Technology-Assisted Language Education **TALE**

Collaborative Writing through the Sites in VR Application: Iranian EFL Learners

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Abstract

Computer-Assisted Language Learning (CALL) has revolutionized language education, with virtual reality (VR) offering innovative opportunities for immersive learning. Through a mixed-methods design, this study examines the effects of collaborative writing using the Sites in VR application on the Iranian EFL learners' writing performance and their attitudes towards using the application for collaborative writing. Adopting a pretest-posttest control group design, two intact classes, including 30 intermediate female learners (aged 16–20),) were randomly divided into experimental and control groups. The experimental group explored sites using the Sites in VR application with a VR box, while the control group viewed the same sites through images. Both groups completed writing tasks after exploration and discussion sessions. Writing performance was assessed pre- and post-intervention. Statistical analyses (ANCOVAs and MANOVA) revealed significant improvements in the experimental group's writing performance compared to the control group. Analyzing the participants' attitudes through semi-structured interviews revealed that they held predominantly positive attitudes toward using the Sites in the VR application for collaborative writing. Key themes included increased motivation, enhanced creativity, and improved collaboration. These findings underscore the potential of VR-based collaborative writing to enhance language learners' performance and engagement.

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Introduction

Virtual reality (VR) applications are set to revolutionize language learning by providing learners with immersive experiences (Becker et al., 2016). Traditionally, language teachers contextualize learning through images, videos, and music. VR has the potential to enhance this contextualization by offering virtual trips, which can improve collaborative, task-based learning (Lloyd et al., 2017). Despite the benefits of VR, most research has focused on speaking and listening skills (Ebadijalal & Yousofi, 2022), with specific VR tools being examined but not fully exploring their potential for improving writing performance (Chen et al., 2020; Chen et al., 2023; Dolgunsöz et al., 2018; Ebadijalal & Yousofi, 2022; Feng & Ng, 2023; Lan et al., 2019; Li et al., 2023). Among language skills, L2 writing is often considered the most challenging compared to listening, reading, and speaking (Jahin & Idrees, 2012). Writing is a time-consuming activity requiring significant attention and effort from learners (Han & Hiever, 2018) and is typically the last skill to be fully developed (Cloud et al., 2010). Many learners struggle with writing (Chen et al., 2020), and although writing is traditionally viewed as a solitary activity, there is growing interest in collaborative writing (CW) (Storch, 2019).

Storch (2005) defines CW as the shared responsibility and co-partnership in producing a text. CW enhances various aspects of writing, such as grammar, content, and language, as learners must express ideas, reach agreements, and decide on language use (Storch, 2019). This approach is rooted in social constructivism, which argues that socially situated activities significantly affect cognitive development through social interactions (Vygotsky, 1978). The integration of VR into educational practices aligns with constructivist learning theories, emphasizing active, contextualized learning through social interaction and collaboration (Ertmer & Newby, 1993; Jonassen, 1994). Constructivism posits that learners construct knowledge through meaningful experiences, making VR an ideal tool for immersive and interactive learning environments (Chen et al., 2020).

Furthermore, VR has been shown to boost motivation and engagement, leading to increased experience, interaction, and collaboration in learning contexts (Kukulska-Hulme & Viberg, 2018). However, the motivational aspects of VR remain under-researched (Tai et al., 2022). Motivation plays a crucial role in shaping learners' writing experiences and performance, with low motivation potentially leading to decreased writing output and avoidance of writing tasks (Abdel Latif, 2019).

Limited quantitative evidence exists on the effectiveness of VR tools for writing performance among EFL learners, often constrained by participants' language proficiency and the specific VR tools used (Ebadijalal & Yousofi, 2022). Thus, further research is needed to provide quantitative data (Parmaxi, 2023) and empirical evidence on the utility of various VR tools for enhancing language skills (Ebadi & Ebadijalal, 2022).

Accordingly, drawing on constructivist learning theories, the current study addresses this gap by using the Sites in VR application available on smartphones for collaborative writing. It investigates the impact of this VR tool on writing performance of intermediate Iranian EFL learners in terms of, content, communicative achievement, organization, and language (Cambridge Preliminary English Writing rubrics, 2022). The following research questions guided the study:

Cambridge Preliminary English Writing rubric test (2022) contains

- Is there a significant difference in the writing performance of Iranian intermediate EFL learners who practice writing collaboratively through VR compared to those who practice with pictures?
- What are the attitudes of Iranian intermediate EFL learners who practice writing collaboratively through VR toward using VR in writing?

Literature review

The literature highlights numerous benefits of VR in education. VR tools enable teachers to take students on virtual trips without leaving their classrooms, providing rich and immersive experiences (Alizadeh, 2019). Constructivist learning theory supports the use of VR in language classrooms, as it encourages learners to construct knowledge and understanding through social discussion and negotiation (Chen et al., 2020; Ertmer & Newby, 1993). Constructivism emphasizes contextualized tasks and real-life learning activities, fostering collaboration and social negotiation among learners (Jonassen, 1994). Since the 1990s, VR has been integrated into educational settings, initially focusing on subjects like mathematics (Kebritchi et al., 2010), geometry (Hwang & Hu, 2013), science (Kartiko et al., 2010), and foreign languages (Ibanez et al., 2011).

An early example is Bell and Fogler (1995), who developed a virtual environment for computer-simulated chemical reactions in an engineering course, guided by Bloom's taxonomy. VR allows users to interact with various stimuli and engage as active participants in virtual worlds (Shin, 2002). For example, Makransky and Lilleholt (2018) found that immersive VR positively impacts learning outcomes, presence in the learning environment, and learner motivation. Over the past two decades, VR has gained significant attention due to increased affordability and widespread availability of VR devices (Pack et al., 2020). Recent technological advancements have made VR more accessible, further enhancing its potential in educational contexts (Rau et al., 2018).

Most studies have focused on the benefits of VR for enhancing speaking and listening skills. Chien et al. (2020) utilized spherical video-based VR to simulate authentic English-speaking contexts, resulting in improved motivation, speaking skills, and reduced anxiety. Similarly, Ebadi and Ebadijalal (2022) demonstrated the effectiveness of Google Expeditions in improving language learners' willingness to

communicate and oral proficiency. However, fewer studies have investigated the impact of VR on writing skills.

Chen et al. (2020) examined the effectiveness of Google Earth on the expository writing of English learners, finding a positive impact on their writing performance. Ebadijalal and Yousofi (2022) also utilized Google Expeditions to enhance writing motivation and performance among Iranian English learners, providing empirical support for its utility in writing education. Furthermore, Rojas-Alfaro (2024) found that VR can enhance writing skills development by providing remote access to educational materials. The study found that while students appreciated the VR library tour, they desired more flexibility and reported some technical issues affecting their experience. Additionally, to explore ways of enhancing writing complexity through richer contextual experiences, Shen et al. (2025) conducted a quasi-experimental study that examined the effects of spherical video-based virtual reality (SVVR) in EFL instruction. The results indicated that SVVR significantly improved learners' lexical and syntactic complexity, supporting its pedagogical value in EFL writing classrooms.

Bonner and Reinders (2018) highlight the significant benefits of using VR in language learning, such as increasing motivation, improving retention, and decreasing distraction. VR tools can enhance learners' knowledge of phonology, morphology, grammar, and syntax, as well as their overall language cognition (Chen, 2016). Gadelha (2018) further emphasizes VR's potential to immerse language learners, fostering deep connections with the material and promoting collaboration. Additionally, VR enhances interaction and exploration, aiding learners in constructing their knowledge (Dreher et al., 2009). Ward (2010) found that tasks in Second Life, such as avatar-based marketing, not only engaged students but also improved their understanding of the lessons, demonstrating VR's effectiveness in creating interactive and enjoyable learning experiences. Cao & Luo (2025) conducted a study that examined the impact of a Virtual Reality intervention enhanced with EEG biofeedback (VR-EEG) on EFL learners' proficiency. Learners in the VR-EEG group experienced adaptive VR environments based on real-time brain activity. Findings showed that the VR-EEG group significantly outperformed the traditional group in overall proficiency, and reported greater engagement.

Despite the effectiveness of VR on language learning, few studies have addressed the impact of VR tools on the process of writing (Chen et al., 2020; Chen et al., 2023; Dolgunsöz et al., 2018; Ebadijalal & Yousofi, 2022; Feng & Ng; 2023; Lan et al., 2019; Li et al., 2023). The few studies on the use of VR for enhancing writing performance have shown promising results across various contexts. Chen et al. (2020) examined the impact of Google Earth on English learners' expository writing, utilizing a non-experimental design with 22 participants. Their findings revealed significant improvements in expository writing skills, including cause and effect, compare and contrast, and description. The study also highlighted learners' increased engagement and positive

attitudes towards using Google Earth. Similarly, Chen et al. (2023) focused on creative writing, investigating the effects of Spherical Video-Based Virtual Reality (SVVR) with primary school students. The experimental group, which used SVVR, outperformed the control group in writing creativity, engagement, and learning persistence, indicating SVVR as a predictor of creative writing success.

Feng and Ng (2023) explored the influence of Immersive Virtual Reality (IVR) on writing performance and vocabulary usage among 144 Chinese learners. Their findings showed that the experimental group, which used IVR, provided more detailed writing and demonstrated better vocabulary use due to the sense of presence IVR provided. However, not all studies showed significant improvements in writing performance with VR. Li et al. (2023) compared SVVR with Conventional Video (CV) and found no significant difference in writing achievement between the groups, although writing motivation improved in both. Dolgunsöz et al. (2018) also found that while learners enjoyed using VR videos, there was no significant effect on short-term writing skills. Lan et al. (2019) investigated the use of Second Life for pre-writing activities among Chinese learners and found that immersive exploration significantly improved writing performance compared to traditional methods. Overall, these findings highlight the promising potential of VR to enhance writing performance and motivation, while also emphasizing that its effectiveness is closely tied to the specific tools and contexts in which it is implemented.

Method

Design

The present study employed a mixed-method approach (QUAN+QUAL), integrating quantitative and qualitative methodologies to enhance the depth and validity of findings (Dörnyei, 2007). The quantitative phase utilized a pretest-posttest control group design to answer the first two research questions (Ary et al., 2018). This design enables comparison of participants' performance on specific variables before and after an intervention, ensuring control over extraneous factors. By comparing the pretest and posttest scores, this study aimed to isolate the effects of the VR-based intervention on collaborative writing and motivation. The qualitative phase addressed the second research question through semi-structured interviews conducted with participants from the experimental group. These interviews, designed by the researchers, explored learners' insights and attitudes toward using VR in collaborative writing. By combining experimental data with qualitative insights, this study provides a holistic view of the impact of collaborative writing in Sites in VR on both measurable outcomes and learner perspectives. All participants were informed about the purpose of the study and provided written consent; their participation was voluntary, and confidentiality was maintained throughout the research process.

Participants

The study was conducted at a female branch of Safir Language Academy in Tehran Province, involving female intermediate EFL learners aged 16 to 20, all of whom were native Persian speakers. Convenience sampling was employed due to the researchers' accessibility to the participants. A total of 30 learners from two intact classes, each with 15 students, were randomly divided into the experimental and control groups. Although the learners were classified as intermediate based on the institute's placement criteria, the Cambridge Preliminary English Writing Test (B1, 2022) was administered as a pretest to ensure comparability in their writing proficiency. Following the pretest, outlier scores were removed from the statistical analysis to enhance the validity and reliability of the findings. Additionally, some participants' data were excluded due to incomplete responses or non-compliance during the pretest phase, reducing the total sample size to 22. Consequently, the experimental group comprised 10 participants, and the control group included 12 participants. Importantly, the students whose data were excluded from the analysis continued to participate in the treatment sessions.

While the reduced sample size may appear to be a limitation, the small number of participants reflects the realities of controlled experimental studies in educational settings, where access to participants can be limited, particularly in specialized environments such as female-only branches of language institutes. Moreover, despite the modest sample size, the study's mixed-method design, combining robust quantitative analyses and qualitative insights, helps to mitigate this limitation and ensure the validity and depth of the findings.

Instruments

Cambridge Preliminary English Writing Test (B1)

The study employed two distinct versions of the Cambridge Preliminary English Writing Test (B1, 2022) (https://www.cambridgeenglish.org/exams-and-tests/preliminary/exam-format/). For both pretest and posttest assessments to evaluate participants' writing performance. The Cambridge Preliminary English Writing Rubric (2020) was utilized to assess four key criteria: content, communicative achievement, organization, and language. Each writing sample was evaluated according to these criteria, with scores assigned on a scale from 0 (lowest) to 5 (highest) (https://www.cambridgeenglish.org/images/231794-cambridge-english-assessing-writing-performance-at-level-b1.pdf).

Semi-structured Interviews

Among different types of interviews, such as structured, unstructured, and semi-structured interviews, semi-structured interviews can be formulated beforehand but modified during the interview. The questions are open-ended and cannot be answered by yes or no. The questions are designed to find the important features of the study (Ary et al., 2018). Participants of the experimental group were interviewed by the researcher, and their attitudes toward using Sites in VR in the process of collaborative writing were investigated through seven interview questions. The primary purpose of these questions was to explore participants' perceptions of the use of *Sites in VR* and their effectiveness in enhancing their writing performance. (Appendix 1). The semi-structured interviews were conducted in person by the researcher after the treatment. Each interview lasted 20 minutes per participant. The interviews were conducted in Persian to avoid misunderstandings.

Sites in the VR application

The Sites in VR application is a virtual reality tool designed to provide immersive and interactive experiences by allowing users to explore a wide range of real-world locations through 360-degree panoramic views. Available on both Android and iOS platforms, the application includes a variety of categories, such as historical landmarks, natural landscapes, and architectural wonders. Users can navigate these virtual environments using a VR headset/Box or through their smartphones in VR mode, offering a sense of presence and engagement that enhances the learning experience (Appendix 2). In educational contexts, Sites in VR enable students to virtually visit and interact with places they might not otherwise have access to.

Data collection procedure

This study utilized two distinct versions of the Cambridge Preliminary English Writing Test (B1, 2022). Both the experimental and control groups participated in the initial administration of the first test version as a pretest. In this test, participants wrote a 100-word response on their preference for watching movies at home or in a cinema and the type of movies they enjoy. Participants in the experimental group were instructed to install the Sites in VR application on their smartphones. A VR Box device was used to facilitate the virtual experience. By inserting a smartphone in VR mode into the VR Box, students could virtually explore the target site while wearing the VR headset. Each session began with participants being divided into pairs or small groups, where they collaboratively explored the virtual sites and exchanged knowledge for approximately 15 minutes.

Students engaged in discussions and negotiated meanings while navigating various topics, including nature, Ancient Egypt, and Ancient Greece, through the Sites in VR application. Due to the availability of a single VR Box, participants took turns using the headset while others explored the sites on their smartphones in VR mode. Following

the exploration phase, participants collaboratively worked for 40 minutes to compose a written description of the site they had virtually visited. This process was repeated for a total of 10 virtual sites, resulting in 10 collaborative writing tasks. On the other hand, the control group engaged in similar collaborative activities involving discussions and writing but without VR integration. Instead, they used printed pictures sourced from the Sites in VR application, which were shared on their smartphones during the sessions. Like the experimental group, they explored 10 sites and completed 10 writing tasks based on the provided images. At the end of the course, both groups completed the second version of the Cambridge Preliminary English Writing Test (B1, 2022) as a posttest.

Data analysis

The quantitative data for the first research question underwent various statistical analyses, including an independent samples t-test, ANOVA, and MANOVA, using SPSS. The statistical procedures are explained in detail in the following section. Additionally, the experimental group participated in semi-structured interviews to explore their attitudes toward using the Sites in VR application for collaborative writing.

The interviews were audio-recorded, transcribed, and subjected to a rigorous content analysis. Content analysis, as defined by Krippendorff (2018), is a systematic research method used to draw valid and replicable conclusions from textual or meaningful data by analyzing it within its specific context. The analysis process involved several structured steps. First, the transcripts were carefully reviewed, and three types of codes were generated: descriptive codes to capture the main ideas in participants' responses (e.g., "motivation" or "collaboration"), in vivo codes to preserve participants' exact words or phrases (e.g., "it was exciting"), and interpretative codes to draw deeper insights connecting responses to broader themes. These codes were then organized into broader themes and subthemes, reflecting recurring ideas and relationships across the data. To enhance the reliability of the analysis, an inter-coder reliability check was conducted. A second researcher independently coded 25% of the data using the same coding framework. Discrepancies between coders were resolved through discussion and consensus to ensure consistency in theme identification.

Findings

To address the first research question, the Cambridge Preliminary English Writing test (B1, 2022) was administered at the beginning of the course to assess the initial comparability of the experimental and control groups regarding writing proficiency. An independent samples t-test in SPSS revealed no significant difference in the mean pretest scores between the experimental and control groups ($t(20) = 0.042$, $p = 0.96 > 0.05$ (two-tailed)). The pretest results established a baseline for this study. The initial test results served as the pretest for this study. Upon completion of the course, participants in both groups undertook an alternate version of the Cambridge Preliminary English Writing test

(B1, 2022) as the posttest. The descriptive statistics for the learners' writing performance on the pretest and posttest are presented in Table 1.

Additionally, to ensure the reliability of the scores, a second rater independently assessed the pretest and posttest results. Inter-rater reliability was evaluated using the Intraclass Correlation Coefficient (ICC). The calculated ICC values for the experimental group were 0.82 for the pretest and 0.97 for the posttest, while for the control group, the values were 0.87 for the pretest and 0.95 for the posttest.

Table 1.

Descriptive Statistics of Writing Performance (Pretest and Posttest)

		Pretest		Posttest	
Group	**N**	**M**	**SD**	**M**	**SD**
Experimental group	10	14.6	.96	17.8	1.75
Control group	12	14.5	.90	16	1.47

As demonstrated in Table 1, the mean score of the experimental group is higher than that of the control group in the posttest. To determine whether this difference is statistically significant, an ANCOVA was conducted with posttest scores as the dependent variable, pretest scores as the covariate, and group (experimental vs. control) as the independent variable. Moreover, Levene's test for equality of variances showed a value greater than .05, suggesting that the assumption of equal variances is met (F = .379, p = .743) (Pallant, 2020). The result of ANCOVA is demonstrated in Table 2.

Table 2.

Tests of Between-subject Effects

Dependent Variable: posttest

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18.264[a]	2	9.132	3.402	.055	.264
Intercept	16.347	1	16.347	6.089	.023	.243
pretest	.591	1	.591	.220	.644	.011
groups	17.611	1	17.611	6.560	.019	.257
Error	51.009	19	2.685			
Total	6292.000	22				
Corrected Total	69.273	21				

a. R Squared = .264 (Adjusted R Squared = .186)

After confirming the assumptions for ANCOVA, the analysis revealed a significant difference in the adjusted posttest scores between groups, $F_{(1, 19)} = 6.5$, p=0.019<0.05,

indicating that the experimental group exceeded the control group regarding writing performance.

Furthermore, the Cambridge Preliminary English Writing test (2020) evaluates content, communicative achievement, organization, and language. Each of these four areas is scored from 0 (indicating the lowest ability) to 5 (indicating the highest). These scores collectively represent the examinee's overall writing performance. Table 3 presents the descriptive statistics for the sub-skills of writing performance in the posttest. According to the descriptive statistics, there are differences in the mean scores for all the sub-skills.

Table 3.

Descriptive Statistics of sub skills of the Writing test (posttest)

Sub skills	Group	N	Mean	Std. Deviation	Std. Error Mean
Content	experimental	10	4.9	.31	.1
	control	12	4.58	.66	.19
Communicative Achievement	experimental	10	4.2	.63	.2
	control	12	4	.42	.12
Organization	experimental	10	4.3	.48	.15
	control	12	3.66	.49	.14
Language	experimental	10	4.4	.69	.22
	Control	12	3.66	.49	.14

To determine if the observed differences in sub-skill scores were statistically significant, a multivariate analysis of variance (MANOVA) was conducted. In this analysis, the four posttest scores—content, communicative achievement, organization, and language—served as dependent variables. The independent variable was the group (experimental vs. control). The result is indicated in Table 4.

Table 4.

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.996	964.867[b]	4.000	17.000	.000	.996
	Wilks' Lambda	.004	964.867[b]	4.000	17.000	.000	.996
	Hotelling's Trace	227.027	964.867[b]	4.000	17.000	.000	.996
	Roy's Largest Root	227.027	964.867[b]	4.000	17.000	.000	.996

groups	Pillai's Trace	.502	4.282[b]	4.000	17.000	.014	.502
	Wilks' Lambda	.498	4.282[b]	4.000	17.000	.014	.502
	Hotelling's Trace	1.007	4.282[b]	4.000	17.000	.014	.502
	Roy's Largest Root	1.007	4.282[b]	4.000	17.000	.014	.502

a. Design: Intercept + groups

b. Exact statistic

The MANOVA results indicated a statistically significant multivariate effect of the intervention on the combined posttest scores across all sub-skills, $F(4, 17) = p < 0.05$. This finding suggests that the experimental group's engagement in collaborative writing through the VR application had a significant impact on their overall writing performance in comparison to the control group.

Further examination of each sub-skill through follow-up univariate ANCOVAs revealed:

Content: There was no statistically significant difference between the groups regarding content scores, $F(1, 15) = 2, p = 0.177 > 0.05$.

Communicative Achievement: No significant difference was found in communicative achievement scores between the groups, $F(1, 15) = 0.06, p = 0.939 > 0.05$.

Organization: The experimental group demonstrated significantly higher organization scores than the control group, $F(1, 15) = 5.4, p = 0.03 < 0.05$.

Language: The experimental group also significantly outperformed the control group in language scores, $F(1, 15) = 5.5, p = 0.03 < 0.05$.

These results indicate that while both groups performed similarly in content and communicative achievement, the experimental group's use of the VR-based collaborative approach led to significant improvements in organization and language, suggesting that the intervention particularly enhanced these areas of writing.

To address the second research question and gain deeper insights into students' attitudes toward the use of the Sites in the VR application and its impact on writing performance, semi-structured interviews underwent rigorous content analysis. Table 5 presents the identified themes, subthemes, and their frequencies for each interview question. Key findings from the content analysis highlighted students' overwhelmingly positive attitudes toward using Sites in VR, with themes such as increased motivation, enhanced creativity, and improved collaboration emerging prominently.

Table 5

Themes and subthemes extracted from the interview questions

Interview Questions	Themes and subthemes	Frequency, N (%)
Question 1	**Theme: Positive attitude and Engagement with VR**	
	They found Sites in VR interesting and are willing to use it in the process of writing.	8 (80%)
	Although they liked Sites in VR, they want to try other VR apps too.	2 (20%)
Question 2	**Theme: Enhanced Motivation/ demotivation through VR**	
	Sites in VR is motivating and interesting.	7 (70%)
	Although liked it, it seemed limited and sometimes hard to find favorite site to write about.	2 (20%)
	Getting distracted by Sites in VR	1 (10%)
Question 3	**Theme: Increased Creativity and Idea Generation**	
	Sites in VR can help them to expand their knowledge and as a result they can write better.	6 (60%)
	Sites in VR is useful to shape ideas, but sometimes not having enough information about some sites to write about.	4 (40%)
Question 4	**Theme: Advantages and disadvantages of VR Integration**	
	Sites in VR is user-friendly and provides a variety of sites which is hard to reach in real life.	4 (40%)
	Sites in VR doesn't provide any information about the place. However, it is easy to use.	4 (40%)
	Sites in VR has limited topics.	2 (20%)
Question 5	**Theme: Language Enhancement through VR**	
	Sites in VR is useful for learning vocabulary needed in the process of writing.	5 (50%)
	Sites in VR might encourage to learn more vocabulary and needed structure.	5 (50%)
Question 6	**Theme: Challenges/Difficulties with Sites in VR**	
	Sites in VR was easy to use and didn't need any special skills.	8 (80%)
	The Internet interruption caused difficulty in using VR	2 (20%)
	Preference for writing collaboratively as this approach helps to come up with more ideas.	9 (90%)
	Preference for writing alone because of bring hard to reach an agreement with others.	1 (10%)
Question 7	**Theme: Improved Collaboration and group work**	
	Preference for writing collaboratively as this approach helps to come up with more ideas.	9 (90%)
	Preference for writing alone because of bring hard to reach an agreement with others.	1 (10%)

As indicated in the Table, 80% of participants expressed interest in using the application in future writing tasks, citing its engaging and interactive nature. For instance, Maral mentioned:

- The app is very interesting and I will use it again. I always have little idea about what to write, but it is much easier to write when I see the place rather than imagine it. (Interview sample excerpt, Maral)

Regarding the second question, 70% of the participants commented that using Sites in VR is interesting, and motivating because they believed that it could help them increase their knowledge.

- I have never been abroad and I have never seen these places. I enjoyed visiting the places, knowing them and writing about them. (Interview sample excerpt, Rana)
- Additionally, *Sites in VR* was perceived as a valuable tool for idea generation (60%), fostering creativity by exposing students to new environments.
- When I used this app, I could see details so it gave me a clear imagination about what I wanted to write. (Interview sample excerpt, Ayda)

Considering the advantages and disadvantages of the application, the fact that students could visit sites they could not visit in real life was considered an advantage, while the lack of information about the sites in the application was considered a disadvantage.

- I like this app because of the variety of places it provides, but there is no information given to us. Sometimes I want to know when the site has been built and who has made it. (Interview sample excerpt, Nahid)

In response to the fifth question, approximately half of the participants felt that using Sites in VR could help them to learn more vocabulary and needed structure, while the other half believed that it might encourage learning new vocabulary depending on the learners and their willingness.

- Because of seeing various sites, I could learn more vocabulary and use them in my writing. (Interview sample excerpt, Rina)

With regard to the challenges and difficulties, the majority of the participants stated that they did not encounter any difficulties, and it was easy to use the app. And finally, the majority of the students mentioned that they preferred to write with others since it helped them to come up with more ideas.

- Yes, we shared our ideas and explored more with one another. When we wrote together, we had more ideas to put in written words. (Interview sample excerpt, Maral)

Discussion

This quantitative study investigated the impact of the *Sites in VR* application on the writing performance and motivation of intermediate EFL learners. Regarding the first research question, the findings indicate that *Sites in VR* effectively enhances learners' writing performance. Studies highlighting the educational benefits of VR tools in language learning, such as those by Chen et al. (2020), Huang et al. (2020), Ebadijalal and Yousofi (2022), Rojas-Alfaro (2024), and Cao and Luo (2025), support the findings of the present study. This study corroborates Chen et al. (2020), who observed that Google Earth VR facilitated improvements in learners' expository writing. Additionally, the results of this study align with Huang et al. (2020), who found that spherical video-based virtual reality (SVVR) improved students' writing effectiveness by enhancing both content and structure. Similar to the findings of the present study, Ebadijalal and Yousofi (2022) demonstrated the positive impact of Google Expeditions on students' writing performance. The current findings also reveal improvements in language and organization sub-skills, which aligns with Ebadijalal and Yousofi (2022), who reported significant progress in these sub-skills following VR-based instruction. Furthermore,

On the contrary, the results of the present study are in contrast with those of Dolgunsöz et al. (2018), who reported that VR tools did not significantly enhance participants' writing performance in the short term. Furthermore, Lobanova et al. (2024) found that while virtual reality (VR) significantly improved overall academic performance in English, it did not positively affect students' writing skills, which showed unsatisfactory results despite VR's effectiveness in enhancing long-term memorization. However, contradictory to the findings of Dolgunsöz et al. (2018) and Lobanova et al. (2024), the present study revealed significant improvement in the writing proficiency of the students. This divergence may stem from differences in research design, participant characteristics, or the specific VR tools employed.

VR's potential to transform collaborative learning experiences is another notable aspect. As highlighted by Zheng et al. (2018), VR-based collaborative tasks foster problem-solving abilities, encourage discussion, and provide opportunities for immediate feedback. The current study supports these findings, demonstrating that VR promotes peer interaction and collaboration, which Kitchen and McDougall (1999) also identified as key benefits of VR in collaborative learning contexts. Such collaborative experiences likely contribute to the observed improvements in writing performance.

The qualitative data for the second research question (Q2) were collected immediately after the VR-based instruction through seven semi-structured interviews. The responses to the first three questions revealed that participants had a positive perception of using *Sites in VR* in their writing classes. They found it enjoyable and beneficial for writing performance, motivation, and idea organization. The findings suggest that VR can enhance active engagement and facilitate learning during writing tasks. This positive attitude toward VR aligns with prior research indicating favorable

student perceptions of VR tools in educational contexts (Ebadijalal & Yousofi, 2022; Chen et al., 2020; Huang et al., 2016). Specifically, 70% of participants mentioned that *Sites in VR* was motivating and interesting, which supports previous studies showing VR's ability to improve learner motivation (Ewert et al., 2013; Huang et al., 2023).

Incorporating VR in writing tasks provides a contextualized and interactive learning experience, leading to better learning outcomes (Chien et al., 2020; Gruber & Kaplan-Rakowski, 2023). The immersive and engaging nature of VR also promotes active learning, making it distinct from traditional, passive learning environments (Allcoat & von Mühlenen, 2018; Hu-Au & Lee, 2017; Qiu et al., 2023). While this study further supports the literature, demonstrating that VR enhances motivation, engagement, and enjoyment in educational settings, it is in contrast with Rojas-Alfaro (2024) which found that although students valued the VR library tour, they expressed a need for greater flexibility and noted that technical difficulties negatively impacted their experience.

The fourth question explored the advantages and disadvantages of using *Sites in VR*. While 40% of participants expressed appreciation for the opportunity to virtually visit inaccessible places and expand their knowledge, 20% noted limitations in content variety, which could lead to boredom or demotivation. This finding is consistent with prior studies, where students expressed a desire for richer content, such as cultural or culinary topics (Huang et al., 2023). Furthermore, Kavanagh (2017) reported similar issues, with 17.1% of studies noting VR's limited effectiveness. Such limitations highlight the importance of diversifying VR content to maintain engagement and maximize its educational impact.

In response to the fifth question, all participants agreed that *Sites in VR* was useful for vocabulary learning, which contributed to their writing performance. Half of the participants specifically noted that the application helped them learn new vocabulary and apply correct grammatical structures in their writing. This aligns with the findings of Tai et al. (2022), who demonstrated that VR tools like Mondly VR enhance vocabulary acquisition, and Wang et al. (2017), who emphasized the role of VR in promoting language proficiency through contextual and social interaction.

The sixth question focused on the usability of *Sites in VR* and potential challenges. Most participants (80%) found the application user-friendly and convenient. Although some students mentioned potential issues such as internet disruptions, these problems did not occur during the study. These results are consistent with Ebadijalal and Yousofi (2022), who reported connectivity challenges in their research.

Finally, responses to the seventh question highlighted the collaborative potential of *Sites in VR*. Collaboration is a cornerstone of social constructivism, fostering learning through discussion and shared ideas (Kavanagh et al., 2017; Zheng, 2018). In this study, 90% of participants preferred working collaboratively, citing the benefits of idea sharing and group discussions. This preference supports prior findings that VR-based

collaborative learning enhances idea organization and fosters a supportive learning environment (Chen et al., 2020; Zheng, 2018).

Conclusion

This study demonstrates that the Sites in VR application is an effective tool for enhancing both the writing performance and motivation of EFL learners. By offering a variety of immersive virtual environments—such as historical sites, natural landscapes, and parks—Sites in VR provides learners with engaging and inspiring contexts for writing tasks. The findings highlight that motivation is crucial for learners' active participation in writing activities, and the use of VR technology facilitates this by increasing engagement, reducing distractions, and enriching the overall learning experience. The immersive nature of VR helps to alleviate boredom, foster involvement, and make writing tasks more enjoyable and productive. Therefore, EFL teachers are encouraged to adopt Sites in VR as a practical and user-friendly tool to inspire students and increase their motivation to write. By enabling virtual "field trips," this application creates authentic and stimulating experiences that facilitate deeper connections to writing tasks, promoting greater creativity and improved performance.

It should be noted that the present study focused specifically on writing skills, and the findings should be interpreted with caution when considering other L2 skills or VR tools. Future research could explore the application of VR in teaching other language skills to determine its broader potential in language education. Additionally, comparative studies involving different VR tools and their impacts on language learning would provide valuable insights.

Bio-data

First Author: Guided the project, helped in the procedures, wrote and reviewed the final draft.

Second Author: Collected the data and and conducted the data analysis.

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Appendix 1

1. Would you consider using Sites in VR in future writing classes? Why or why not?
2. Did using Sites in VR increase your motivation to write? Can you explain how?
3. How did Sites in VR influence your ability to generate ideas during the writing process?
4. In your opinion, what are the advantages and disadvantages of using Sites in VR in writing classes?
5. Do you think Sites in VR helped you use the target language more effectively? If yes, how? If no, why not?
6. What challenges, if any, did you face while using Sites in VR in your writing activities?
7. Did using Sites in VR enhance your collaboration with group-mates? Can you describe your experience?

Appendix 2

Sites presented through VR and pictures (experimental vs. control group)