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***Digital Creativity Development in English
Language Teaching***

*The effects of virtual reality on EFL learners' motivation, engagement
and creative writing skills*

Supervisor:

Bereczki Enikő Orsolya

PhD Assistant Professor

Author:

Gyömbér Hanna Ilona

Teacher of English Language and Culture –

Teacher of Spanish Language and Culture –

Master's Program

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Abstract

In recent years, there has been a notable increase in the use of digital tools to stimulate creativity within educational settings. The pedagogical potentials of virtual reality (VR) and augmented reality (AR) tools have also gained recognition. The aim of this study was to contribute to this field by examining the effects of a VR-based EAL writing intervention using Google Earth compared to a matched paper-based intervention among secondary school students' motivation, engagement and creative writing performance. In line with the aims, this study adopted a mixed methods design including (1) a between-subject classroom experiment using quantitative measures of students' creative writing motivation, engagement, and performance, (2) and qualitative analysis of students' perceptions of the interventions. The study was conducted with $n = 28$ 10th and 11th graders who were randomly assigned in a VR and a paper-based group. Both interventions consisted of a 45-minute pre-writing phase in which students were introduced to creative writing, then students in the VR group worked with Google Earth to plan and write a crime fiction set in London while exploring locations with 3D in the map, while students in the paper group worked with printed maps and photos of these locations for 90 minutes. During the next 45 minutes students in both groups worked on finishing up their stories. Google Earth was selected as the VR tool due to its affordability and accessibility. The theme of the writing task, crime fiction, was used because detective stories enjoy widespread popularity in contemporary culture. The theme and the VR tool were anticipated to motivate and engage students, and encourage the creation of imaginative writing products. Results indicated that the technology-based approach was not superior to the paper-based approach; engaging activities motivated students regardless of the medium. However, the paper group showed slightly better grammatical accuracy and lexical density. These results could arise from differences in individual writing abilities or preferences, or possibly because students are more accustomed to paper-based resources than technologies such as VR which might be distracting due to its novelty. The study addressed a gap in existing literature, investigated student motivation, engagement, creativity, and the use of a low immersive VR tool in the language classroom. Future research could include within-subjects studies with larger sample sizes and extended durations, explore different genres or themes and incorporate more immersive devices.

Key-words: VR, AR, EFL/EAL, digital tools, computer technologies, Google Earth, motivation, engagement, creativity, immersion, story writing, crime fiction

Table of contents

Abstract	4
1. Introduction	6
1.1 Background and inspiration of the study	6
1.2 Purpose and research questions	5
1.3 The importance of the study	5
2. Literature review	6
2.1 Understanding creativity: theoretical background and definitions	6
2.2 The role of motivation and creative mindsets in creative performance	7
2.3 Promoting creative writing skills in the EFL classroom	8
2.4 Employing advanced technologies in education to stimulate creativity	9
2.5 Augmented and Virtual Reality	12
2.5.1 Definitions	12
2.5.2 Learning Theories	13
2.6. Virtual and Augmented Reality in education	15
2.6.1 Virtual and Augmented Reality in the Language Classroom	15
2.6.2 Incorporating VR and AR tools in language education: practical examples	16
2.6.3 Google Earth Virtual Field Trips in EFL Teaching	17
2.6.4. Enhancing EFL Writing Performance Through Immersive Virtual Environments .	18
2.7 Connections to the present study	20
2.7.1 Hypotheses	20
3. Research design and methods.....	20
3.1. Participants	20
3.2. Materials	21
3.3. Measures	21
3.3.1. Demographic and background questions	21
3.3.2. Creative writing motivation scale	22
3.3.3. Engagement scale	22
3.3.4. Creative writing effort	22
3.3.5. Linguistic quality	22
3.3.6. Creativity	24
3.4. Procedures	24

3.5. Data analysis.....	25
4. Results.....	25
4.1. Analyses of baseline characteristics	25
4.2. Effects of the VR intervention.....	25
4.2.1. Writing motivation (H1).....	25
4.2.2. Intervention engagement (H2).....	25
4.2.3. Creative writing performance (H3)	27
4.3. Qualitative findings	27
4.3.1 Student feedback	27
4.3.1 Classroom observations.....	29
5. Discussion	30
7. Conclusions	32
References	33

1. Introduction

1.1 Background and inspiration of the study

Researchers and educators have widely acknowledged creativity as a crucial skill for learners in the 21st century. This recognition has caused a surge of interest in digital tools and computer technologies to enhance creativity within educational contexts. Recent investigations are focusing on exploring innovative settings that could foster and cultivate creative processes (Li et al., 2022).

According to Alizadeh (2019), virtual reality has turned into a „buzzword” among educators as advancements in tools and equipment continue to improve and become more accessible. Virtual reality is a computer-assisted immersive technology that recreates environments, enabling users to simulate presence and interact within them. What is more, it enables learners to participate in virtual reality tours or field trips (Lloyd et al., 2017).

Virtual reality (VR) and augmented reality (AR) tools have become increasingly common technologies and their benefits for language education have also been indicated by many researchers. VR devices have been investigated in several studies and classroom experiments. These efforts addressed various language skills including writing development (Amiryousefi et al., 2022).

After examining existing literature on the topic, I recognised a gap in research. Regarding writing skills development, most studies focused on descriptive or expository writing and involved adult EFL learners. A meta-analysis conducted by Amiryousefi et al. (2022) also pointed out that there was a need for future studies investigating specific writing genres when examining the efficiency of different types of technologies.

Consequently, I decided to conduct a classroom experiment similar to those of previous studies, comparing the effectiveness of a VR tool to traditional paper-based materials. Despite offering less immersion compared to devices like VR goggles or headsets, I selected the Google Earth application due to its affordability and accessibility.

After deciding on the instruments, the virtual scene and topic of the creative writing task were determined. I chose London for its cultural significance, and the detective theme, inspired by the Sherlock Holmes stories of Arthur Conan Doyle. Another reason for this choice was my observation that crime stories enjoy widespread popularity in contemporary culture, which could raise the students' interest and enhance their engagement. Moreover, experiences from my teaching practice also influenced my decision. Last year I addressed this topic in an EFL class by incorporating story telling tasks and creating a Sherlock themed digital escape game with the Genially platform. My observations and the students' feedback suggested that they found these activities highly engaging and motivating. What is more, I discovered that motivation and engagement are closely associated with research on VR in education as well. Therefore, I have decided to include them as factors to be examined in the classroom experiment.

1.2 Purpose and research questions

The aim of this study was to investigate the impact of a VR-based ESL/EAL creative writing intervention compared to a traditional paper-based intervention on students' motivation and engagement in creative writing. Additionally, the study aimed to determine if the IVR treatment would lead to enhanced effort, linguistic quality, and creativity in student writing. In alignment with the aims of the study, the following research questions were asked:

- Q1.** How does the use of a VR-based creative writing intervention influence writing motivation compared to a traditional paper-based intervention?
- Q2.** How do engagement levels compare between students involved in VR-based creative writing intervention and those participating in paper-based intervention?
- Q3.** How does the IVR intervention impact creative writing effort, quality and creativity compared to the traditional paper-based intervention?

To answer these questions a between-subjects classroom experiment was conducted including secondary school students (n=28). The study adopted a mixed methods design. Quantitative data was obtained through questionnaires and from the analysis of students' written products, while qualitative data was gathered from student feedback and observational notes taken during the intervention. The experiment was carried out twice with two different classes of the same upper-intermediate English level. The participants were divided into two groups and randomly distributed in a traditional paper-based intervention group or in a VR assisted treatment group. Despite the difference in tools, both groups were assigned the same task: to write a creative detective story set in London.

1.3 The importance of the study

The present study contributes to the efforts of previous researchers by addressing a gap in existing literature. It involves young learners attending secondary school, and investigates creative writing effort and quality in two different treatment groups in the genre of crime fiction. It also explores the use of Google Earth for the purpose of English writing skills development and indicates future research directions. Moreover, it provides valuable insights into the factors influencing student motivation and engagement. Furthermore, this investigation contributes to a deeper understanding of the pedagogical affordances of using virtual reality tools in the language classroom.

2. Literature review

2.1 Understanding creativity: theoretical background and definitions

Creativity is widely recognized by researchers and educators as a crucial skill for learners in the 21st century (Li et al., 2022). According to Torrance (1977) creativity involves approaching problems from novel perspectives, rearranging ideas or discovering previously unnoticed connections between them. Another definition suggested by Franken (1998) describes creativity as a tendency to create or identify ideas, options, or potentials that could prove valuable in problem-solving, communication, and entertainment for both oneself and others. Creativity can also be regarded as the production of resourceful solutions to problems (Amabile 2018; Ceretkova et al. 2018). According to a widely used definition creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context. (Plucker et al., 2004, p. 90). Furthermore, Lubart (1994) argues that the creative process involves a series of thoughts and actions that result in the creation of a creative output. He also proposes a theory that aims to highlight the differences between the creative process and the routine problem-solving process. Lubart claims that there are four distinct ways in which the creative process could be different.

The first difference between the two processes is the quality in which the fundamental steps of the problem solving is performed. These steps are: (1) formulating a problem-solving objective, (2) gathering significant information, (3) constructing a solution based on this information, and (4) subsequently assessing and improving upon the suggested solution (Lubart, 1994). According to Lubart's theory the creative problem solver is completing one or more of the basic steps more effectively than average. For instance, a learner with a creative mind might find more complex and innovative connections when linking prior knowledge to problems. He also mentions that the creative problem solver might also have a more developed set of skills for evaluating potential solutions to problems.

According to the same theory, the second difference lies in the time allocated to each phase, or in the frequency of performing each task. Creative thinkers may spend more time on defining and examining problems. They are also likely to engage in the exploration and observation of objects or issues more frequently. In addition, the creative process may include multiple uses of analogies (Lubart, 1994).

The third difference emphasized in the study focuses on the necessity for a special sequence of problem-solving activities. For example, if the assessment of one's own ideas occurs at an inopportune time, the solution for the problem might be less creative. From this perspective early evaluation may hinder creative exploration of a subject by excessively restricting the process of generating ideas (Lubart, 1994).

Finally, the last aspect that differentiates the normal problem-solving process from the creative process is the involvement of a unique task or phase of operation that differs from routine problem resolution. For example, brainstorming or the return to unfiltered thoughts (Kris, 1952; Lubart, 1994).

Another important aspect of creativity is evaluation. When measuring creativity various techniques and tools could be used. Bachelor & Hocevar (1989) mentions eight major methods: (1) tests of creative thinking; (2) evaluations of attitudes and interests; (3) inventories measuring personality traits; (4) biographical questionnaires; (5) assessments by teachers, peers, and supervisors; (6) judgments on creative outputs; (7) recognition of eminence; and (8) self-reported engagement in creative activities and accomplishments. In the following paragraphs I would like to highlight one of the most prominent and widely recognized tests: Torrance's Tests of Creative Thinking (TTCT).

According to TTCT, creativity includes four important components: fluency (quantity of significant responses), flexibility (diversity of relevant response sets), elaboration (richness of details

within responses), and originality (the novelty of the responses) (Torrance & Presbury, 1984). As other cognitive tests, these are also designed to measure the basic thinking processes that result in creative products. The Torrance tests include relatively simple verbal and figural tasks that involve divergent thinking and other problem-solving abilities. Lubart (1994) mentioned some samples of subtests of TTCT:

- Question generation: The test-taker generates a set of questions based on a depicted scene.
- Enhancing Products: The person proposes ways to modify a toy monkey to enhance children's enjoyment during playtime.
- Unconventional ways of using tin cans: The examinee lists interesting and unusual uses of tin cans.
 - Circle Expansion: The participant fills empty circles with creative drawings and assigns titles to each one.

These subtests can be scored for the four important factors of creativity mentioned above. Taking the Unusual Uses test as an example, a participant might find multiple uses for a tin can (fluency). These answers could show flexibility by extending the categories of furniture (can as a foot stool), eating utensils (can as a drinking cup), and repositories (can as a garbage container) (Lubart, 1994).

According to Lubart (1994) some uses for a can are more common than others. For example, "garbage can" is a common response but "foot stool" is an original response. Originality is defined in practical terms as being statistically uncommon. Finally, the distinction in elaboration becomes evident in responses such as "put holes in the sides of the can and run a wire through to make a pail", compared to the simpler suggestion of "utilizing the can as a pail" (Lubart, 1994).

TTCT however have been criticized by multiple researchers for being relatively devoid of knowledge and deforming the meaning of creativity by employing fluency, flexibility, and elaboration, and utilizing the same standards for originality responses across numerous samples in an inappropriate manner (Lubart, 1994).

Nonetheless, according to Lubart (1994), cognitive tests like TTCT have been the most popular means of creativity evaluation: they offer concise, simple administration, providing objective numerical creativity scores for comparative analysis among individuals. Moreover, other cognitive tests worth mentioning and further exploring in the future are for example the Remote Associates Test (RAT) by Mednick and Mednick (1967) or the tests of metaphor generation by Barron (1988).

2.2 The role of motivation and creative mindsets in creative performance

The drive for accomplishment is one of the three fundamental human motives in general theories of motivation (Freund et al., 2011). It has been associated with various achievement contexts (e.g., Atkinson, 1974; Richardson & Abraham, 2009; Steinmayr & Spinath, 2008). However, a high degree of achievement motivation may not automatically result in corresponding behaviour in performance situations, as the characteristics of the task at hand also play a crucial role. (Rheinberg et al., 2001, or an English version see Vollmeyer & Rheinberg, 2006).

A concept „current achievement motivation” (CAM) has emerged to define the product of an achievement motive on the person side and situational task characteristics. CAM is believed to directly impact task-related behaviour within a specific performance situation. A model of CAM proposed by Rheinberg and his colleagues (2001) distinguished four distinct factors. These factors are the following: anxiety, challenge, interest and probability of success. Anxiety can be defined as a fear of unsuccessful achievement situations. It has negative influence on creative performance. Challenge is related to how much an individual views a task as significant. It is also affected by the perceived task simplicity. Interest is associated with a person's positive attitude toward and positive assessment of a task. Finally, probability of success means that people compare their own perceived ability with the perceived difficulty of a task. If the level of ability surpasses the difficulty of the

task, the likelihood of success will be high, and vice versa. This aspect is also present in models of overall task motivation. (e.g., Atkinson, 1957; Bandura, 1997).

These factors can be measured with the Questionnaire on Current Motivation (QCM) introduced by Rheinberg et al. (2001). It serves as a self-report tool created for the measurement of the four CAM factors in specific performance situations. The original QCM includes a total of 18 items and uses a 7-point rating scale (disagree-agree). Researchers have demonstrated the efficacy of the QCM as an effective predictor of performance across various complex problem-solving tasks (Rheinberg et al., 2001; Vollmeyer & Rheinberg, 2006).

The role of creative mindsets on creative performance is also worth highlighting. Creative mindsets are defined as beliefs that creative abilities are either inherent and unchanging or can be cultivated through time and effort (Bereczki & Nagy, 2023). The interest in creative mindsets stems from the concept that individuals' creative performance and the effort they invest in creative activities are influenced by these mindsets. (Hass, Katz-Buonincontro, & Reiter-Palmon, 2016).

Previous studies have found that whether people view creativity as malleable (growth creative mindset) as opposed to unalterable (fixed creative mindset) influences their creative effort and engagement (O'Connor, Nemeth, & Akutsu, 2013). Therefore, individuals with growth mindsets are expected to excel in creative activities, while those with fixed mindsets are likely to evade such tasks, resulting in poorer performance in these activities (Karwowski & Brzeski, 2017).

Nonetheless, the studies examining the relationship between creative mindsets and creative performance produced mixed results. It is possible for people to have both sets of beliefs. For instance, an emerging poet might hold the belief that they are creative, although they may never attain the same level of excellence as Sylvia Plath, their writing will improve with time and practice (Bereczki & Nagy, 2023).

A research was conducted by Bereczki and Nagy (2023) regarding the impact of creative mindsets on ESL (English as a second language) creative writing performance. They found that holding fixed creative mindset beliefs had negatively affected ESL creative writing performance, regardless of their proficiency level in creative ESL writing. Furthermore, a positive influence of growth creative mindset beliefs on ESL/EAL creative writing performance was observed exclusively among students in the high ESL/EAL writing proficiency group, showing a trend level impact. Additionally, the rise in growth mindset correlated with enhanced creative performance only within the group characterized by high fixed mindset and high ESL/EAL writing proficiency (Bereczki & Nagy, 2023). Hence, their findings align with the perspective that creative thinking and action should be perceived as dynamic and continually evolving concepts (Beghetto & Karwowski, 2019).

In conclusion, it is confirmed by many researchers that motivation and creative mindsets are important factors regarding creative performance. The present study will rely on the above mentioned research and theories incorporating a QCM so as to measure students' motivation regarding the classroom experiment.

2.3 Promoting creative writing skills in the EFL classroom

Developing writing skills is a crucial component of language learning for students (Febriyanti et al., 2017). Through writing, individuals can effectively convey their thoughts and emotions (Srimularahmah & Marwil, 2021). Writing is a captivating process that entails significant divergent thinking rather than concentrating on a single idea and creativity is the ability to invent and generate something original and imaginative (Zulaeha, 2011). As for creative writing, it can be described as the ability to produce imaginative and unique literary pieces or compositions across diverse writing genres. While rooted in the basic principles of traditional writing, creative writing places particular emphasis on inventive elements, which are integral to a writer's or author's creative process in developing their works. This creativity encompasses both the conception of ideas and the final outcomes (Titik & Toha, 2023).

Creative writing is a type of literary work designed to captivate readers by sparking their imagination. The practice of creative writing encompasses six key components: knowledge, attitude,

process, skill, result, and profession. Critical thinking, emotional sensitivity, talent, and imaginative power are crucial aspects of creative writing that need to be nurtured to support the writing process (Fitria, 2024). Creative writing differs from formal writing, such as news articles, journals, and academic papers, which follow systematic and standardized rules. Instead, creative writing emphasizes narrative, character development, personal expression, and informal language. Examples include novels, poetry, epics, short stories, drama scripts, film scenarios, song lyrics, television scripts, advertising copy, and fairy tales, among others (Fitria, 2024). The study of creative writing supports the development of language skills in students, with the hope that future generations could express their ideas or emotions with exceptional language proficiency. According to Aziz's research in 2023, an effective method to promote creative writing skills is to provide a fun and engaging approach for students. This can be achieved by giving students ample space to explore their ideas, offering positive and constructive feedback, and presenting writing challenges and contests to spark their interest and motivation. Developing creative writing skills requires the support and guidance of teachers and a school environment that fosters creativity and innovation.

Several studies have investigated the instruction of creative writing to students. According to Fitria (2024) developing your creative writing skills encompasses several techniques and strategies, including:

1. **Reading diversely:** Engaging with a wide variety of literary works to draw inspiration and improve the quality of your writing.
2. **Regular practice:** Dedicating time to writing regularly, even if it's just a few words or paragraphs each day, to refine skills and develop consistency.
3. **Exploring different styles:** Experimenting with various language styles such as descriptive, narrative, persuasive, or experimental to unlock your creative potential and broaden your writing repertoire.
4. **Using writing prompts:** Utilize writing prompts or stimuli to spark your imagination and creativity, providing a starting point for your writing endeavors.
5. **Seeking feedback:** Being open to receiving feedback from friends or mentors who can offer constructive criticism and assistance in refining the quality of your writing.

In the classroom, these strategies can be implemented through structured activities, interactive workshops, and engaging discussions to nurture creativity and enhance students' creative writing skills. Moreover, Fitria (2024) also highlights some creative writing tips. For example using the five senses—touch, sight, smell, hearing, and taste—to create vivid experiences for readers and utilizing descriptive writing techniques to convey impressions of objects, events, ideas, or places, making the scene more vivid without detailing every aspect. According to Feng & Ng (2023) VR devices contribute to this, because of the sense of embodiment and the stimulating and immersive environments they offer. The present study aims to extend existing research by investigating the effects of a VR tool, Google Earth, on students' creative writing skills.

2.4 Employing advanced technologies in education to stimulate creativity

In recent years, there has been an upsurge of interest in the use of digital tools and computer technologies for the promotion of creativity in educational contexts. Researchers and educators are investigating innovative environments that potentially encourage and nurture creative processes (Li et al., 2022). For instance, employing digital instruments to enhance collaborative idea generation, foster inventive solutions to problems, and bolster imaginative artistry. (Burkhardt & Lubart, 2010).

These innovative digital tools and instruments could be regarded as emerging technologies, although the term still lacks a consensus-based definition in education (Li et al. 2022). The New Media Consortium (NMC) defined emerging technologies as those that have a substantial influence on teaching and learning within a period of one to five years (Johnson et al., 2011). According to another definition provided by Siemens & Tittenberger (2009) emerging technologies are social

media platforms such as blogs, Wikis, and Facebook, with special focus on their educational benefits. Another definition was suggested by Veletsianos (2010), who highlighted the pedagogical use of technologies which are artifacts, theories, breakthroughs, and developments employed in various educational environments to fulfil a multitude of educational objectives.

However, there is a need to take contexts such as regions, access to resources, and institutional levels into consideration when defining the term „emerging technologies”. This claim is supported by various researchers (e.g., Johnson & Adams, 2011, Veletsianos, 2010). Certain technologies may be firmly established in one region or country but considered emerging in others. For instance, online learning has been broadly used in developed countries, while in other countries it is still considered as emerging technology, because of deficiencies in the digital communication infrastructure (Veletsianos, 2010).

Recent studies mainly focus on the theoretical foundations of creativity and on educational policies regarding the application of digital tools in different countries. Other scholarly works also aim to organize them in order to construct a more comprehensive understanding. Li and her colleagues’ review (2022) aims to categorize the types of emerging technologies, assess the level of technology integration in the classroom, and analyse the effects of technology on creativity in current academic works. Another purpose of their research was to identify key features in the study designs that examine the use of innovative technologies to promote creativity. They examined and compared n=32 studies in total. In the following paragraphs I aim to present their most important findings and conclusions.

The studies examined in the research were published between 2010 and 2020. Half of the studies were carried out in Asia (Indonesia, Taiwan, Thailand, Turkey, Malaysia, and China). Additional studies were carried out in Europe (including the UK, Spain, France, etc.), the Near East (such as Qatar, Iran, Saudi Arabia, etc.), as well as in the USA, Canada, and Australia. A total of 41 digital technologies and media were extracted from the analysed studies and organised into seven different categories. These categories are the following:

- Next-generation web technologies and online applications that allow user interaction with content, such as social networking platforms like Facebook and interactive content-sharing sites like Wikispaces.
- Wearable tools or gadgets worn by individuals functioning with user-defined applications to track user interactions. For example: Oculus Rift DK2 VR tool and HTC Vive VR tool. (*See Figure 1.*)
- Video games and virtual environments. They are instruments that enhance the knowledge and skills of users through interactive experiences. For example, games like Portal 2 and Minecraft, or simulations, such as PhET simulations that offer dynamic models of artificial systems.
- Computer applications utilized for creating and/or generating text, graphics, videos, and other multimedia content. etc. for example Adobe Photoshop and 3D Max.
- Multimedia educational resources that integrate text, graphics, audio, and animation, for instance Digital Comic Books.
- Online instruction, also known as web-based learning, where all learning materials and activities are delivered to students through the internet, as seen in e-learning courses.

- Technologies for visual thinking: applications designed to facilitate cognitive thinking processes, for instance CMAP Concept Mapping tool.



Figure 1. VR headsets (source of image: japanupclose.web-japan.org)

This review included another categorization as well, according to the level of technology integration within teaching and learning. There are multiple existing models for classification, such as the Technological Pedagogical Content Knowledge (TPACK) model (Mishra & Koehler, 2006), the Substitution, Augmentation, Modification, and Redefinition (SAMR) model (Hilton, 2016), and the Technology Integration Matrix (TIM) model (Harnes et al., 2016). Li et al. (2022) used the TIM model to determine the primary types of technology integration in their research (Li et al. 2022, p. 4). These major categories were the following:

- Active Entry where teachers employ technology to transmit information, while students passively receive them.
- Collaborative Entry where students mainly work individually but have some degree of interaction with others through the use of technology.
- Active Adoption where teachers instruct students to use technology in traditional ways.
- Collaborative Adoption where learners engage in digitally supported collaborative activities under the guidance of teachers.
- Active Adaption where teachers guide learning activities while students engage in individual work via technology.
- Collaborative Adaption where educators facilitate the learning journey as students actively collaborate with others through the use of digital tools.
- Active Infusion where students have the freedom to pick and regularly employ various tools.

The reviewed studies primarily focused on overall creativity, but they also explored other sub-constructs of creativity, including originality, fluency, flexibility, and elaboration. If general creativity was not adequate to illustrate the target construct, researchers defined the specific creativity depending on studied behaviours. Li et. al, (2022) described such creativity as content-specific creativity. For example, Obeid and Demirkan (2020) evaluated design process creativity by incorporating virtual reality technology into a design class, as opposed to assessing overall creativity.

In conclusion, Li and her colleagues' systematic review (2022) affirmed that emerging technologies are context specific. The potential educational benefits for creativity development determine the choice of specific technology usage. Because of the possibilities for idea exchange and collaboration through web-based software and online courses, students' horizons are expanded. They

become immersed in the learning process that fosters creativity. Extensive internet-based resources and digital tools inspire learners to generate original and creative ideas.

The interactivity provided by videos, wearable devices and simulations enhances originality and innovation. Moreover, VR tools create a stimulating environment for creative thinking and brainstorming. In terms of flexibility, dynamic learning possibilities offer a high level of freedom for experimentation. Furthermore, design tools like Adobe Suite, Microsoft PowerPoint and 3D modelling programs foster the elaboration of unique and artistic ideas. What is more, the use of advanced digital tools demands increased cognitive effort, enhancing learners' capacity to generate more fluid, adaptable, and innovative ideas (Li et al., 2022).

On the other hand, it is also noteworthy to mention that further research exploring the relationship between creativity and innovative technologies would be necessary so as to acquire a more comprehensive view. This study aims to contribute to the effort by investigating the impact of Google Earth on the development of students' creativity and writing skills.

2.5 Augmented and Virtual Reality

2.5.1 Definitions

Google Earth and other advanced technologies such as Oculus Earth and VR, Roundme, 360Cities and Apple ARKit offer highly immersive and stimulating environments for students. They are classified as augmented and virtual reality tools. According to Alizadeh (2019) virtual reality (VR) has become a prevalent term among scholars in recent years as advancements in tools and equipment continue and costs become more accessible. VR devices and applications make it possible for students to take part in virtual field trips around the globe while augmented reality (AR) tools such as the popular Pokemon Go or Lonely Planet Compass City Guides have the potential to expand reality (Bonner & Reinders, 2018).

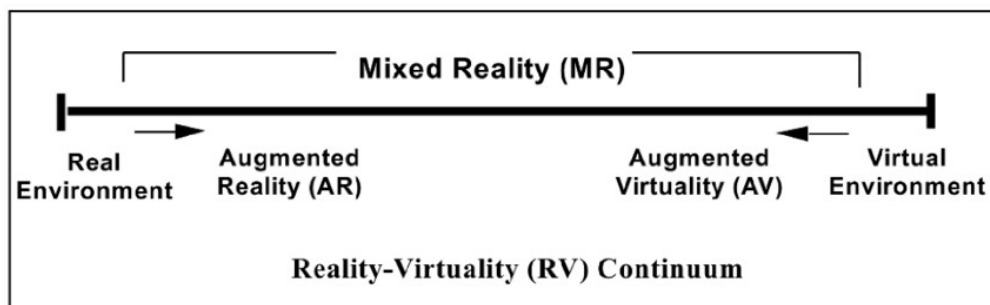
The expression „virtual reality” was first created and introduced by John Lanier, the founder of VPL Research (Alizadeh, 2019). The term has developed and expanded since then. Lloyd et al. (2017) defined virtual reality as a computer-enabled immersive technology that recreates an environment, enabling users to simulate their presence and interact within it. The most widespread definitions of VR refer to hardware such as tools, devices, headsets or head mounted displays (HMDs), however Steuer's description (1992) differs from them, because he defines VR as a tangible or virtual setting where an observer encounters telepresence.

The origin of virtual reality is unclear, but it appeared in the shape we know today during the second half of the 20th century. Initially VR devices were used in aviation as flight simulations and in the military personnel instruction (Sherman & Craig, 2003; Craig et al., 2009). Later, virtual reality tools were introduced in fields such as gaming, entertainment, advertisement and marketing. Today VR is present in various areas of education, for example in medical and science education, and also rapidly gaining space in second language education.

AR, VR, and their combination, known as mixed or extended reality, encompass a variety of technologies involving location, motion, and information. These technologies enhance reality with digital resources in the case of AR or create entirely digital environments in the case of VR, enabling users to interact with information and other users (Bonner & Reinders, 2018).

In order to distinguish the two, a reality-virtuality continuum was proposed by Milgram and Kishino (1994). It is a scale between two extremes: real environment and virtual environment. (See figure 2.) In the centre of this continuum exist mixed environments, known as mixed reality (MR). Such environment could be closer to augmented reality, where virtual objects interact with real ones in the real world, or they could have more of the immersive digital space with some tangible objects present, known as augmented virtuality (AV).

Figure 2. Milgram and Kishino's Mixed Reality on the Reality-Virtuality Continuum.
(Milgram and Kishino 1994)



Augmented reality enhances the existing real environment by incorporating virtual objects to it in ways that make the participants believe those objects actually exist. In AR students can interact with the real world, because virtual objects are placed there, so this way they can experience both. Smartphone cameras and devices like Microsoft HoloLens smart glasses can serve as tools to participate in this experience. However, the experience is not completely immersive (Bonner & Reinders, 2018).

In contrast, virtual reality takes users to a digital environment completely independent from the real world. VR transports users to a digital environment entirely different from the real environment. It can be experienced by various devices, such as stand-alone, computer-powered, or mobile-powered VR headsets. As opposed to the AR experience, VR enables an entirely immersive experience.

2.5.2 Learning Theories

There are multiple pedagogical theories that support the use of virtual reality technologies, including constructivist learning, situated learning, inquiry-based learning, game-based learning, and engagement theory (Chen, 2009; Chen et al., 2019; Rahimi & Pourshahbaz, 2019). This section aims to highlight two of the most prominent theories: constructivist learning, and engagement theory.

Constructivist learning addresses the integration of VR into education. In contrast to earlier learning paradigms such as behaviourism, constructivism characterizes learning as an engaged, contextualized endeavour of knowledge building, encouraging learners to generate their own insights and confirm them through social interaction (Ertmer & Newby, 1993). Virtual reality enables learners to construct knowledge from impactful and enriched interactions. According to Jonassen (1994) this process may be encouraged in educational settings which:

- offer diverse representations of reality; thereby
- ensuring instruction does not oversimplify by accurately depicting the inherent complexity of the real world;
- emphasize the construction of knowledge rather than its reproduction;
- provide authentic tasks that contextualize instruction rather than abstracting it;

- offer learning environments based on real-world cases, rather than using pre-established instructional sequences;
- promote reflective thinking;
- facilitate the construction of knowledge that is dependent on context and content, and
- encouraging the collaborative construction of knowledge through interpersonal negotiation, rather than fostering competition among learners for recognition.

According to Alizadeh (2019) virtual reality offers more engaging experiences than the traditional 2D multimedia methods. VR also aims to reflect the complexity of the world by providing detailed venues that make it possible for learners to engage in elaborate interactions. Instead of solely presenting information, it allows students to explore facts on their own. What is more, it can help learners to practice authentic tasks without actually being in a foreign country and provide personalized learning and individual learning paths in life-like contexts (Schön, 1983). Moreover, in contrast to older methods of knowledge transfer virtual reality and augmented reality may offer gamified problem-solving tasks while activating learners' prior knowledge (Alizadeh, 2019).

Engagement theory is another framework proposed by Kearsley and Shneiderman (1998) that supports the integration of VR technologies in education. Engagement theory was inspired by the authors' experiences teaching in digital and remote learning environments. The core idea of engagement theory is that learners need to be actively involved in learning tasks through meaningful interactions with peers and engaging activities. It is the conceptual framework for digitally enhanced learning and teaching. It shares similarities with constructivist approaches. For example, it also puts emphasis on meaningful learning, cooperation between peers and learning communities. It can also be compared to situated learning theories, because it emphasizes experimental and self-directed learning, sharing similarities with theories of adult education.

Engaged learning entails active cognitive processes like creating, problem-solving, reasoning, making decisions, and evaluating. What is more, learners are naturally motivated to learn due to the authentic nature of the educational setting. The theory promotes three important means to achieve engagement: A focus on teamwork, project-based tasks, and activities outside of traditional academic subjects (Kearsley & Shneiderman, 1998).

Another way to describe these three principles is with the „Relate-Create-Donate" triangle (Kearsley & Shneiderman, 1998). The „Relate" component puts emphasis on collaborative effort. Traditionally, students were encouraged to learn and work on their own. However, new studies have found that cooperative teamwork increases the motivation of students to learn, promotes tolerance and understanding towards diversity and multiple viewpoints.

The second component is „Create". It refers to the importance of project works, because they promote creative thinking and inspire the creation of original ideas. Elaborating their own ideas are much more engaging than solving traditional coursebook exercises. Moreover, project-based learning gives more autonomy than conventional learning.

The third component is the "Donate" element, asserting that when a project serves a tangible real-life purpose outside the classroom, it enhances students' engagement. Ideally a project has a „consumer". The consumer or client could be a university organization, community association, learning centre, religious institution, library, cultural centre, governmental organization, small business, or any individual in need (Kearsley & Shneiderman, 1998). Furthermore, these projects could fit the career interest of students. This aspect could also increase enthusiasm and satisfaction.

In conclusion, VR technologies provide realistic environments that engage students and inspire original and creative ideas. They have the potential to activate previous knowledge of students and simulate authentic situations. What is more, they give place for autonomous exploration in a stimulating and dynamic environment.

2.6. Virtual and Augmented Reality in education

2.6.1 Virtual and Augmented Reality in the Language Classroom

A widely held belief is that the most effective approach to learning a foreign language involves language immersion, where the language is spoken. (Cai, 2022) Due to frequent constraints such as time, space, or financial limitations it is not possible for the majority of language learners. However, virtual and augmented reality allows students to explore a world full of interactive and engaging simulations. Various studies in the field confirmed that the use of VR or AR tools could facilitate language learning (Cai, 2022).

Most of the studies examined different aspects of EFL (English as a Foreign Language) learning. For example, Tzu-Yu Tai & Howard Hao-Jan Chen's research in 2021 investigated the impact of mobile VR (MVR) on EFL learners' listening comprehension in Taiwan. They found that MVR may be a beneficial tool to support listening skills development.

Another study by Yukie Saito (2021) in Japan delved into the impact of three distinct technology-assisted communication methods (voice, video, and virtual reality) on foreign language anxiety (FLA). The experiment's findings revealed that VR conditions facilitated the easiest communication and fostered the most entertaining and supportive atmosphere. These results suggested that VR lessons have the potential to enhance student involvement, reduce foreign language anxiety, and improve speaking skills.

In a different line of research, Li X. et al. (2020) developed and implemented an oral English teaching system based on VR. Yi-chen Chen (2022) explored the effects of digitally supported learning in decreasing EFL learners' Public Speaking Anxiety (PSA). Additionally, other researchers investigated the effects of Mixed Virtual Reality (MVR) on oral proficiency improvement, confirming that VR usage reduced students' PSA, and the prompt-based peer-tutoring approach in VR showed promise in enhancing speaking skills and interactions (Hoang et al., 2022).

Further studies were conducted to explore the impact of VR tools on EFL vocabulary acquisition (Chen C. H., 2021; Lai & Chen, 2021). The findings indicated that the VR group outperformed the control group in vocabulary acquisition, with significantly better performance in the vocabulary translation delayed post-test compared to the PC group. The experimental group exhibited superior vocabulary learning and retention compared to the control group.

Additional research focused on EFL writing, with one study examining the effects of VR-supported classes on paragraph writing for extrovert and introvert EFL learners (Khodabandeh, 2022). Others investigated the incorporation of a virtual reality tool into the writing process of Iranian EFL lessons (Ebadijalal & Yousofi, 2022). The results consistently indicated enhanced EFL writing performance in the VR experimental group.

Although the list of studies presented here could extend further, an examination of these works makes it possible to draw conclusions, and identify both the positive and negative aspects of Virtual Reality Assisted Language Learning (VRALL). Hua & Wang (2023) published a follow-up review of various studies conducted between 2018 and 2022. The research papers of this compilation, 38 in total, incorporated both high-immersion VR and low-immersion VR tools. In terms of language learning, L1 acquisition and L2 or foreign language learning were both included. The studies employed empirical research methods such as quantitative, qualitative or mixed methods.

Hua & Wang (2023) concluded that VRALL have benefits and drawbacks, and they differentiated cognitive and affective benefits. VRALL have several cognitive benefits, such as the improvement of writing, speaking, listening reading and presentation skills. What is more, it could enhance critical thinking, cultural competencies, memory retentions, and the overall language learning process. The use of VR tools for language learning also supported multimodal literacy and vocabulary acquisition. As for the affective benefits, VRALL promotes task engagement, willingness to communicate, confidence, and enhances motivation. Moreover, it has the potential to reduce foreign language anxiety and the psychological distance between students and the teacher.

However, VRALL could have drawbacks or disadvantages as well. For example, the technical challenges that might emerge during learning. VR sessions could also be time-consuming and in some cases ineffective. The enriched environment might distract learners from their task, lower their attention and level of thinking, and slow down the speed in answering questions while not improving accuracy (Hua & Wang, 2023).

To summarise, several studies were conducted in order to examine the effects of VR and AR tools, and to determine the possible benefits and drawbacks of their incorporation in language lessons. The studies explored different dimensions of language learning, and frequently focused on specific language skills, such as speaking, listening, reading or writing skills. They employed quantitative, qualitative and mixed research methods.

However, there is a need for further research in this field. Chen et al. (2022) pointed out that future studies should broaden the range of VR devices and programs applied in language learning. They should also focus more on children, and investigate age categories beyond young adults and university students. Language learning applications mainly involve English as a foreign language, and there has been little research regarding native language teaching. For this reason, future research should also incorporate other languages. Furthermore, there is a need to compare different VR and AR devices, because most of the existing studies only examine the differences between VR assisted and traditional language lessons. Finally, later investigations should not only consider language learning gains, but also the improvement or alterations in higher-order thinking or abilities (Chen et al., 2022).

2.6.2 Incorporating VR and AR tools in language education: practical examples

Virtual and Augmented Reality can be encountered through a variety of tools and digital applications. VR headsets and head mounted displays (HMDs) such as Oculus Rift, Oculus Quest, and HTC Vive are the most immersive and engaging, yet expensive devices. Due to financial limitations, the use of VR tools is not an affordable possibility for all schools and language institutes (Bonner & Reinders, 2018).

However, there are tools and virtual programs available that come at a lower price or are entirely free. (Alizadeh, 2019). Google Cardboard is a cheaper alternative for VR headsets. (*See figure 3.*) In recent years it has gained popularity among teachers, because Cardboard goggles can be easily ordered in large quantities from online stores and assembled without major effort. Nonetheless, it has to be pointed out that the VR content viewed with these goggles is not as interactive as the content of more advanced VR headsets like the Vive or the Rift. Users have limitations in terms of the views they can access, they are only able to view 360° videos or panorama photos. Moreover, mobile phones are essential for the use of Cardboard goggles, as they need to be placed in front of the lenses (Alizadeh, 2019).



Figure 3. Cardboard goggles

Nevertheless, there are less immersive, but useful and stimulating virtual programs that do not require VR headsets, HMDs or goggles. Users only need mobile phones, personal computers (PCs), laptops or tablets to access programs such as Pokemon Go, Lonely Planet Compass City Guides, or Google Earth. They provide less engaging experiences than VR headsets and goggles, because they are closer to augmented reality in the reality-virtuality (RV) continuum (Bonner & Reinders, 2018).

There are various ways in which VR and AR programs could be employed in the language classroom. Many digital platforms and applications offer the possibility to participate in virtual field trips and explore historical sites, buildings or foreign countries. For example, the participants of Ya-Chun Shih's research (2015) walked on the virtual streets of London through the Blue Mars Lite program. Blue Mars Lite is an application that can be installed on PCs or laptops. The learners did not wear HMDs or VR goggles, however they were able to create avatars for themselves on the computer and communicate between each other through chat and voice messages. The results of this experiment confirmed that this virtual environment enhanced the learners' cultural knowledge and language learning motivation due to its engaging nature. In another experiment students explored Hong Kong Youth Culture via a virtual reality tour (Cheung & Wang, 2021). The learners had the chance to explore a virtual house and interact with objects from different eras. The findings of this research were also positive in terms of cultural knowledge acquisition and students' attitudes.

Other ways to implement VR or AR in language classes is by creating virtual campus tours, community content maps for local areas or location-based treasure hunts. Virtual reality video creations and practicing presentation skills in a digital environment were also proven to be beneficial for language learning purposes (Bonner & Reinders, 2018).

2.6.3 Google Earth Virtual Field Trips in EFL Teaching

Google Earth is a captivating virtual reality tool that allows users to explore nature, cities and buildings around the world. This digital program makes it possible for everyone with stable Internet connection to travel around the world. Google Earth has been used in geography education for many years, but it is gaining space in language education as well (Patterson, 2007). Google Earth can help to enhance technology skills and cognitive skills like critical and spatial thinking. Google Earth supports the four elements of the learning life cycle model (Cates et al., 2003). The four E model is the following: engagement, exploration, explanation and evaluation. The virtual globe enables learners to engage in the lesson, explore the world, explain what they identify and evaluate the implications of what they are learning.

The use of Google Earth, like most educational tools, has benefits and drawbacks. It has the potential to improve students' abilities and motivate students due to its entertaining value. It also includes affective components like visual and emotional images. What is more, it supports autonomous learning, because students do not need to be at school in order to use this digital program. The free version of it can be downloaded for any PC, tablet or mobile phone (Patterson, 2007).

Another advantage is that Google Earth Community and Google's Keyhole mapping service, Bulletin Board Service, provides complementary materials, such as readings, photos and videos. Collaborative forums like Google „Maps Mania" blog can also be found useful, because it enhances communication skills and supports discussion between users. Google Earth is an alternative for paper-based atlases. It offers seemingly infinite dimensions and dynamic components. For example, the user isn't limited to merely observing the Grand Canyon from space; they can discover it from multiple perspectives and appreciate its dimensions through virtual exploration. (Patterson, 2007) Google Earth includes 3D models and Street views that increases the virtual reality experience. (See figure 4. a-b)

Moreover, it is not as complex as true GIS (Geographic Information System) applications, so its interface is more user-friendly. This feature is also beneficial for teachers and educators,

because it does not require extensive training, therefore they can put more emphasis on learning rather than on the mechanics of the application itself (Patterson, 2007).

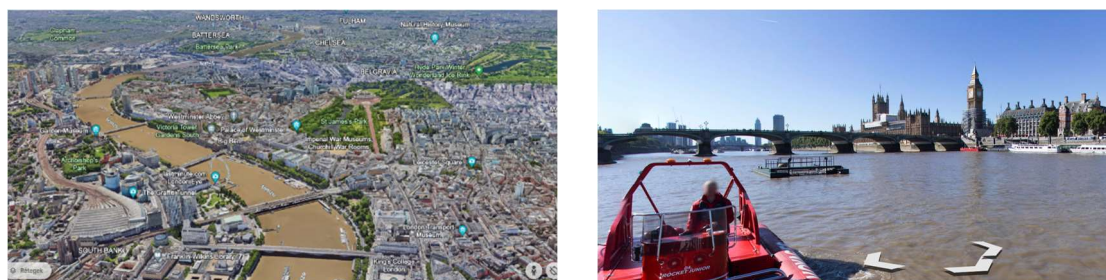


Figure 4. a-b, 3D map and a street view of London in Google Earth

However, Google Earth has a few drawbacks as well. One of the disadvantages is that it requires stable and relatively fast Internet connection. In order to use this software three conditions have to be present: "opportunity" (availability of time), "motivation" (desire or motive), and "assets" (expertise and abilities) (Patterson, 2007). Although Google Earth and its associated websites provide a wide range of data, students would need to learn how to create their own accounts so as to search for information not included in the Google Earth platform. Furthermore, the exact accuracy and authenticity of data might not be immediately accessible, which could compromise the educational value of the lesson. Due to the fact that it is not a real GIS, it cannot perform complex spatial operations so it has somewhat limited capabilities as well (Patterson, 2007).

In conclusion, despite of its few drawbacks, Google Earth could be a useful tool in education. Chen et al. (2019) investigated its effects in language education. More specifically, they examined the impact of this software on expository writing for young English Learners from a Funds of Knowledge (FoK) perspective. FoK involves utilizing existing knowledge and past experiences of students to facilitate new learning (González et al., 2005). The results of their study indicated that the software had positive effects on writing skills development and cultural knowledge acquisition.

Other researchers like Bo-Kristensen et al. (2009) introduced the notion of 'geotagging' in order to encourage learners to add tags in Google Earth or Google Maps using Mobile City and Language Guides and also to connect informal settings with formal language exercises in learning Danish. Moreover, Awada & Diab (2018) investigated the use of Google Earth, more specifically the integration of it and a Wiki platform to enhance EFL learners' oral presentation skills at two private institutions in the Middle East. The findings of these investigations were positive, the results indicated that Google Earth could be a useful tool in terms of language skills development. However, there is a need for further research. The present study aims to contribute to the effort of previous researchers, because it will focus on EFL learners' writing skills, motivation and creativity development in a virtual reality (Google Earth) assisted environment.

2.6.4. Enhancing EFL Writing Performance Through Immersive Virtual Environments

In the context of the present study, it is important to review previous research papers that addressed writing skills development in virtually supported environments. Chen et al. (2019) examined the impact of Google Earth virtual reality on young EFL learners' writing skills from a Fok (Funds of Knowledge) perspective. Fok is rooted in Vygotsky's theories of cultural-historical psychology (1978), it includes drawing upon students' existing knowledge and past experiences to assist in their acquisition of new learning (González et al., 2005). Nevertheless, most importantly their study focused on expository writing. It is a type of writing that puts emphasis on the following components: description, enumeration, cause/effect, compare/contrast, and problem/solution. (Chen et al. 2019) Their research plan also integrated the International Society for Technology in Education Standards for Students (2017):

- Originality and inventiveness
- Investigation and proficiency in information retrieval
- Analytical thinking, troubleshooting, and decision-making

It means that they examined if students participating in this research demonstrated creative thinking and developed novel products. Moreover, they analysed how learners used digital devices to collect, assess and use information. The investigation of their cognitive skills like critical thinking, problem solving, and decision thinking was also part of the research.

The participants of this study were English learners attending middle school (aged 11-15 years). Their task was to describe their “favourite country”, their “hometown/favourite city”, and a “treasure” found in their hometown/favourite city. They were required to write an essay about these topics before and after taking a Google Earth virtual trip. The writings were then graded using the IMAGE Writing Summary Rubric of Illinois State Board of Education. It includes a 5-point scale that assessed language production, focus, support/elaboration, and organization (Gottlieb, 1999). The results indicated that there were considerable differences in the growth of the EL’s expository writing skills before and after using Google Earth VR. The increase was consistent with the growth of students’ engagement (Chen et al., 2019).

Another research that investigated writing performance of EFL learners in a virtually supported environment put emphasis on concepts such as immersion, presence and embodiment (Feng & Ng, 2023). Immersion is defined as a quantifiable measure of the richness of experience provided by a system, and its capacity to block out external distractions (Cummings and Bailenson, 2016). Presence is described as the sensation of "being there" whereas agency pertains to the sense of controlling one's actions within the virtual environment. (Riva et al., 2003; Moore & Fletcher, 2012). This is associated with users feeling their bodies to be located in another place. Regarding embodiment, it is a term that refers to the experience of having a digital avatar, and the potential to perceive sensory events aimed at that body (Kiltner et al., 2012).

The participants of Feng & Ng’s study (2023) were divided into a control group and an experimental group. The control group had to complete writing tasks related to the topic of “housing” based on photos and other paper-based materials. In contrast, the other group, while having the same requirements, was instructed to explore a virtual house as the basis for their writing. The written products were then evaluated on a four-level scale according to the five dimensions of “target word usage, lexical density, distribution richness, spelling mistake and completion of task”.

The results indicated that the experimental group performed better in terms of content, organization, vocabulary, and grammar. The sense of immersion and embodiment provided by VR contexts were found to be beneficial in terms of promoting output skills, such as speaking and writing. However, its effectiveness might also depend on individual differences. For example, virtual environments could distract some learners or make them nervous (Feng & Ng, 2023).

A meta-analysis regarding the relative effectiveness of digitally supported language learning on ESL/EFL writing performance was also elaborated by Seyyedrezaei et al. (2022). Sixty-four studies were analysed and evaluated. The analysis reached similar conclusions to the studies mentioned above. Their findings confirmed that digital tools facilitate writing skills acquisition. However, the effectiveness of these may be influenced by the type of technology and the genres of writing. For example, the results indicated that collaborative instruments had higher effects on argumentative writing, while non-collaborative systems had greater impact on narrative writing.

Nevertheless, the researchers of the meta-analysis highlighted the importance of future investigations. According to them, further research is needed with young participants, as the majority of the existing studies involve adults. Moreover, they argued that there is a need for future experimental studies that focus on specific writing genres when investigating the effectiveness of different types of digital tools in language education. The current study aims to broaden the scope of existing research by investigating the influence of Google Earth on creative story writing, with a specific focus on crime fiction.

2.7 Connections to the present study

Given that the majority of existing investigations involve adults, and they mainly focus on expository or descriptive writing, researchers of the meta-analysis (Seyyedrezaei et al., 2022) put emphasis on the need for future studies involving young participants and specific writing genres. This study aims to fill this gap by exploring the influence of Google Earth on crime fiction writing among secondary school students. Additionally, it seeks to develop and test the effects of VR-based ESL creative writing intervention against a traditional paper-based intervention on students' creative writing motivation, engagement and performance. Subsequently, the following research questions and associated hypotheses have been developed:

2.7.1 Hypotheses

Q1. How does the use of a VR-based creative writing intervention influence writing motivation compared to a traditional paper-based intervention? With regard to this question, based on the findings of previous literature (i.e. Feng & Ng, 2023; Shih, Y.-C., 2015) the following hypothesis has been developed: **H1.** Writing motivation will be higher in the VR group than in the paper-based group.

Q2. How do engagement levels compare between students involved in VR-based creative writing intervention and those participating in paper-based intervention? With regard to this question, based on the results of previous research papers (i.e. Feng & Ng, 2023; Chen, et. al. 2019) the following hypothesis has been developed: **H2.** Engagement will be higher in the VR group than in the paper-based group.

Q3. How does the IVR intervention impact creative writing effort, quality and creativity compared to the traditional paper-based intervention? With regard to this question, based on prior studies (i.e. Chen, et. al. 2019 ; Feng & Ng, 2023) there were 3 hypotheses: **H3.** Due to increased motivation and engagement, students in the IVR group will put more effort in creative writing (**H3.1**), which will lead to higher quality (**H3.2**) and more creative (**H3.3**) texts.

3. Research design and methods

In line with the aims, this research adopted a mixed methods design including (1) a randomized between-subject classroom experiment using quantitative measures of students' creative writing motivation, engagement, and performance, (2) and qualitative analysis of students' perceptions across the two groups.

The study was approved by the Research Ethics Committee of the Eötvös Loránd University's Faculty of Education and Psychology (Nr: 2024/2) and was conducted as part of a larger study on game-based educational technologies and creativity whose Principal Investigator (PI) is Enikő Orsolya Bereczki.

3.1. Participants

Participants were 28 students from a secondary school of Budapest. The majority of the students were Hungarian, with one student of Chinese origin. Among all participants, 15 were female (54%), 10 were male (36%), 2 identified themselves as members of the third gender (7%), and 1 did not wish to reveal their gender. Age ranged from 16 to 19 ($M=17.39$, $SD=.79$). Although the students were recruited from two different grades: 10th ($n=13$) and 11th ($n=15$), they were all at the same

(Upper-intermediate) level of English. GPA ranged from 3.6 to 5 ($M = 4.39$, $SD = .43$). Participating students were randomly assigned to the VR and paper based groups.

3.2. Materials

In accordance with the aims, various materials and tools were used in the research. The experiment was carried out twice, initially with the 11th graders ($n=15$), followed by the 10th graders ($n=13$). During the pre-intervention session all students had access to the same coursebook, story-writing guide, and Kahoot activity. Moreover, all participants were provided with the same paper-based questionnaires before and after the experiment.

However, during the intervention the groups were divided into two, with participants were randomly allocated either paper-based materials or computers. Paper-based tools included tourist maps of London in size A3, and photos of the most important sights of the city with short descriptions. (See figure 5 a.) On the other hand, the participants assigned in the Immersive Virtual Reality (IVR) treatment group were offered the Google Earth program. This digital program also contains descriptions and photos, but with virtual maps, street views, and 3D models of buildings. (See figure 5 b.) In total, there were 15 students in the paper-based treatment group and 13 in the other intervention group.

Students who utilized the printed materials were instructed to write their stories on paper, whereas those using the Google Earth program composed their stories in Microsoft Word. The members of both study groups were allowed to use online dictionaries as well. (See Appendix 1. for more details)



Figure 5 a-b. Paper-based tools vs. Google Earth

3.3. Measures

The research methodology included quantitative measures to assess students' creative writing motivation, engagement, and performance, alongside qualitative analysis of students' perceptions. Quantitative measures involved demographic and background questions, a creative writing motivation scale, and an engagement scale. Creative writing effort, linguistic quality and overall creativity were also examined through the students' written products. The qualitative analysis consisted of the observation and examination of students' written feedback.

3.3.1. Demographic and background questions

Participants were requested to answer three demographic and background questions placed at the beginning of the creative writing motivation scale. Anonymity was provided, because the students were instructed to choose a detective name for themselves. The aim of these questions was to collect and evaluate data about the participants age, gender and grade from English. (See Appendix 3.)

3.3.2. Creative writing motivation scale

Before the intervention sessions, the participants completed a questionnaire regarding creative writing motivation. In this research the short form of the Questionnaire on Current Motivation (QCM) by Rheinberg et al. (2001) was utilized. The motivational scale consists of 12 items on a scale of 1 to 7. On the scale “1” means strongly disagree while “7” indicates strongly agree. It is a Likert-type scale (Likert, 1932). QCM measures four factors of current achievement motivation, including: ‘anxiety, challenge, interest, and probability of success’. The questionnaire was translated into Hungarian so as to ensure that the students clearly understand its content. (*See Appendix 3.*) The Cronbach alpha of this questionnaire is 0.75, therefore it is a reliable tool for measuring.

3.3.3. Engagement scale

Parong and Mayer’s (2018) Interest, Motivation and Engagement Scale was adapted to the creative writing interventions. (*See appendix 4.*) Participants rated statements on a seven-point Likert scale from 1 (Strongly Disagree) to 7 (Strongly agree) about motivation (1 item, ‘I felt motivated to understand the material of the detective-themed creative writing classes.’), interest in creative writing (4 items, ‘I am interested in learning more about creative writing.’, ‘I would like to learn about creative writing this way in the future.’, ‘I enjoyed learning about creative writing this way.’, ‘I found the detective-themed creative writing classes to be useful to me.’) and engagement (1 item, ‘I felt that the detective-themed creative writing classes were engaging.’). Cronbach's alpha for the scale was $\alpha = .86.$, which indicated good reliability for this tool as well.

3.3.4. Creative writing effort

Similarly to previous studies (e.g. Feng & Ng, 2023) creative writing effort was measured through formal characteristics, such as word count (the total number of words used in the detective stories written by students) and sentence length (the average number of words used in a sentence).

3.3.5. Linguistic quality

Nine dimensions were employed to analyse students' stories for linguistic quality. According to Hypothesis 3 increased motivation and engagement would lead to writings of higher linguistic quality, particularly evident through the use of rich and diverse vocabulary, and the abundant use of descriptive elements, adjectives and adverbs. The proportion of target vocabulary items was also examined in the creative stories. Some of the target vocabulary elements was already familiar to the students, while others were introduced in the pre-intervention session. Other aspects such as grammar, cohesion and coherence, and language use were also analysed, as they are typical assessment components of the Hungarian Matriculation exam. (*See Table 1. for the dimensions, their definitions, calculation methods and sources; and Appendix 5. for one of the evaluated student stories*).

Table 1.

Linguistic quality dimensions and their assessment

Linguistic dimension	Definition	Calculation	Source
Grammar	The examinee's grammatical accuracy (ie.use of sentence structures and overall linguistic refinement)	The original evaluation scale of the language accuracy component of the EFL matriculation exam of Hungary was adapted. The writings were rated on a 1 to 5 scale, where 5 means the highest proficiency.	The reference material for grading the English as a Foreign Language (EFL) B2 level matriculation exam in Hungary. (<i>Javítási-értékelési útmutatók</i>) Their website: https://www.oktatas.hu/koznevelas/erettsegi/feladatsorok
Cohesion and coherence	The use of linguistic elements and techniques to create logical connections between different parts of text. Overall clarity, logic, and organization of ideas within a text.	The original evaluation scale of the text composition component of the EFL matriculation exam of Hungary was adapted. The writings were rated on a 1 to 3 scale, where 3 means the highest proficiency.	The reference material for grading the English as a Foreign Language (EFL) B2 level matriculation exam in Hungary. (<i>Javítási-értékelési útmutatók</i>) Their website: https://www.oktatas.hu/koznevelas/erettsegi/feladatsorok
Language use	Use of appropriate and rich vocabulary.	The original evaluation scale of the use of vocabulary component of the EFL matriculation exam of Hungary was adapted. The writings were rated on a 1 to 5 scale, where 5 means the highest proficiency	The reference material for grading the English as a Foreign Language (EFL) B2 level matriculation exam in Hungary. (<i>Javítási-értékelési útmutatók</i>) Their website: https://www.oktatas.hu/koznevelas/erettsegi/feladatsorok
Target vocabulary	The number of different words or expressions related to the topic of 'crime'	The number of different target vocabulary items in the texts /types (unique words)*100 (the items of the crime vocabulary were marked and counted in the text)	Feng, B., & Ng, L. L. (2023). Facilitating writing performance of EFL Learners via virtual reality: Immersion, presence, embodiment. <i>Frontiers in Psychology, 14</i> . https://doi.org/10.3389/fpsyg.2023.1134242 The website used to determine the number of types: Reuneker, A. (2017). <i>Lexical Diversity Measurements</i> . Retrieved 19 March, 2024, from https://www.reuneker.nl/files/ld .

Proportion of adjectives	The number of adjectives identified in the stories.	Adjectives/total number of words*100	The website used for measurement: https://www.analyzemywriting.com/index.html
Proportion of adverbs	The number of adverbs identified in the stories.	Adverbs/total number of words*100	The website used for measurement: https://www.analyzemywriting.com/index.html
Lexical density (LD)	The proportion of lexical words (nouns, verbs, adjectives, adverbs) to the total number of words. It provides insight into the richness and informativeness of the language used.	Total number of words*100/Number of lexical words	Laufer, B., & Nation, P. (1995). Vocabulary size and use: Lexical richness in L2 written production. <i>Applied Linguistics</i>, 16(3), 307–322. https://doi.org/10.1093/applin/16.3.307 The website used for the analysis: https://www.analyzemywriting.com/index.html
Lexical variation (LV)	Lexical variation shows how well students can express themselves with the vocabulary they know. It refers to the diversity and range of vocabulary used in a text.	Number of types (unique word)*100/tokens (total number of words)	Laufer, B., & Nation, P. (1995). Vocabulary size and use: Lexical richness in L2 written production. <i>Applied Linguistics</i>, 16(3), 307–322. https://doi.org/10.1093/applin/16.3.307 The website used for measurement: Reuneker, A. (2017). <i>Lexical Diversity Measurements</i>. Retrieved 19 March, 2024, from https://www.reuneker.nl/files/ld.
Descriptive elements	Description is an element of expository writing. Descriptive elements in this context are the number of words used for the description of different locations.	The number of descriptive elements/total number of words*100 (the descriptions were underlined in the texts and the number of words counted)	Chen, Y., Smith, T. J., York, C. S., & Mayall, H. J. (2019). Google Earth Virtual Reality and expository writing for young English learners from a Funds of Knowledge perspective. <i>Computer Assisted Language Learning</i>. doi: https://doi.org/10.1080/09588221.2018.1544151

3.3.6. Creativity

Participants' texts were rated for creativity following the Consensual Assessment Technique (CAT, Amabile, 1982) by three expert raters. They were all EFL teachers. The raters evaluated the stories for creativity on a scale of 1 (not creative at all) to 7 (extremely creative) in a random order. Inter-rater reliability for CAT scores was low but still acceptable ($ICC2 = .50$ 95% CI [.04, .75])

3.3.7. Students' perceptions

At the end of the research, participants were asked to provide written feedback using their detective names. The students were encouraged to share their perceptions, ideas or feelings in relation to the experiment. This collection was later analysed through thematic coding in Microsoft Excel.

3.4. Procedures

In February 2024, the study was conducted in a secondary school, involving two different English learning groups of Upper-intermediate level. Firstly, it was carried out with the 11th graders, then repeated with the 10th graders. While planning the classroom experiment, the Google Earth program was selected as a virtual reality tool for the experimental group. Although it offered less immersive experience than VR goggles or headsets, it was a more affordable and accessible choice. Following this, the detective theme was selected. In determining the specific genre, my aim was for it to serve as guidance to the students, and I designed the pre-intervention session with the same objective in mind.

The study began with a 45 minutes long pre-intervention session. During this lesson the key concepts of story writing, and the vocabulary of the crime topic were revised. Both language learning groups had previous knowledge in relation to this theme, but some vocabulary items were new for the students. A story writing guide was also read and discussed in class, and a Kahoot game was used to test their knowledge. What is more, a short sample story that I had created was also presented to them. (*see Appendix 2.*)

A few days later a 90 minutes long intervention session was held. Before the experiment the students answered demographic and background questions and completed a motivational questionnaire. Following this, the groups were divided into two and each learner was randomly assigned to either the paper-based or to the immersive virtual reality (IVR) treatment group.

Although the tools were different, the instructions were the same. Students were required to write detective stories that take place in London. They were free to use any place, building or famous sight as scenes in their crime stories, but they needed to include at least three. The participants were also instructed to mark these locations in their maps (printed or Google Earth maps) and connect them so as to create story webs. (*See Appendix 6.*) The IVR group received technical guidance. The stories could be about anything within the crime theme, not just about murders. (i.e. robberies, kidnapping etc.) There were no other requirements or specifications. During the experiment the participants were monitored, and any questions or technical issues were addressed promptly.

Following the classroom experiment, an additional 45 minutes was provided to ensure that everyone had enough time to complete their stories. Once the students had finished, they were requested to fill out another questionnaire regarding their level of engagement during the intervention. Finally, the learners were asked to write feedback regarding their experience with the experiment. They were encouraged to share any ideas, feelings or thoughts. (*See Appendix 1. for more details*)

3.5. Data analysis

Quantitative analyses were conducted in IBM SPSS Statistics Version 21.0 for Mac. To compare the effects of the VR and paper-based interventions, tests from Cohen and his colleagues' manual (2007) were selected: a series of Independent Samples-T Tests were conducted when the assumption of normality was met. With those independent variables for which the assumption of normality was violated, non-parametric Mann-Whitney U tests were used. The students' perceptions were analysed through thematic coding in Excel (Bree & Gallagher, 2016). Classroom observation notes were also taken into consideration.

4. Results

4.1. Analyses of baseline characteristics

The analyses of baseline characteristics confirmed that there were no significant differences among the two groups in terms of grade and gender distribution, or age and ESL/EAL GPA as presented in the following Table 2.

Table 2.

Baseline characteristics

<i>Variable</i>	<i>IVR Condition (n = 15)</i>	<i>Paper-based condition (n = 14)</i>	<i>Test results</i>
Grade	10 th grade: n = 8 11 th grade n = 7	10 th grade: n = 5 11 th grade n = 8	$X(1,28) = .62, p = .43$
Gender	Female: n = 8 Male: n = 5 Other: n = 1	Female: n = 7 Male: n = 5 Other: n = 1	$X(2,27) = .03, p = .99$
Age	M=17.20 (SD = .76)	M=17.62 (SD = .77)	$t(26) = .17, p = .29$
GPA	M=4.31 (SD = .41)	M=4.46 (SD = .46)	$t(25) = -.87, p = .39$

4.2. Effects of the VR intervention

The effects of the interventions on measured outcomes are presented in the following Table 3.

4.2.1. Writing motivation (H1)

The results of an Independent samples T-test with motivation as an independent variable and condition as a fixed factor showed that there was no significant difference between the VR group and the paper-based group in terms of motivation. (*See Table 3 for results*). However, it is important to note that motivation was high in both groups (for the VR group: M =4.54 , SD = .54 , Mdn = 4.42; for the paper-based group: M =4.28, SD =1.07 , Mdn = 4.42)

4.2.2. Intervention engagement (H2)

The results of an Independent Samples T-test with engagement as an independent variable and condition as a fixed factor showed that there was no significant difference between the VR group and the paper-based group in terms of engagement with the intervention. (*See Table 3 for results*). Engagement was high in both groups (for the VR group: M =4.77, SD =1.16, Mdn=4.50; for the paper group: M =4.57 , SD =1.45, Mdn=4.50)

Table 3.

The effects of the VR and paper-based interventions on creative writing motivation, engagement, and performance

Variables	VR-group (n = 13)	Paper-based group (n = 15)	Difference
Creative writing motivation	M=4.54 SD=.54 MD=4.42	M=4.28 SD=1.07 MD=4.42	t(17,21) =.82 , p = 0.42
Engagement	M=4.77 SD=1.16 MD=4.50	M=4.57 SD=1.45 MD=4.50	t(26) =.41 , p = 0.69
Creative writing performance			
1. Effort			
Sentence length	M=16.13 (SD=3.36)	M=15.32 (SD=5.16)	t(26) =.50 , p =0.62
Word count	M=572.40 (SD=154.52)	M=502.77 (SD=204.79)	t(26) =1.02 , p= 0.32
2. Linguistic quality			
Grammar*	M =3.40 (SD =.51)	M = 4.00 (SD =.58)	U=48.00, z=-2.57, p=.01
Cohesion and coherence*	M=2.13 (SD=.64)	M=2.31 (SD=.48)	U=84.50, z=-.71 p=.555
Language use*	M=4.33 (SD=.49)	M=4.54 (SD=.66)	U=75.00, z=-1.18, p=.316
Target vocabulary	M=11.24 (SD=3.00)	M=11.78 (SD=4.68)	U= 97.000 z= -.023 p= .982
Proportion of adjectives	M=4.92 (SD=1.80)	M=4.90 (SD=1.71)	U= 90.000 z= -.346 p= .730
Proportion of adverbs	M=4.27 SD=1.52	M=4.75 SD=1.72	U= 74.000 z= -1.083 p= .279
Lexical density (LD)	M=47.07 SD=2.96	M=50.05 SD=4.22	U= 56.000 z= -1.912 p= .056
Lexical Variety (LV)	M=44.47 SD=4.85	M=46.15 SD=6.73	t(26) = -.77 , p = 0.45
Descriptive elements	M=8.25 (SD=7.33)	M=13.85 (SD=14.56)	U = 69.000 , z = -1.313, p = .189
3. Creativity*	M=5.13 (SD=.21)	M=5.00 (SD=.33)	U = 94.5 , z = -.14, p = .89

* Note: Grammar and Language use were measured on a scale of 1 to 5. Cohesion and coherence was measured on a scale of 1 to 3. Creativity was measured on a scale of 1 to 7.

4.2.3. Creative writing performance (H3)

4.2.3.1. Effort (H3.1)

The results of the Independent samples T-tests with, first sentence lengths, and then word count as independent variables and condition as fixed factor showed that there were no significant difference between the VR group and the paper-based group in terms of sentence lengths and word count. (See Table 3)

4.2.3.2. Linguistic quality (H3.2)

The results of the Independent samples T-tests with lexical variety as an independent variable and condition as a fixed factor showed that there was no significant difference between the VR group and the paper-based group in terms of lexical variety.

The assumption of normality was violated in case of text quality dimensions: grammar, cohesion & coherence, language use, creativity, target vocabulary, descriptive element, adjectives and adverbs, and lexical density. Therefore, Mann-Whitney U tests were used for these variables with each of these dimensions as an independent variable and condition as a factor. The analysis showed that there were no significant differences between the VR and paper group for cohesion & coherence, language use, creativity, target vocabulary, descriptive elements, number of adjectives and adverbs. (See Table 3) A significant difference in the grammar dimension and a marginal significant difference in lexical density dimension was found, with the paper group outperforming the VR group. (See Table 3)

4.2.3.3. Creativity (H3.3)

The assumption of normality was violated for the creativity dimension of writing. Therefore, a Mann-Whitney U test was used for this variable. The analysis showed that there was no significant difference between the VR and paper group in terms of creativity (See Table 3).

4.3. Qualitative findings

4.3.1 Student feedback

Qualitative data was collected in the form of student feedback at the end of the experiment. Twenty-eight pieces of feedback were collected in total. The students used detective pseudonyms hence anonymity was ensured. The data was analysed through thematic coding in Excel. While examining the feedback seven themes were identified. Some comments addressed multiple themes, resulting in 80 references across all responses. (See figure 6.)

The most frequently mentioned themes were the level of engagement experienced throughout the experiment (29%), opinions about task quality (21%), and the level of motivation before and during the interventions. (16%). Expressions such as *"I very enjoyed this activity, and it was fun to write a detective story"* were common.

Many students mentioned that they found the task to be very exciting and creative. Another positive aspect they noted was that the creative writing task and the classroom experiment, in general, were out of the ordinary and unlike anything they typically experience in their regular lessons.

Regarding motivation one participant wrote the following: *"At first I was like alright, let's get over with it so I can just chill in class while everyone else is writing. However, my brain went crazy with ideas and I started to really enjoy it (...)"* A few other learners expressed similar feelings. One of them confessed that initially she felt a little anxious, because she was not sure if she could perform

well in this activity. These responses indicated that their motivation level at the beginning of the writing task was moderate, but later it became higher.

Returning to the themes mentioned earlier, there were other ones that focused on the instructions of the creative writing task (9%) and on the time restrictions (6%). Some students wrote that they would have preferred to be in the IVR intervention group, because they did not like writing by hand. Conversely, other learners commented the opposite. This could be attributed to differences in individual preferences.

Other participants noted positively that they had a high level of freedom. An example: *“I was honestly glad that there weren't obligatory words we had to use in the story or a specific number of words. I was also happy that I could freely use my imagination and have fun.”* They appreciated that only the genre and the minimum number of scenes (3) was given without any length requirements or specific words to use, allowing them to use their imagination and channel it into creative ideas. Only one student remarked that he would have preferred if he could choose the main topic as well and write about something else.

In terms of time restrictions, a few learners commented that if they had more time, they would have performed better in the creative writing task. They mentioned that the brainstorming and planning stages of the creative stories required a considerable amount of time as they are not accustomed to these type of activities. Moreover, according to one participant, it would have been better to have a break between the 90 minutes of the classroom experiment.

Returning to the topic of themes, the learners' reflections on the quality of their own work (10%) and their personal development during the classroom experiment (9%) also emerged. Some students formed self-critiques. For example, one participant commented that “he was not in a creative mood that day”, so his story did not turn out the way he had expected. Another student wrote that he “overcomplicated the plot” which did not leave him enough time to write a great ending. On the other hand, several students had positive views regarding their own work.

Concerning personal development, many participants commented that the creative task helped them learn new words and enhance their language and writing skills. Furthermore, a significant number of them expressed interest in participating in similar activities in the future.

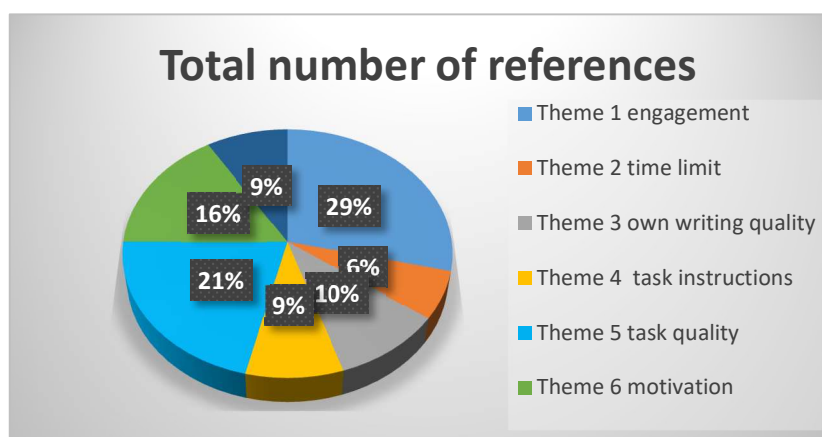


Figure 6: number of references

There were a few differences in the number of references between the students from Class 10.a and learners from Class 11.b. While engagement level, and task quality were the most frequent themes in both classes, Theme 7 (personal development) did not appear at all in the feedback from Class

10.a. On the other hand, Theme 2 (time restrictions) only appeared in the feedback from Class 11.b. (See figures 7. and 8.)

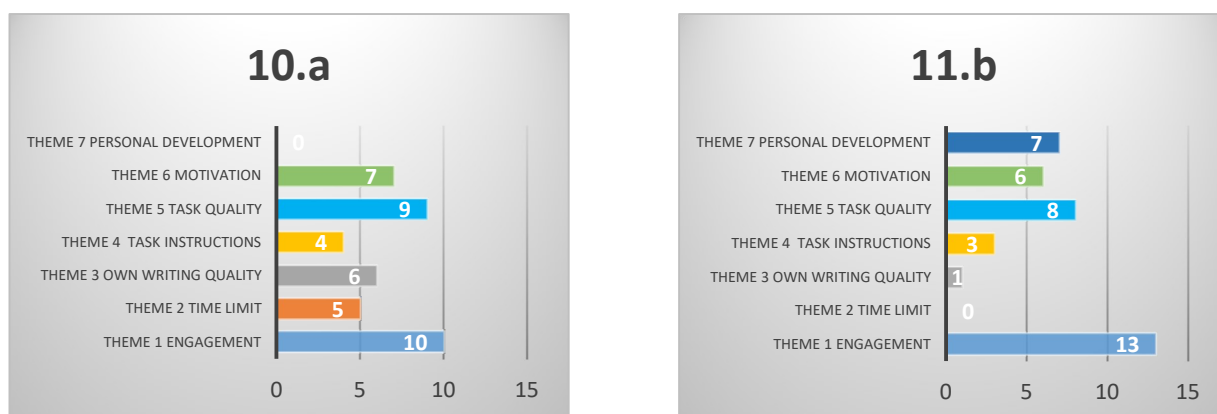


Figure 7-8. number of references in classes 10.a and 11.b

In conclusion, the qualitative analysis of student feedback provided valuable insights into their experiences. The analysis identified seven main themes, with engagement level, task quality, and motivation being the most frequently mentioned. Many students expressed excitement and enjoyment in participating in the activity, highlighting its unique and creative nature. Their feedback also revealed that many students experienced growth in their motivation levels during the experiment.

Furthermore, students appreciated the freedom provided, however, some expressed preferences for additional options in topic selection or more time for the task. In terms of personal development, many students noted improvements in vocabulary, language and writing skills, indicating the beneficial impact of the activity. Additionally, a significant number expressed interest in participating in similar activities in the future.

Moreover, the analysis showed that feedback varied between classes, emphasizing the need to take into account individual preferences and experiences. Further research and adjustments in future interventions could help bridge these gaps and improve the overall experience of participants.

4.3.1 Classroom observations

Throughout the intervention sessions I monitored the students' behaviour and offered help whenever necessary. I noted down some evidence that could imply that the participants were feeling motivated and enjoyed the writing process.

One of the students commented during the class experiment that "he was having goosebumps" while writing his detective story, because he found it so exciting. From both classes there were learners who expressed similar feelings. This implies that the chosen genre was indeed interesting and inspiring for them.

Other students inquired if they could receive information about the points they earned in the evaluation, because they wanted to compete with each other. They were eager to discover who could create the best crime story. From this I deduced that the sense of competition was also a motivating factor for some participants.

Some students finished early, while others needed more time to elaborate their ideas. What I observed was that after completing their stories, they continued discussing the task and their writings. Some participants from the IVR intervention group kept exploring cities in the Google Earth program instead of playing on the computer or engaging in other activities. This suggests that they found both the virtual reality tool and the creative task in general very captivating.

Another thing that I noticed later, after reading their stories, that three learners appeared in each other's stories as the main characters. From my point of view, this was likely because the students were familiar with each other and shared a strong bond. This aspect could also increase engagement and serve as a motivating factor.

After the intervention it was also very interesting to observe the student maps with their distinct shapes of story webs formed by both the VR and paper-based groups. This suggests that each group developed highly imaginative creations. (*See Appendix 6.*)

In conclusion, my observations supported the students' written feedback regarding motivation and engagement. What is more, it revealed that the sense of competition and positive relationships between the students were two additional motivating factors during the classroom experiment.

5. Discussion

The purpose of this study was to examine the effects of a VR-based ESL/EAL creative writing intervention against a traditional paper-based intervention on students' creative writing motivation and engagement. The study also sought to understand whether the IVR treatment would result in increased effort, linguistic quality and creativity in student writing.

In line with the purposes, a mixed methods study was conducted. First, the effects of the VR-based intervention were examined against a matched paper-based condition in a randomized between-subject experimental design. In addition, qualitative data was collected on students' perceptions about the creative writing interventions and some observation notes were taken. Considering the hypotheses formulated earlier, derived from previous literature, the expected outcomes were as follows:

- (H1) Writing motivation was expected to be higher in the VR group compared to the paper-based group (i.e. Feng & Ng, 2023; Shih, Y.-C., 2015).
- (H2) Engagement was expected to be higher in the VR group compared to the paper-based group (i.e. Chen, et. al. 2019; Feng & Ng, 2023).
- (H3) Due to increased motivation and engagement, students in the IVR group were predicted to invest more effort in creative writing (H3.1), resulting in higher quality (H3.2) and more creative (H3.3) texts (i.e. Chen, et al. 2019 ; Feng & Ng, 2023).

However, the results obtained from both the quantitative and qualitative data indicated that there were no significant differences in terms of motivation and engagement between the VR and paper-based groups. Motivation and engagement were high in both groups. This finding was further supported by qualitative evidence, as students in both groups expressed high enjoyment and interest in the activity. This could be explained by the novelty and the captivating nature of the creative task, as it represented something beyond their usual experiences.

Consequently, there was no significant difference in terms of effort and creative writing quality in the writing task done by the students. In terms of linguistic quality, a significant difference in the grammar and a marginal difference in lexical density were found in favour of the paper group.

On the one hand, when investigating potential causes, it is important to take individual differences into account. Even though the participants were at a similar language proficiency level, it is possible that those in the paper-based group had stronger grammatical skills or a slightly bigger vocabulary repertoire prior to the experiment, as this classroom experiment used randomization but did not control for baseline differences between students. Moreover, based on the feedback from students, they have different preferences regarding the materials used. Consequently, some students may have felt more comfortable with the familiar, paper-based tools, which could explain their slightly better performance.

On the other hand, it is possible that students from the paper-based group had higher grammatical accuracy, because they focused more on the writing process itself and had more time for revisions without the distractions of a VR environment. Conversely, individuals in the VR group might have been more immersed in their surroundings, dedicating more time to exploring locations for their stories. Feng & Ng, (2023) made similar observations regarding accuracy. In their research the traditional intervention group had more time to memorise the correct spelling of vocabulary items, whereas the VR group could not pay so much attention to this. As a consequence, the writings of the VR group contained more spelling mistakes than the traditional one.

The difference in lexical density could be explained by the VR group's preference for diving into the virtual space and focusing on exploring buildings and street views rather than consulting the descriptions provided by Google Earth. In contrast, the paper-based group, lacking interactive features, concentrated more on the short descriptions provided for the main attractions of the city. The use of expressions extracted from these descriptions likely contributed to the lexical density of their narratives. In relation to the immersive nature of VR tools, Dolgunsöz et al. (2018) mentioned the presence of a novelty effect. According to their research, when students encounter something unfamiliar, it enhances their engagement and shifts their attention towards interactive elements.

The VR and paper-based approach were thus equally successful in promoting motivation, engagement, and creative writing. This is in contradiction with studies that found superiority of VR-based interventions over traditional paper-based ones (i. e. Feng & Ng, 2023). However, it is important to note that no passive control condition was used and there were a few limitations to the present study. (*See Chapter 6.*) Future studies could consider incorporating a passive control condition and address these limitations to further investigate the comparative effectiveness of VR-based and paper-based interventions.

Moreover, the present study used a between-subjects design, meaning that the performance of two different classes was compared, despite their similar language proficiency levels. Nonetheless, in future investigations it could be worthwhile to adopt a within-subjects design which involves conducting the classroom experiment with the same students multiple times while changing the conditions of the experiment.

Another possible direction for future research is the exploration of collaborative writing facilitated by VR or AR tools, as opposed to individual writing with the same tools. What is more, in the present research the creativity of student stories was evaluated by teachers, however it could also be worthwhile to integrate peer-evaluation or peer review in future investigations.

The study is in line with other research which did not find technology-based interventions for writing more effective (e.g. Lin, 2014; Qi-Yuan, 2013; Topacio, 2018). It implies that the medium alone does not necessarily determine the effectiveness of a creative task regarding linguistic effort and quality. On the other hand, this investigation incorporated the Google Earth program due to its cost-effectiveness and accessibility. Future studies may find it beneficial to explore the use of fully immersive devices, such as VR goggles, within the virtual reality group, because they could potentially be more motivating and effective in activating students' knowledge and vocabulary than desktop-based VR devices. Regarding pedagogical implications, VR technology could also be tested in other types of activities, such as speaking or reading tasks.

Although the present study did not reveal many significant differences between the results of the VR group and paper-based group, it aligned with the findings of Lin (2014) and served with valuable information about the overall effectiveness of a creative task in motivating and engaging students in writing activities. What is more, it successfully addressed a gap in existing research. It focused on young learners and tested a different writing genre than previous studies, while also indicating potential research directions.

6. Limitations

Although the findings indicated that there were no significant differences between the results of the IVR and the paper-based treatment group, some limitations have to be taken into consideration. Due to its small sample size ($n=28$), it was an underpowered study, consequently it could not be representative of a broader population. Moreover, the research was conducted within a short time period. Using larger sample sizes and extending the research period with repeated interventions could potentially lead to different outcomes.

7. Conclusions

The findings of this research indicated that technology-based approaches are not always superior to paper-based approaches. Interesting and fun activities may motivate and engage students irrespective of the medium used. Students from both treatment groups created stories of similar creativity. In terms of linguistic effort and quality, there were only two differences.

The traditional intervention group achieved higher points for grammatical accuracy, and the lexical density of their writings was also slightly higher. These results could be attributed to differences in individual abilities or preferences, or possibly because paper-based tools are more familiar to students compared to novel technologies like VR, which might be distracting due to their novelty.

This research addressed a gap in existing literature, because it involved young EFL learners and a specific genre: crime fiction. In spite of its limitations, it provided valuable insights into the effectiveness of creative writing tasks in motivating and engaging students. What is more, it revealed that interpersonal relationships and the sense of competition are two other important factors influencing learners' motivation.

Future research could address the limitations of this study by including more participants and repeating the interventions during a longer time period. It would also be worthwhile to compare the performance of a VR group and a passive, no-treatment group. Other potential areas for future investigations could involve conducting within-subject experiments and exploring the use of more immersive virtual reality tools, such as VR goggles or headsets.

Declaration on AI Usage: Artificial intelligence (ChatGPT) was used in the literature review section for finding synonyms and rephrasing expressions, but not for text generation. Moreover, one of the illustrations included in the appendix, titled "Moriarty in the Cricket Field," was created using the Leonardo.ai image generation program.

Nyilatkozat az MI használatról: Mesterséges intelligenciát (ChatGPT) az irodalmi összefoglaló részben szinonimák keresésére, illetve kifejezések átfogalmazására használtam, szövegek generálására nem. Továbbá a mellékletben szereplő egyik illusztrációt melynek címe "Moriarty in the cricket field" a Leonardo.ai nevű képgeneráló programmal készítettem.

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Appendices

The appendices can be found in the following Google Drive link:

https://drive.google.com/file/d/15xmvoRoRfK0ztnm2FrxlLMLokdDhbwL/view?usp=drive_link