you enjoy using technology for learning English?

-Yes

-No

Pre-qüestionari (CATALÀ)

Títol de l'estudi: L'impacte de la Realitat Virtual en l'adquisició de vocabulari i la motivació dels estudiants

Aquest pre-qüestionari té com a objectiu investigar si la implementació d'eines de RV millora l'adquisició de vocabulari i augmenta la motivació entre els estudiants de primària. El pre-qüestionari es realitza com a part d'un projecte de recerca (TfM) del Màster d'Ensenyament de l'Anglès a la Universitat Rovira i Virgili, Tarragona.

Gràcies per acceptar participar en aquest pre-qüestionari, que es realitza amb finalitats acadèmiques i de recerca. Totes les vostres respostes i dades personals es mantindran segures

i i confidencials. Trigareu 5 minuts a completar el qüestionari. De nou, gràcies pel vostre temps!

Informació bàsica:

1. Quin és el teu nom complet?

.....

2. Quants anys tens?

.....

3. Quin és el teu gènere?

-Home

-Dona

-Prefereixo no dir-ho

4. A part de la teva llengua materna, quines llengües parleu a casa?

-Català

-Espanyol

-Català i espanyol

Altres: Quina/es?

5. Assisteixes a classe d'anglès en alguna acadèmia?

-Sí

-No

6. Mires dibuixos animats, vídeos a les xarxes socials (Instagram, TikTok) o programes en anglès?

-Sí

-No

7. Has provat d'utilitzar ulleres de realitat virtual (RV) abans?

-Si

-No

Preguntes basades en la motivació:

8. T'agradaria utilitzar la realitat virtual per aprendre vocabulari en anglès?

-No gens

-No ha estat malament

-Sí, moltíssim!

9. Creus que utilitzar la realitat virtual et facilitarà aprendre vocabulari?

-Sí, estic convençut/convençuda

-No n'estic segur

-No ho crec

10. Teniu interès en aprendre nou vocabulari en anglès?

-Sí, estic molt interessat

-Una mica

-No gaire

11. T'agrada aprendre anglès?

-Sí

-No

12. Què prefereixes: aprendre anglès a través de la tecnologia (RV, tauletes, mòbils, portàtils) o a través de mètodes tradicionals (com llibres, pissarra, fulls d'exercicis)?

-Mètodes tradicionals

-Tecnologia

13. T'agradaria provar noves maneres d'aprendre anglès com per exemple amb RV?

-Sí

-No

14. Vols millorar el teu vocabulari en anglès?

-Molt motivat/da

-Una mica motivat/da

-Gens motivat/da

15. T'agrada utilitzar la tecnologia per aprendre anglès?

-Sí

-No

Appendix D

Post-questionnaire (English)

The impact of Virtual Reality on student vocabulary acquisition and motivation

This post-questionnaire is meant to investigate whether the implementation of VR tools has enhanced vocabulary acquisition and boosted motivation among Catalan primary school students. The post-questionnaire is done as part of a Master's research project at URV, Tarragona.

Thanks for agreeing to participate in this post-questionnaire, which is conducted for academic and research purposes. All your answers and personal data will be kept secure and confidential. The questionnaire will take you 5 minutes to complete. Again, thanks for your time and consideration.

Background Information:

What is your full name?

.....

Motivation-based Questions:

1. Are you excited about having used virtual reality to learn vocabulary in English?

-I am not excited at all

-I am moderately excited

-I am extremely excited

2. Do you think that using virtual reality has helped you learning English vocabulary?

-I am extremely confident

-I am moderately confident

-I am slightly confident

4. Are you now more interested in learning new English vocabulary?

-I am extremely interested

-I am moderately interested

-I am slightly interested

5. Do you enjoy learning English?

-Yes

-No

6. Which one do you prefer most: learning English through technology (VR, tablets, mobile phones, laptops) or through traditional methods (like books, whiteboard, worksheets)?

-Traditional methods

-Technology

7. Do you like trying out new ways of learning English like VR for instance?

-Yes

-No

8. Are you now more motivated to improve your English vocabulary?

-Extremely motivated

-Moderately motivated

-Not motivated at all

9. Do you enjoy using technology for learning English?

-Yes

-No

Post-qüestionari (CATALÀ)

Gràcies per acceptar participar en aquest post-qüestionari, que es realitza amb fins acadèmics i de recerca. El qüestionari us prendrà 5 minuts per completar.

Quin és el teu nom complet?

.....

1. T'ha agradat utilitzar la realitat virtual per aprendre vocabulari en anglès?

-No gens

-No ha estat malament

-Sí, moltíssim!

2. Creus que utilitzar la realitat virtual t'ha facilitat aprendre vocabulari?

-Sí, estic convençut/convençuda

-No n'estic segur

-No ho crec

3. Ara tens interès en aprendre nou vocabulari en anglès?

-Sí, estic molt interessat

-Una mica

-No gaire

4. T'agrada aprendre anglès?

-Sí

-No

5. Què prefereixes: aprendre anglès a través de la tecnologia (RV, tauletes, mòbils, portàtils) o a través de mètodes tradicionals (com llibres, pissarra, fulls d'exercicis)?

-Mètodes tradicionals

-Tecnologia

6. T'ha agradat provar noves maneres d'aprendre anglès com per exemple amb RV?

-Sí

-No

7. Ara estàs més motivat per millorar el teu vocabulari en anglès?

-Molt motivat/da

-Una mica motivat/da

-Gens motivat/da

8. T'agrada utilitzar la tecnologia per aprendre anglès?

-Sí

-No

Appendix E

Pre-test and Post-test

Name:..... Number:.....

❖ Circle or match the right answers:

1. What is "marine life"?

- A) Life in mountains
- B) Life in forests
- C) Life underwater

2. Which picture shows "marine life":

1



2



3. Which picture shows a "school of fish":

1



2



4. What type of animal is a shark?

- A) Reptiles
- B) Bird
- C) Fish

6. Which one is a "Great White":

1



2

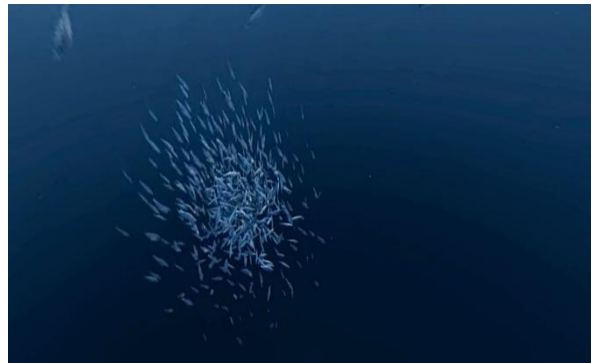


6. Which picture shows “liver”:

1



2



7. Which picture shows “sharks”:

1



2



8. The “Great White Shark” is:

- A) Tiny
- B) Huge
- C) Invisible

9. The word "tiny" means:

- A) Large

- B) Small

- C) Loud

10. A shark can be described as being:

- A) Short

- B) Long

- C) Round

11. "Scary" refers to:

- A) Happy

- B) Bored

- C) Frightening

12. Feeling "joyful" means:

- A) Sad

- B) Happy

- C) Angry

13. Match the word "surprised" with the corresponding picture:

Surprised



14. The word "terrified" means:

- A) Scared

- B) Sleepy

- C) Happy