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Virtual Reality (VR) for generating motivation in learning English integrated in a non-linguistic subject:

Mozaik VR ® Human body game

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TABLE OF CONTENTS

LIST OF FIGURES:

LIST OF TABLES:

LIST OF ABBREVIATIONS

L2	Foreign language
YL	Young learner
YLL	Young language learner
ICTs	Information and communication technologies
AR	Augmented Reality
VR	Virtual Reality
FMP	Final masters project
niVR	Non-immersive virtual reality systems
siVR	Semi-immersive virtual reality systems
VE	Virtual environment
IM	Intrinsic motivation
EM	Extrinsic motivation
DGBL	Digital game-based learning
DGBLL	Digital game-based language learning
EG	Entertainment games
SG	Serious games
CLIL	Content Language Integrated Learning
SLA	Second Language Acquisition
SLT	Second Language Teaching
CALL	Computer Assisted Language Learning
IMMS	Instructional Material Motivation Survey
MALL	Mobile assisted language learning
VRALL	Virtual reality assisted language learning
HMD	Head mounted display
VKS	Vocabulary knowledge Scale
niG	Non-immersive group
siG	Semi-immersive group
CG	Control group

Abstract

Finding and keeping motivation for learning a foreign language (L2) is challenging, particularly for multilingual young learners. However, the incorporation of digital tools into their educational context has made L2 learning more motivating, as educators effectively utilize engaging digital games and computer-generated environments. The rapid advancement of these tools allows for the effective creation and implementation of immersive virtual reality (VR) technologies in educational settings. Despite the multiple benefits of this immersive technology in the L2 field, studies on its application in early education are limited. This project explores the influence that game-based VR tools have on young language learners' motivation and input uptake. It also assesses the affordances and limitations of VR for L2 learning and teaching. Using quantitative and qualitative methods, the impact VR has on the learning process over digital traditional teaching methods would be determined. To do so, a series of game-based activities would be implemented in Natural Science as a non-linguistic subject. The findings deriving from pre- and post-tests and motivational questionnaires may suggest that VR tools have a beneficial impact on motivation. This study seeks to demonstrate that VR is an effective and inclusive tool to enhance learning conditions and positively influence students' perceptions towards learning English.

Key words: Virtual reality, motivation, digital game-based language learning, CLIL, multilingual learners.

Resumen

Mantener la motivación en el aprendizaje de una lengua extranjera (L2) supone un reto, especialmente para los alumnos multilingües en etapas tempranas. Sin embargo, la incorporación de herramientas digitales en su contexto educativo ha hecho que el aprendizaje de idiomas sea más motivador, ya que los educadores utilizan los juegos como los entornos digitales. El rápido avance de estas herramientas permite la creación e implementación efectiva en entornos educativos de la realidad virtual (RV). A pesar de los múltiples beneficios de esta tecnología inmersiva, los estudios sobre su aplicación en etapas educativas tempranas son limitados. Este proyecto explora la influencia que los juegos basados en herramientas de RV tienen en la motivación y asimilación del input entre alumnos de primaria. Además, evalúa el potencial y las limitaciones de estas herramientas aplicadas a la enseñanza y aprendizaje de idiomas. Mediante métodos cuantitativos y cualitativos, se determinaría el impacto que la RV tiene sobre el proceso de aprendizaje en comparación con métodos tradicionales digitales. Para ello, se aplicarían actividades basadas en el juego sobre contenido no lingüístico: Ciencias Naturales. Los posibles resultados del pre- y post-test, así

como de los cuestionarios sobre la motivación sugerirían que la RV sería una herramienta efectiva e inclusiva para mejorar las condiciones de aprendizaje e influir positivamente en las percepciones que el alumnado tiene sobre el inglés.

Palabras clave: Realidad virtual, motivación, aprendizaje basado en juegos digitales, AICLE, alumnos multilingües.

1. INTRODUCTION

The evolution of language teaching methods and approaches have improved educators' instruction, thus boosting effective learning. In practice "new approaches and methods are often developed in direct response to perceived problems with or inadequacies in an existing popular approach or method and/or to the learning theory prevalent at that time" (Celce-Murcia, 2014 p.13). However, the effectiveness in teaching and learning is still a field of inquiry for many researchers. In this vein, the author suggested that the effectiveness depends on many factors among which students' motivation stand out.

Therefore, "motivation is one of the main determinants of foreign language learning achievements" (Dörnyei, 1994, p.273), especially among those whose learning is developed in multilingual and digital rich contexts (Lázaro-Ibarrola & Azpilicueta-Martinez, 2021). Then, this final master's project (FMP) is focused on how technology can help generate motivation in foreign language (L2) learning among young language learners (YLL's).

The significant growth in the use of information and communication technologies (ICTs) in the English classroom has led to the improvement of traditional teaching techniques, materials, and tools. In this regard, researchers have noted that Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality are gradually becoming teaching aids due to their enormous potential to engage and motivate students (Kerawalla et al., 2005), for their educational affordances (Cowie & Alizadeh, 2021) and for their ability to contextualize and link learning to real-life worlds (Wang et al., 2017).

Given these reasons, this FMP is based on the application of non-immersive (niVR) and semi-immersive (siVR) VR systems with primary school students to boost their motivation in learning English as a L2 integrated in a non-linguistic subject. Having said this, the theoretical aspects underpinning the application of VR systems to boost YLL's motivation in L2, integrated in a non-linguistic subject, requires delimiting key concepts.

1.1. Justification

Firstly, VR can be defined as "simulation of a three-dimensional virtual environment (VE), generated by a computer, in which the person can interact with the said environment with, for example, a helmet with an integrated screen" (Peixoto et al., 2021, p.48952) which produces sensory, motor, and cognitive effects similar to those experienced in real life. According to the authors and depending on the degree of immersion VR can be classified as *non-immersive VR,* which is easier to implement since it only requires simple computer peripherals -monitor, keyboard, and mouse- but provides fewer real experiences. *Semi-immersive VR* provides more realistic experiences as the degree of immersion is higher with more complex but accessible peripheral devices -cardboard glasses, 360º lenses-. Lastly, *Immersive VR* gives the highest degree of immersion and presence, but requires sophisticated and expensive peripherals - headsets, gloves, or handsets. In this sense, Cowie and Alizadeh (2021) suggested another classification linked to the degree of learners' autonomy and authentic interaction with the VE. *Social VR* systems being the most suitable for learning since students, through avatars, join a virtual world to socialize, play and learn.

Another aspect key for this FMP is motivation in L2 which is defined as "a factor that provides the impetus to start, and later continue, learning a second language" (Fenyvesi, 2018, p.671). Motivation can be classified into different types, on one hand, intrinsic motivation (IM) which is based on the innate willingness to pursue an objective (Noels et al., 2000). On the other hand, extrinsic motivation (EM) which is driven by external factors such as "receive an extrinsic reward or to avoid punishments". (Dörnyei, 1994, p.275). The author stated that L2 motivation is a multifaceted construct affected by three broad levels, namely, *Language level*, *Learner level* and *Learning situation level.* Studies on these three broad levels, show that instructors must consider different strategies to maintain students' motivation in L2 (Dörnyei, 1994) since it tends to decrease gradually with time (Fenyvesi, 2018). These studies point out that a positive learning environment with challenging and varied learning tasks such as games seem to be essential to boost students' engagement and interest in L2 (Fenyvesi, 2018; Wu, 2003; Dörnyei, 1994).

As this project intends to generate L2 motivation through VR games, it is worth considering the role that digital game-based learning (DGBL) plays in motivation and effective learning. Firstly, according to Vaz de Carvalho and Coelho (2022), DGBL is the application of digital games in education for specific didactic purposes. In this respect, Acquah and Katz (2020) distinguished, on one hand, entertainment games (EG) as ready-made games designed to be used in educational contexts, for didactic purposes or to engage students on a

given topic. On the other hand, serious games (SG) are those produced or designed specially to teach and learn. Then, it is widely accepted that EG and SG, either digital or analog, have a powerful effect on learning (Acquah & Katz, 2020, Casan-Pitarch, 2017; Hitsogi et al., 2014; Woo, 2013; Prensky, 2003). Furthermore, "the intrinsic properties of games can be enhanced by the multisensory stimulation provided by immersive technology" (Vaz de Carvalho & Coelho, 2022, p. 1). When DGBL is applied for L2 learning the authors refer to digital game-based language learning (DGBLL).

Finally, the use of English as a medium for instruction of non-linguistic subjects is widespread in the Spanish education system (Mendez-García, 2013), even in areas where minority languages are included in the curriculum (Lázaro-Ibarrola & Azpilicueta-Martínez, 2021; Cenoz, 2014). The most popular teaching approach used is Content Language Integrated Learning (CLIL), which was created to boost motivation for L2 learning (Coyle, 2015). One of the main reasons to implement CLIL is to increase exposure to L2 and to aid in naturalistic learning. Rather than focus on form as in an English as a second language traditional class. CLIL refers to a "dual-focused educational approach in which an additional language is used for learning and teaching of both content and language" (Coyle, 2015, p. 239). CLIL can be applied in all educational levels, either in core subjects or in content-based themes, however, in the primary stage it tends to be applied in several subjects (Cenoz, 2014). Although the research on the correlation between motivation and CLIL is scarce, the findings so far "suggests that the inclusion of English through CLIL in bilingual contexts could benefit YLs' attitude/motivation towards English" (Lázaro-Ibarrola & Azpilicueta-Martinez, 2021, pp. 14-15).

The positive impact that virtual SGs have on motivation and learning, as well as the considerable potential of VR in the realm of education (Vaz de Carvalho & Coelho, 2022) are sufficient to justify the implementation of *Social VR systems* in primary schools. Nevertheless, their application in this context is very limited, especially in L2 teaching and learning due to the lack of technological resources, hence, training of educators in their use and pedagogy needed. Fortunately, technology is developing quickly and most of the technological manufacturers and designers are considering the potential of VR for didactic purposes. This study has the intention to use game-based VR systems to improve the way YLLs receive and perceive English with the final goal to motivate them to L2 learning integrated in a non-linguistic subject.

The study is designed for multilingual YLLs' of 5th grade of Primary Education, who attend a bilingual school. They are beginner users of English with high digital skills but showing an increasing lack of motivation for learning English as a L2. This is why the VR

game Human Body by Mozaik® has been considered appropriate. This tool is intended to generate motivation in L2 learning through engaging 3D scenes and improve YLLs' input uptake. The possible results would be collected by motivational questionnaires and vocabulary scales and analysed through quantitative and qualitative methods.

2. THEORETICAL FRAMEWORK

Recent research has shed light on the connections between second language acquisition (SLA), second language teaching (SLT) and Computer Assisted Language Learning (CALL) since technology provides L2 students with rich interactive learning environments (Chapelle, 2009). To begin with, the field of SLA tries to explain how an L2 is acquired. According to Chapelle (2009) there are four general approaches to SLA theory: the cognitive linguistic approach is "concerned with learners' internal mechanisms responsible for linguistic development" (Chapelle, 2009, p.743); the psycholinguistic approach explains natural language acquisition without explicit instruction; the human learning approach focuses on language learning as a human process, finally, the language in social context approach focuses on language learning through communication and social interaction.

With relation to this, Celce-Murcia's (2014) historical review of SLT shows that the evolution of L2 teaching methods shifted from approaches based on behaviourism (learners' behavior) and structuralism (linguistic structures) to those based on cognitivism and humanism that emphasize cognitive traits and the human dimension of learners. Current L2 teaching trends centre their attention on the Communicative approach since it encompasses integrated teaching approaches such as CLIL and learner-centred teaching procedures whose main aim is to teach L2 for communicative and functional purposes (Celce-Murcia, 2014). In practice, the Communicative approach integrates these theories when the didactic intervention and the language input provided is focused on and driven by students' needs and interests. (Coyle, 2015)

2.1. Content Language integrated learning

Unlike other methodologies based on the Communicative approach, such as English medium instruction or Content-based instruction, CLIL and DGBLL are widely used in primary schools. This is because they boost YLLs' motivation (Lázaro-Ibarrola & Azpilicueta-Martinez, 2021; Acquah & Katz, 2020; San Isidro & Lasagabaster, 2019; Pladevall-Ballester, 2019), promote genuine communication (Coyle, 2015) and interaction (Acquah & Katz, 2020).

Research indicates that CLIL is a widely adopted approach in the Spanish educational system since the implementation of linguistic promotion programs (Mendez-García, 2013). These programs were conceived to give response to the L2 needs of YLLs, as well as to comply with the language education policies set by the Council of Europe, which encourages European citizens to communicate in more than two L2s (Council of Europe, 2001). In this regard, the introduction of CLIL programs has grown in monolingual settings, for instance, in Andalucía in 1998 there were 24 bilingual schools and in 2010 694 schools adopted bilingual programs (Mendez-García, 2013). Similarly, in bilingual settings such as the Basque Country, where the co-official language is embedded in the curriculum, CLIL programs have become extensively implemented as an effort to improve L2 proficiency from early stages (San Isidro & Lasagabaster, 2019). The suitability of CLIL relies on its versatility in terms of context-content application and language (Cenoz, 2015). For example, CLIL can be applied on any educational level, whole or thematically based subjects; the additional language may refer to English and/or the co-official language.

Secondly, with relation to CLIL and motivation, a longitudinal study carried out by Pladevall-Ballester (2019) with a total of 287 primary school students from a bilingual school, ascertained that adding CLIL to the language experience of YLLs "seems to be one of the factors that promote higher levels of motivation and interest in the FL" (Pladevall-Ballester, 2019, p. 784). The author found that students' perceptions are affected by the non-linguistic subject, wherein Arts & crafts was better valued than Science. In this line, a subsequent study carried out in a Navarre schools concluded that "the inclusion of English through CLIL in bilingual contexts could benefit young learners' attitude/motivation towards English" (Lázaro-Ibarrola & Azpilicueta-Martinez, 2021, pp. 14), especially among those who participated in immersion program of the minority regional language (Basque). It seems that the relevance of CLIL goes beyond L2 learning as it is a way to generate motivation towards L2 as well as it also enhances multilingualism (Cenoz, 2015) and pluriliteracies (San Isidro & Lasagabaster, 2019), which are of special importance in 21st century pluralistic public classrooms.

In order to reach the heterogeneity found among L2 learners Coyle (2015) revisited CLIL turning it into an inclusive pedagogical approach. This requires interweaving the 4Cs conceptual framework, namely, content, cognition, culture and communication, and inclusive pedagogical practices. These inclusive practices, which have clear language learning goals, are "coherence and connected learning approaches, accessibility to language-rich classrooms, successful learning (learner progression) and motivating (dialogic) climates for learning." (Coyle, 2015, p.245). As a result, based on her study among primary and secondary students,

the inclusive CLIL seems to provide a learning context where all learners, regardless their capabilities and predominant language, are represented and engaged, therefore, motivated.

2.2. Digital game-based language learning

Shifting to digital games and since their popularization in L2 classrooms, DGBLL has been extensively utilized as an alternative to traditional teaching methods (Hitosugi et al., 2014). DGBLL distinguishes itself from DGBL by using digital EG and/or SG with L2 learning goals, for example, teaching L2 vocabulary with Kahoot! DGBLL and DGBL are widely implemented not only for content or L2 learning but also to promote contemporary competences and participatory behaviours in any field (Acquah & Katz, 2020). In the same vein, Woo's (2014) research pointed out that DGBL "possesses significant potential for increasing students' learning motivation" (p.291). The author demonstrated this by conducting a study among high-school students to measure the effect of games on students' cognitive loads as well as on learning motivation using Instructional Material Motivation Survey (IMMS) based on Keller's ARCS model. The results showed a positive correlation between germane cognitive load and learning motivation which improves students' performance. Furthermore, a systematic literature review conducted by Acquah and Katz (2020) indicated, among others, that digital learning games produce positive learning outcomes. These authors examined studies carried out from primary to high-school settings where most of the digital SGs were applied to learn English as a L2 in formal learning environments. The authors also analyzed experimental and quasi-experimental studies that depicted how games were implemented through DGBLL to learn different language variables such as vocabulary or teach with innovative technology such as 3D VEs. Their conclusions explicitly indicated that DGBLL has a positive effect on motivation and engagement in students' learning process. Additionally, Blume (2019) asserted that DGBLL promotes linguistic skills, cultural knowledge, and positive attitudes towards the target language. It is widely accepted by renowned psychologists and pedagogues that gameplay has positive effects on affective traits and cognitive abilities. For Piaget, games contribute to learning and the development of mental structures. Vygotsky considered that games recreate social scenarios to interact and learn (Bernabeu & Goldstein, 2009). Prensky (2003) proved that digital gamers, who are highly motivated in playing, learn how to interact, cooperate, and perform tasks in the digital world. Acquah and Katz (2020) attributed the success of DGBLL to specific characteristics of digital games. For instance, interaction, rewards, immediate feedback, and cooperation have a positive influence on students' learning, therefore motivation. Nevertheless, competition along with an imbalance between skill and challenge may negatively affect students' motivation.

Conversely, among its limitations, the study of Marqués and Pombo (2021) about technological training impact on in-service teachers concluded that the lack of digital game-related skills of digital immigrants' educators limits the potential and benefits of DGBLL. Especially the ones provided by immersive experiences. The participants of this study were Portuguese educators of basic education that had full access to technology for their practice. This reluctance to participate and use digital gameplay in the L2 classroom may generate inequalities in terms of language and cultural learning (Blume, 2019). Accordingly, for Blume, DGBLL gameplay promotes equity in both students and educators. Finally, another important challenge is that digital gameplay demands a huge cognitive effort to process the extraneous stimulation of digital games. In order to mitigate this, according to Woo (2014) educators should choose games that provide a germane cognitive load and reduce both the environmental and social stimulation.

2.3. Role of information and communication technologies

Turning now to the role of ICTs in L2 learning and taking into consideration Chapelle's assertions on the relationship between SLA and CALL. The relevance of ICTs for SLA theory not only lies in the designing of learning activities but also on the "breadth and depth of exposure that learners can have with the target language" (Chapelle, 2009, p.735). Chun et al., (2016) also stated that ICTs have shaped learning and teaching as well as the context and form of interactions. This is particularly evident with the use of mobile devices since they provide students with varied L2 learning and interaction opportunities. This area of technology-mediated learning is called mobile-assisted language learning (MALL) and it can be defined as the "use of mobile technologies in language learning, especially in situations where device portability offers specific advantages" (Kukulska-Hume, 2012, p.1). In the author's view, its potential resides in the ubiquity of mobile devices in educational contexts; its flexibility since learning happens anytime, anywhere; and its varied learning applications. In fact, "the development and increasing accessibility of emerging technologies such as VR has opened new perspectives in the area of MALL, paving the way for a new research field called virtual reality assisted language learning (VRALL)" (Berns & Reyes, 2021, p. 159). Then, VRALL refers to the use of VR systems and learning applications aimed at L2 teaching and learning.

2.4. Factors affecting foreign language motivation

The factors affecting motivation in L2 learning have been widely studied. Firstly, early studies categorized L2 learners' motivation into integrative and instrumental orientations. The first one, integrative, is generated by factors related to a learners' desire to interact with the L2

community. Conversely, instrumental orientations are generated by factors linked to learners' desire of obtaining a practical goal (Noels et al., 2000). The self-determination theory distinguished between IM and EM. IM is triggered by innate factors such as self-perceived L2 competence and autonomy (Wu, 2003; Noels et al., 2000; Dörnyei, 1994). Whereas EM is triggered by external factors such as rewards or avoidance of punishment (Noels et al., 2000; Dörnyei, 1994). Research concluded that the learning environment and feedback are factors affecting, either positively or negatively, IM and/or EM (Wu, 2003; Noels et al., 2000).

Further to this, Kormos and Csizér (2008) the L2 motivational self-system analyses the factors affecting the "*Ideal self*" which is related to the learners' self-image and includes integrative and intrinsic factors; the "*Ought-to L2 Self*" which refers to the attributes an L2 learner thinks that one ought to possess in order to obtain positive learning outcomes and includes instrumental and extrinsic factors; the "*L2 Learning Experience"* are those factors related to attitudes towards the elements of the learning environment. In addition to these, Yeung et al., (2011) analyzed adaptive and maladaptive motivational factors affecting YLs. The first group encompasses self-efficacy, interest, mastery goal orientations and engagement. The second group encompasses avoidance coping and effort withdrawal. The authors ascertained that to enhance the adaptive constructs a positive learning environment and challenging activities are needed.

However, Dörnyei (1994) suggested three broad levels which affect L2 learners, especially YLLs. These levels are important as they clearly depict and include the above mentioned factors. Thus, the first level is "*Language level"* which refers to the L2 as an educational subject. It includes integrative and instrumental factors. For example, if the English subject has sociocultural components with which the learner identifies, he/she will perceive the usefulness of learning the language. The second is "*Learner level"* and refers to the personal dimension of the student and it is related to IM and EM. For instance, mastery goal orientation to get better marks. The third one is "*Learning situation level"* that refers to the conditions affecting the learning environment, for instance, social and group cohesion, rewards, teacher behaviour, satisfaction, and feedback, among others. In sum, the motivational strategies adopted must be addressed to reinforce each of the three levels suggested by Dörnyei (1994). In this regard, the emphasis is on the selection of varied teaching tools, methods and tasks that support the importance of learning English; in the application challenging tasks that enhance learners' affective factors; provide a learning environment conducive for learning (Fenyvesi, 2018; Wu, 2003; Dörnyei, 1994).

2.5. Virtual Reality. Affordances and Limitations

Regarding VR systems, the first attempts of creating immersive scenarios were in the mid-1950s and later, in 1987, Jaron Lainer coined the term VR. His company developed and sold the first VR equipment (Alfaldil, 2020). Since then, VR has become an essential training tool in different realms (Hua & Wang, 2023; Cabero et al., 2022). Recently and due to its enormous potential, VR has rapidly emerged and developed in the field of L2 learning (Cowie & Alizadeh, 2022; Berns & Reyes, 2022; Alfaldil, 2020). In accordance with several authors, VR can be understood as a computer technology that recreates digital immersive scenarios. VR replaces the user's real surroundings with an artificial newly created digital environment, also known as a VE. The user can interact with the VE through head mounted displays (HMDs) such as VR goggles, handsets, or gloves (Berns & Reyes, 2021; Alfadil, 2020). In addition to Peixoto et al.,'s (2021) classification, niVR, siVR and Immersive VR, Cowie and Alizadeh (2022) suggested an alternative categorization based on the user's interaction with the VE. Namely, *Swivel* allows basic interaction through basic movements such as observing the VE*; Explore* allows access to 360º files embedded in the VE; *Discover,* allows for more sophisticated interaction, for instance, to touch and dissect a frog; *no code create* allows the interaction for creating 3D objects without coding, for example, creating blocks to build a wall in the VE; *code create* allows the interaction and creation by coding; *Social VR* in which "learners join a permanent social world to socialize, play and learn. In this line and given the scarce offer of VR systems designed for L2 learning, Berns and Reyes (2022) determined that to consider a commercial VR application appropriate for L2 learning it must provide immersion and interaction with the VE. Furthermore, it should be applicable under novel L2 learning approaches, facilitate the practice of the four linguistic skills in varied scenarios and provide feedback through digital artifacts such as chatbots.

It is worth noting that VR is not synonymous with AR. In this regard, AR allows users to explore objects in 3D since digital images are integrated their real environment and, unlike VR, AR does not provide immersion in VE (Kerawalla, 2006). Research so far has demonstrated that both AR and VR have great educational and technological affordances (Cowie & Alizadeh, 2022; Kerawalla, 2006). Nevertheless, the learning possibilities of VR outweigh those offered by AR (Cabero et al., 2022). The authors proved with the Technology Acceptance Model that among university students VR is more accepted than AR technology, as it increases their attention in the task, which, according to the authors, generates motivation. Furthermore, the Virtual Immersive Language Learning Gaming Environment (VILLAGE) project tested by Wang et al., (2017) established that VR enhances the motivational effects of gaming learning

environments. Particularly if they embed digital artifacts that allow teleportation and real-time interactions with chatbots. Moreover, the three phases of Cowie and Alizadeh's (2021) study, conducted in Japanese universities, proved that VR helps polish high order thinking skills, cooperation, and divergent thinking. Further to this, VR produces physical and psychological effects similar to those that are experienced in real-life situations which increases student motivation and satisfaction in the subject matter (Peixoto et al., 2021). Lastly, Wang et al., (2017) concluded that when L2 is learnt through VR games resembling realistic scenarios increases students' presence, therefore, motivation. Their study analyzed quantitatively the results obtained by two presence questionnaires, the *Igroup Presence Questionnaire (IPQ),* which measures the presence in VE, and the *ITC sense of Presence Inventory (SOPI),* which measures presence with a variety of media. The results showed that presence in 3D VE games fosters meaningful learning since students apply skills to interact with the resembled realistic scenario and experience new ways of using L2. For Hua and Wang (2023), VR allows practicing the language with multimodal resources and scenarios which boost learners' cognitive abilities and memory retention.

Conversely, among the limitations of VR, Cowie and Alizadeh (2022) highlight that the peripherals needed are not affordable in many educational settings. Another important constraint is related to the exploitation of VR, first, educators need more technological/pedagogical training, second, developers must be acquainted with the educational context to design better learning VR tools and third, the authors observed that some of their participants experienced health related issues such as cybersickness. In Berns and Reyes' (2021) view VR learning applications do not provide users with enough immersion and interaction with the VE. Additionally, VR applications must be designed considering current SLT trends and SLA theory. VR systems are immature L2 teaching tools which need, on one hand, further research and permanent feedback between educators and VR developers and, on the other hand, cover L2 learners' needs. In consonance with this constraint, Huang et al., (2020) observed among K-12 students that VR produces a "novelty effect", which could be mitigated by the constant exposure to VR tools specially designed to tackle students' learning needs.

Eventually, a systematic literature review conducted by Hua and Wang, (2023) on VRALL in different learning levels proved that it positively influences learners' cognitive and emotional aspects. In this line authors agree that despite the challenges that VR pose in specific L2 learning settings, it generates students' motivation and provide authentic

interaction with the immersive learning scenario (Hua & Wang, 2023; Berns & Reyes, 2021; Cowie and Alizadeh, 2022).

Given these reasons, this FMP explores the use of niVR and siVR game-based VR to generate YLLs' motivation in L2 learning integrated in a non-linguistic subject. This also focused on the improvement of learners' input uptake, that is, in their perception of L2 at a language, learner and learning situation level. This project is addressed to demonstrate the effectiveness of VR tools in vocabulary acquisition of the human body.

2.6. Role of Virtual Reality games in foreign language motivation

The scarce literature on VRALL points out that it is an effective and motivating teaching tool that should be considered by educators (Hua & Wang, 2023). Firstly, VR games provide students with new learning scenarios that help them, on one hand, acquire new language and/or knowledge, e.g.: knowing the vocabulary related to the Universe. On the other hand, acquire skills related to participatory behaviours such as the interaction with avatars dwelling in the VE (Berns & Reyes, 2021; Acquah & Katz, 2020). What is more, VR games have the potential to teleport students to virtual worlds. These worlds are 3D VE which resemble realistic but unreachable scenarios, for example, human organs. These immersive scenarios are created to facilitate users' presence and embodiment. Wang et al., (2017) demonstrated that when digital artifacts such as chatbots are embedded in the immersive scenarios, presence and embodiment are enhanced, which increases students' engagement and motivation in L2 learning. Consequently, when learners are immersed in VEs their L2 motivation is triggered at a *"Language level"*. For example, their desire for learning L2 to interact with the community coexisting in the VE is a factor that triggers integrative motivation; as well as their desire to understand the L2 to obtain a practical and attainable goal embedded in the VE is a factor that triggers instrumental motivation.

Secondly, digital games have quickly established themselves as an alternative teaching tool to engage students in their learning (Casan-Pitarch, 2017; Prensky, 2003;). YLs, who are digital natives, are familiar with digital gameplay and prefer digital game-mediated teaching over conventional methods (Hitosugi et al., 2014). Videogames and digital SGs are sound L2 teaching materials as they provide students with meaningful learning experiences. Thus, DGBLL motivates, and engages students in L2 learning (Hitosugi et al., 2014). In line with this, the immersion that VR games provide lets students experience a "state of deep mental development" (Vaz de Carvalho, 2022, p.1), which increases their involvement in the dynamics and mechanics of a game. VE generated by VR systems boosts the properties of games,

especially those related to factors that trigger IM and/or EM, for example, autonomy, self-confidence and/or need for achievement to obtain high scores. These properties are even more enhanced if students use HMDs such as glasses, handsets, or gloves. In sum, VR games could generate motivation at a *"Learner level."*

Eventually, the characteristics of games are what attract and engage gamers in gameplay. The most common features of SGs are goals, rewards, challenges, curiosity, and feedback. Moreover, digital SGs embed multimodal interfaces with sensory resources aimed at increasing students' interest and enriching the game experience. A balanced combination of both the characteristics and the resources creates a motivating gaming environment where students hold an optimal cognitive load (Woo, 2014). In this regard, the immersion provided by VR educational games "engage the learner in a natural, embodied, perception-action rich context" (Legault, 2019, p.3). These features let the learner have control of navigation in the VE. In Legault's (2019) view when the learner has autonomy and the control in the VE, learning is more successful since, on one hand, content and game components are effectively perceived since they are accurately contextualized. In other words, components are optimally integrated and presented from a perceptual and sensorimotor view. On the other hand, objects are more manipulable. All of these have an impact on students' motivation and enable effective learning (Cowie & Alizadeh, 2022; Legault, 2019). Then immersive VE in VR games could foster motivation at a "*Learner situation level"* (Dörnyei, 1994) since both the characteristics of games and the learning conditions affecting learning environments, namely rewards, objects and feedback are introduced in an optimal degree avoiding extraneous stimulation.

3. OBJECTIVES

The literature review on VR shows that it has great potential to increase L2 motivation and learning, but how this potential can be enhanced among YLLs is not so clear. This leads me to the following research question:

a) Can the integration of VR games generate YLLs' motivation for learning English in CLIL courses?
   - If yes, is there a difference in the motivational effect between niVR and siVR systems?

Therefore, the objective of the present FMP is twofold:

1. To generate L2 motivation in multilingual YLLs through VR games within the framework of DGBLL methodology.

2. To improve the way in which multilingual YLLs receive and perceive English input to be applied in a non-linguistic subject within the framework of CLIL.

4. METHODOLOGY

4.1. Learning context and participants

The study is to be carried out in a Valencian state-funded bilingual school belonging to a medium socioeconomic context where ethnic diversity is found. The school promotes multilingualism, digital literacies, and innovative projects through the active participation in Erasmus+ projects. English is learnt as a foreign language and integrated in non-linguistic subjects: Natural and Social Science, Arts & Crafts and Social and Ethical Values. CLIL is the methodology utilized as a way of increasing exposure to L2, which is 10 hours a week.

Participants are 30 students from the 5h grade of Primary Education (mean age 10 years old). The group of students is heterogeneous and mixed ability with no special educational needs. According to the Common European Framework of Reference for Languages, they are beginner users of the language (A2 Waystage) thus, having a low medium Communicative Competence in English. This allows students to communicate in everyday situations with commonly used expressions and basic vocabulary. Their oral and written language abilities related to reception, production, interaction, and mediation, are framed within a guided practice of the language. Finally, since the target language variable to be measured is vocabulary, all participants were engaged in human body vocabulary acquisition lessons which belong to the Natural Science subject.

The school is equipped with portable devices and internet connection. Participants have great digital skills and are able to create multimodal texts and use language learning applications. However, the vast majority lack experience dealing with immersive virtual worlds and handling VR peripherals: VR goggles, handsets, and gloves. The participants were not told in advance that they would be using VR systems because we wanted to explore their reactions and usability of devices.

The participants are chosen randomly to learn the same vocabulary across the same learning lessons. The participants were split up into three groups, two experimental conditions, the non-immersive group (niG) and the semi-immersive group (siG) and a control group (CG). All groups had 10 students and were evenly distributed for gender and linguistic abilities. That is, 2 learners with low performance, 3 learners with low-medium performance, 2 learners with high performance and 3 learners with medium-high performance in each group. The niG learnt with niVR toolkits, the siG learnt with Homido® Grab toolkits, and the control group without VR

technology (see table 1). None of the students had previous experience with niVR or siVR applications and only a few students reported having participated in multiplayer online 3D videogames such as Minecraft.

Group	No. students	Toolkit	Gender	Linguistic Abilities
Semi-immersive (siG)	10	Homido ® Grab Smartphone	5 girls, 5 boys	2 low, 3 low-medium, 2 high, 3 medium-high
Non-immersive (niG)	10	Tablet	5 girls, 5 boys	2 low, 3 low-medium, 2 high, 3 medium-high
Control Group (CG)	10	Printed materials	5 girls, 5 boys	2 low, 3 low-medium, 2 high, 3 medium-high

Table 1: Distribution of participants

The English teachers who participated in this study were previously trained in the use of VR systems and HMDs. In addition, they received specific training in the implementation of DGBLL with an emphasis on the techniques aimed at enhancing the motivational factors that affect language, learner, and learning situation level (Dörnyei, 1994) with the final purpose of generating motivation among students. Further to this, English teachers were trained on the inclusive CLIL practices suggested by Coyle, that is in "coherence and connected learning approaches, accessibility to language-rich classrooms, successful learning (learner progression) and motivating (dialogic) climates for learning." (Coyle, 2015, p.245).

4.2. Technology: Human Body Mozaik®

Turning now to the VR environment chosen: "Human Body" developed by Mozaik® education, which is a VR software designed to interact with interactive 3D scenes of the human body. It is an educational VR application compatible with Android operating systems and designed for elementary and middle school students (see table 2). It recreates a realistic and accurate representation of the organs and anatomical structures of each body system. This allows YLLs to explore and analyze different anatomical structures and basic concepts of the human body systems. Students can navigate in the VE in an immersive way by means of HMDs and handsets and in a non-immersive way by interacting directly with the tactile screen of a portable device. Mozaik® VR also provides real-time simulation for students to learn how the different anatomical features of the body systems relate to each other. In this line, the software includes a movement and rotation function that allows users/players to see the organs from

different angles. Finally, the interactive features allow the manipulation of 3D scenes, namely, isolate organs, modify their layers and so on.

Platform	OS	Screen	Size	Cost	Player	Digital Artifacts	Genre
Tablet Smartphone	Android 5.0 or later 1.5 GB RAM	Tactile HD resolution	176 MB	Free	Single player	No	Education (Biology)

Table 2: Technical specifications of Human Body Mozaik

For this study, this tool is utilized to facilitate vocabulary acquisition, so, the focus is on the specific functions that help YLLs navigate and interact easily with the application. Firstly, when the VR experience Human Body is first launched it places the student in front of a human silhouette with a quick menu interface which shows the available options and the button for exiting the application. At the bottom bar of this screen there is a goggles icon that allows the navigation with VR headsets. On the left there are tabs with the human body systems that, if pressed for a couple of seconds, students can preview the 3D scene. Finally, there is a small round button, which is the main menu, that contains options to cover these functions: draw, enable/disable rotation, turning on/off the panning, text-to-speech, information, language, and settings. At the top of the screen, there is the exit button and the quick menu that facilitates interaction such as volume control, rotation, shifting, help and settings (see figure 1). Finally, students can easily navigate all of the screens either with head movement, if they are wearing headsets, or with their fingers.

Figure 1: Main menu and shortcut interface

Secondly, students can access their desired body system by pressing the corresponding tab, which, will teleport them to that specific system. Automatically, a notecard emerges listing the parts of the system, and, at the same time, the main menu includes new options and functions. With these options learners can resize, shape, highlight or delete labels. Students can also take screenshots and listen to short explanations of the 3D scene. Furthermore, the information bar can be turned on/off, to add or to hide content (see figure 2).

Another function to cope with the diversity is the one provided by the text to speech option that reads out the information for learners to hear the pronunciation and/or deepen understanding (see figure 3). Additionally, students can pause, fast forward, or rewind the information by using the player bar. The scenes can be scrolled up and down with their fingers or with head movement if learners are wearing headsets. Unlike other VR systems this application does not embed any digital artifact, e.g.: chatbots to promote verbal interaction.

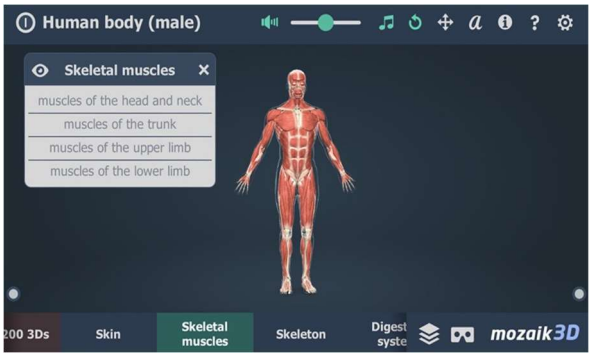

Figure 2: Specific menu functions

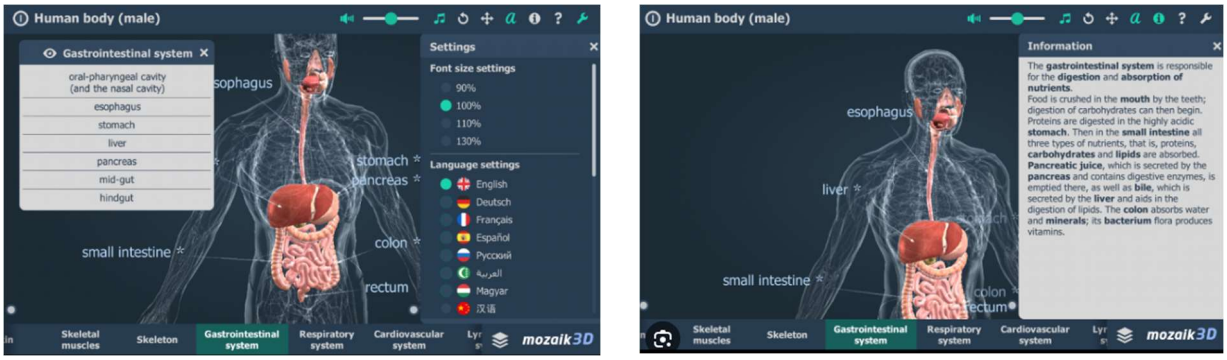

Figure 3: Inclusive menu functions

The application offers basic exercises to practice the content in situ like dragging labels and dropping them into empty boxes (see figure 4) as well as engaging mini-games such as quizzes or gap-filling texts.

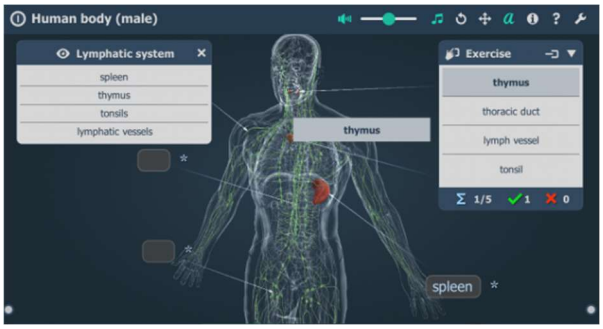

Figure 4: Sample of gap-filling game

As for the immersion modes, niG will navigate in a niVR way through a tablet with the application installed and using their fingers to indicate movement (see figure 5). Whereas siG will navigate in a siVR mode by wearing a headgear designed to accommodate the smartphone with the Mozaik3D® VR player installed. Once the application is launched (see figure 6), the student must press on the goggle icon placed (1) in the bottom navigation bar to activate the semi-immersive mode, the Mozaik® 3D player is launched. Once siG students place the smartphone in the centre of the Homido® goggles (2), they can navigate through the 3D scenes by tilting their head. For instance, to activate the main menu students must tilt their heads left or right. They can also switch to the walk mode (3) or select preset views (4) or turn labels on and off. The position of the cursor is controlled by the movement of students' head, for example, to select a menu function or select the walking mode. It is worth noting that walking does not require body movement or displacement in the physical space, that is, the classroom. With relation to the HMDs, siG students wear Homido® Grab headsets as they are compatible with most of the commercial smartphones. Also, it is suitable for large phones, and it is easy to wear, adjust and comfortable for users. Moreover, it covers near-sighted, far-sighted, and standard vision students. However, the installation of an application to navigate is required (see figure 7).

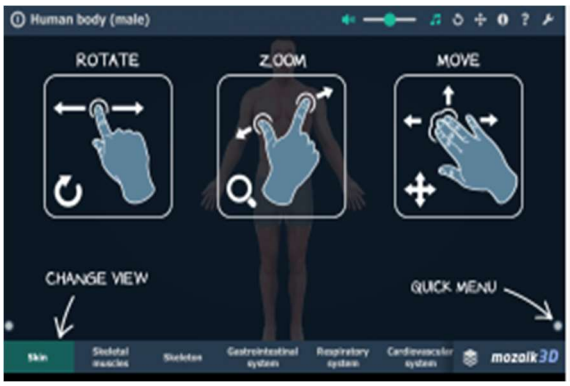

Figure 5: non-immersive navigation mode

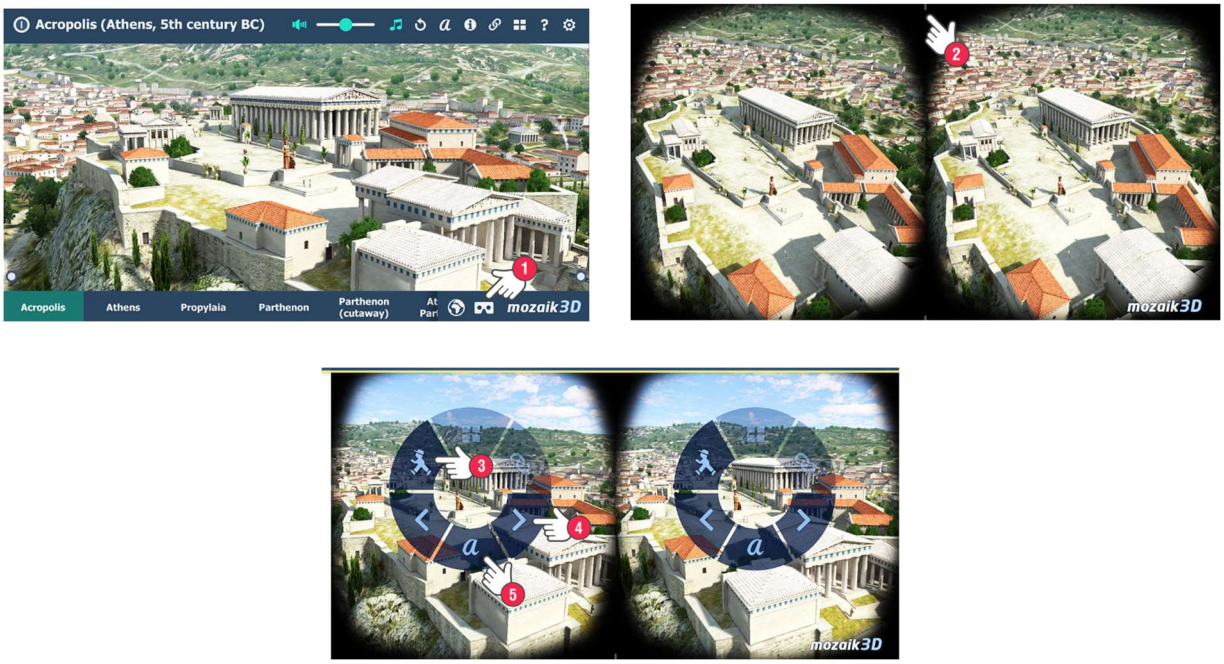

Figure 6: Sample of semi-immersive navigation mode

Figure 7: Homido® Grab VR headset

5. THE PEDAGOGICAL APPLICATION

With relation to the pedagogical application of VR Mozaik® the steps to follow throughout 13 lessons of 1 hour each (see table 3) are aimed at i) measuring (and comparing) if the VR tool helps generate students' motivation and ii) checking if the VR tool has a positive impact on students' input uptake and subsequent application. To facilitate this, the application of the Mozaik ® VR should be focused only on the digestive and muscular system and students must be autonomous without interference in all the lessons. Prior to the implementation of the scheduled lessons, a VR pilot group of students outside the target groups underwent the same guidelines, procedures, and activities to which the target students would be subjected. That was done to validate the coherence of the lessons and to minimize errors. The lessons would be as follows:

Steps	Timeline
Administer the pre-test	Prior to the familiarization of the VR tools (1st lesson)
Familiarization of niVR and SiVR	Prior to input reception (2nd and 3rd Lesson)
Input reception	Digestive S. (4th & 5th lesson) Muscular S. (9th & 10th lesson)
Quiz time	Digestive S. (6th lesson) Muscular S. (11th lesson)
Trivia competition	Digestive S. (7th lesson) Muscular S. (12th lesson)
Administer post-test	Digestive S. (8th lesson) Muscular S. (13th lesson)

Table 3: Procedural steps and timeline

- **1st lesson:** Students are not divided into groups since this lesson is for conducting a pre-test to check their prior knowledge of the digestive and muscular system. The test, which includes 20 words, is based on the vocabulary knowledge scale (VKS) by Paribakht and Wesche (1993) (see appendix 1). Its purpose is to measure the degree of knowledge about the digestive and muscular systems. The results will be used to rank students in low, medium low, high, and medium high performances.
- **2nd lesson:** This lesson familiarizes and trains all students in niVR navigation mode through detailed guidelines to ensure clarity and understanding. Firstly, students observe a VR trainer demonstrating navigation in Acropolis Mozaik ®, which shares interface and functions with Human Body Mozaik ®. Secondly, students practice basic navigation skills in pairs, including rotating, panning, zooming, switching views, adjusting screen size, and controlling volume. They also learn to access the content menu for exercise selection and activation of inclusive features like text-to-speech. Finally, simple tasks are given to refine their navigation skills and complete embedded exercises.

Unlike desktop-based VE, immersive VR has a dynamic and fast-changing spatial layout. These changes and movements are even more noticeable if users do not know how to handle VR headgear which according to Cowie and Alizadeh (2022) may cause cybersickness, nausea or related issues. That is the reason why an additional lesson is added to train students in handling HMDs.

- **3rd Lesson:** This lesson is to familiarize and train all of the students with siVR navigation mode. Students are randomly grouped into pairs and receive orientation training on simple right and left head movements. Firstly, VR trainers demonstrate the use of Acropolis Mozaik ® through a video, emphasizing the control of 3D scenes by tilting the head. Each pair is given a smartphone and Homido Grab ® toolkit and will

insert properly the smartphone into the HMD. Secondly students are guided in carrying out navigation actions such as rotating, panning, zooming, walking, and changing size. Students take turns as performers and observers to ensure equal training time. Finally, the focus shifts to interacting with menu options to select and access exercises.

- **4th and 5th lesson:** Following the familiarization and training lessons, students are split into the niG, siG and CG. Each group is taught by their regular English teacher and a VR trainer. The teaching approach is CLIL, and the teaching method is DGBLL. In order to contextualize the project, students assume the role of expert scientists who are asked to develop a big mural about the body system. The purpose of it is to illustrate to 4th graders about the "Human Body systems" and review for the trivia quiz competition conducted on Kahoot! application. It is worth noting that these lessons take place simultaneously in different classrooms.

During lessons 4, 5, 9 and 10, students are exposed to the same content and exercises but the niG learns using niVR toolkits on tablets. The siG learns using siVR HMDs, and the CG learns by means of traditional materials such as printed images and worksheets as well as screenshots from Human Body Mozaik® tool on the Interactive whiteboard. Students autonomously explore the digestive and muscular system throughout the lessons with breaks of 20 minutes so as not to overload them with extraneous input and stimuli. During the breaks niG and siG will complete the exercises embedded in the VR tool and CG in printed worksheets. Both the teacher and the VR trainer move around the classroom to ensure students' engagement and active participation.

- **6th lesson:** This lesson focuses on students playing the games embedded in the VE. NiG and siG could freely choose among dragging organ words and dropping them into the organ's pictures and/or answering comprehension questions. Whereas the CG will complete the same games but using a printed worksheet except for the drag and drop game that will be completed jointly on the interactive whiteboard. Once the playing experience finishes some time is given to students to prepare their mural that is going to be exhibited and presented in further lessons.
- **7th Lesson:** In this lesson students within their groups, play a Trivia game competition. The Trivia game was designed by teachers using Kahoot application. This game contains questions about the body system, e.g.: *Is the liver an organ of the digestive system?* The game aims to create a dialogic, cooperative, and motivating learning atmosphere while showcasing students' knowledge. Moreover, Kahoot graphs that analyze the results of the answers, in terms of time spent and number or right/wrong

answer, allowed teachers to obtain at a glance a general picture of students' performance.

- **8th lesson**: Finally, in this last lesson students undergo a post-test (see appendix 2) whose objective is to determine if VR tools and games improved vocabulary acquisition by comparing and later, analysing the results obtained by the three groups. In this sense and with the aim of facilitating the analysis process students individually must take the test right after the lessons finish. As for the post-test, it was designed by the English teachers, and it was nearly identical to the pre-test. The only variation included was an additional block of images with the newly learnt words.

In order to minimize the influence of the novelty effect on students' IM and EM, it was decided to repeat from lessons 4 to 8. Therefore, in the upcoming lessons, the same lesson plan will be followed, but the topic will be the muscular system. Lessons 9 and 10 will focus on receiving input, lesson 11 will involve completing a quiz, lesson 12 will include a trivia competition and lesson 13 will be dedicated to the post-test. This approach aims to mitigate the potential decline on motivation and engagement in the task as suggested by Huang et al., 2020.

6. POSSIBLE OUTCOMES AND DISCUSSION

6.1. Data collection

In order to collect data on students' motivation in learning through VR tools, English teachers and VR trainers developed three instruments:

The first survey is an adaptation of the System Usability Scale (SUS) by Brooke (1996). It measures the usability of the Human Body Mozaik VR ® application. Usability impacts students' perceptions of the VR tool, which in turn affects the novelty effect and motivation. The survey uses a 10-item Likert scale, from "strongly agree" to "strongly disagree," and has high reliability, validity, and sensitivity. It is flexible and easy to use, making it suitable for small sample sizes. It was administered to niG and SiG after the post-test, the adapted survey assesses participants' willingness to use the tool, complexity, functions, and self-perception in handling the application, e.g.: *"I need help to use the system".* It provides an overview of students' perceptions of the VR system and peripherals, which is crucial for understanding the correlation between motivation and usability, as suggested by Vaz de Carvalho (2022) and Yousef (2020).

The second instrument is a questionnaire based on Keller's (2010) IMMS, which measures students' motivation through four dimensions: attention, relevance, confidence, and satisfaction. The original test has 36 items divided into these subscales, but for this study, it was adapted to YLLs' context with 12 items since they "can be used and scored independently" (Keller, 2010 p. 282). Some words and expressions were replaced for consistency, and each subscale now has 3 easy to understand items, e.g.: "*The materials were eye-catching"*. Scoring is done by totalling the scores and dividing by 3. Symbols were used to indicate response values, representing not true, mostly true, and true. The questionnaire measures all participants' motivation in learning via siVR and niVR tools as well as traditional digital methods. (See Appendix 4).

The third instrument is based on Wu's (2003) scale, which is an adaptation of "The Academic Motivation Scales" by Vallerand and the Language Learning Orientations Scale by Noels et al., (2000). It consists of nine items equally divided into three subscales. The first one is IM-Knowledge, related to learners' perception of exploring new ideas being linked to Language level. The second is IM-Accomplishment, which refers to sensations attempting to achieve a goal, which is linked to Learner level. The third subscale is IM-Stimulation, representing motivation derived from stimuli in the learning environment, which in turn is related to Learning situation level. Students rated each item on a 3-point scale ranging from not true to true. Additionally, the instrument included an open-ended question for students to express their opinions about the experience, e.g.: "*Write a short sentence about the things that you liked or disliked in these lessons…"*. (See Appendix 5).

English teachers developed pre- and post-tests using the VKS by Paribakht and Wesche (1993) to assess participants' input uptake. The VKS, known for its reliability, was adapted to the context. The tests aimed to evaluate students' body systems knowledge before and after the lessons. Pre-tests were conducted in the 4th and 9th sessions, while post-tests were conducted in the 8th and 13th lessons. Both tests have the same structure, with questions aligned to the contents seen. The pre-test consisted of 9 questions-images asking about word familiarity, word names, and human body system. For example: *"The name of this picture is…"* The pre-test results helped assess students' prior knowledge, while the post-test evaluated input uptake.

6.2. Data Analysis

In relation to the research question, the quantitative data obtained from the IMMS and the L2 motivation tests would be analyzed by a correlation analysis since it would help examine if

there is a positive or negative relationship between the use of VR tools and the motivation to learn English. Then, for both instruments, a t-test would serve to compare the results from the experimental and CG.

Before starting the analysis, the results of the SUS might show that the perceived usability of Mozaik VR ® was positive for most students. Nevertheless, some students might express unclarity in the instructions of the tool. This would be useful to understand the results from the motivation questionnaires, especially in the items related to satisfaction and IM-Stimulation. Now, shifting to the data analysis for the research question, the IMMS results might show that the two experimental groups, especially the niG, were more motivated than the CG. SiG students might pay more attention to the lessons and be more satisfied with the learning experience. Then the correlation could seem positive, and students might appear to be more motivated to explore and learn through VR tools. Secondly, the L2 motivation test would determine if students in niG and siG would be more predisposed to learn English, either because they would have enjoyed the virtual experience and/or due to their greater achievements. The qualitative analysis of the open-ended questions was conducted using thematic analysis, where English teachers and VR trainers discussed learners' answers until a consensus is reached. In that case, most of students, especially participants in niG and siG, would describe aspects of the experience with positive adjectives such as interesting and funny. Conversely, only a few students, particularly participants from the control group, would report sentences with negative adjectives such as boring or uninteresting.

The quantitative data obtained by the pre-tests of both the experimental and the CG might show that students had similar prior knowledge about the subject matter. The quantitative data obtained by the post-tests were analyzed by t-tests to show if there is a correlation between the application of a game-based VR tool and the improvement of students' input uptake. The results might conclude that the experimental group performed slightly better than the control group. Specifically, niVR students would obtain better results than siVR students.

7. CONCLUSIONS

To conclude, game-based VR systems is a technology that can be integrated into language teaching and learning since it has a lot of potential, among them, the ability to teleport students inside the virtual world of any subject (Wang et al., 2017). This sense of being within the VE has a positive effect on students' learning and motivation. As well as it simplifies the teaching

and learning of vocabulary (Alfaldil, 2020) under the CLIL and DBGLL framework. Nonetheless, there are some limitations that must be mentioned.

The first one is the length of the project, it should be implemented for a longer and more optimal period of time, for example, a quarter. This might have a greater impact on the usability of the VR tool since students would have gained more control over it thus reducing potential navigation and spatial reasoning problems. As well as the novelty effect might have manifested among students, which would help obtain more accurate results on motivation.

The second limitation could emerge from the access to innovative VR technological resources in state-funded schools. Then, with additional and more sophisticated resources, the game-based VR tool might have given a higher degree of contextualization. Moreover, it would embed digital artifacts or handsets to increase the degree of interaction with VE. All of these might support better motivation at a language, learner, and learning situation level.

Another limitation is related to the opportunities of English teachers to experience for themselves how VE and VR tools work. Thus, it would be necessary to have a solid training program focused on the gradual implementation of VR tools, ranging from the least to the most immersive systems. These programs would have a twofold objective, the first one is for teachers to get used to HMDs and even create their own VE. The second one, eliminate their perception that planning VR lessons is time-consuming. Finally, a key limitation is the sample size which would not allow to generalize the predicted positive results in similar contexts and subject matter.

The implications of this project are focused on raising awareness of the importance of immersive technology in education. Not only to generate motivation among YLLs but also to make L2 learning accessible to all students. In this line, VR should be seen as a powerful tool for fostering inclusion, particularly in L2 subjects, as it exposes students to new worlds where learning L2s is seen as tool of progress and understanding rather than an obligation.

Future research is required to explore the use of VR in L2 learning and teaching for YLLs since the research in this area is still scarce. It would be beneficial to conduct studies on the gradual implementation of VR to generate motivation and to determine the impact on the four linguistic skills considering factors such as gender, age production and reception skills. Additionally, more empirical studies should be conducted to determine what influences students' perception on the learning approaches using VR systems.

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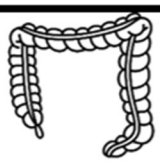
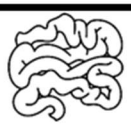
APPENDICES

Appendix 1: Pre-test

					
I saw this picture before	Yes	No	I saw this picture before	Yes	No
The name of this picture is			The name of this picture is		
It belongs to digestive system/muscular system			It belongs to excretory system/muscular system		
					
I saw this picture before	Yes	No	I saw this picture before	Yes	No
The name of this picture is			The name of this picture is		
It belongs to digestive system/skeletal system			It belongs to digestive system/muscular system		

Appendix 2. Post-test

					
I saw this picture before	Yes	No	I saw this picture before	Yes	No
The name of this picture is			The name of this picture is		
It belongs to digestive system/muscular system			It belongs to excretory system/muscular system		
					
I saw this picture before	Yes	No	I saw this picture before	Yes	No
The name of this picture is			The name of this picture is		
It belongs to digestive system/skeletal system			It belongs to digestive system/muscular system		

Appendix 3. System Usability Scale (SUS)

Mark with a cross in the column that best describes the experience with Virtual Reality	Agree	Somewhat agree	Disagree
I will use this system frequently.			
I think the system is difficult to use.			
I thought the system was easy to use.			
I need help to use this system.			
I find the functions were well integrated.			
I find that the functions were too difficult.			
I learn to use this system very quickly.			
I find the tool very cumbersome to use.			
I felt very confident using the system.			
I needed to learn a lot of things to navigate.			

Appendix 4. Instructional Materials Motivation Survey (IMMS)

Mark with a cross in the column that best describes your experience	Not true	Mostly true	True
The materials were eye-catching.			
The lessons have things that arise my curiosity.			
The activities and images keep my attention in the lessons.			
Completing the lessons was important to me.			
The words were no important to me because I knew them.			
I think the materials and lesson were useful for me.			
Before starting, I thought the lesson was difficult.			
I can't remember all of the things because there was a lot.			
The exercises were very difficult.			
I really enjoyed the lessons and the activities.			
I felt good completing the lessons and the activities.			
It was so good learning the body systems.			

Appendix 5. L2 Motivation Scale

Mark with a cross in the column that best describes your experience	Not true	Mostly true	True
I always ask words because I want to know everything.			
I ask my doubts because I want to check my answers.			
I read and listen to English because I want to learn more.			
I feel very happy when I can say anything in English.			
I enjoy completing successfully difficult activities.			
I actively participate in the activity to see how good I am.			
I think the lesson was stimulating.			
I like learning English with VR, it is easy and interesting.			
I have so much fun in these lessons.			
Write a short sentence about the things that you liked or disliked in these lessons.....			