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PAPER

The Use of Augmented Reality through Assemblr Edu to Inspire Writing in an Ecuadorian EFL Distance Program

Fernando Carrión-Robles(⊠), Verónica Espinoza-Celi, Alba Vargas-Saritama

Faculty of Education, Universidad Técnica Particular de Loja, Loja, Ecuador

lfcarrion5@utpl.edu.ec

ABSTRACT

This study analyzed the effectiveness of using augmented reality (AR) through the Assemblr Edu platform to improve English as a foreign language (EFL) writing skills in distance education. The participants included 40 freshmen university students who speak English at a basic level. This case study was approached through the mixed method. The data collection instruments encompassed a pre-test, a post-test, written tasks assessed through a rubric, and a survey. Findings evidenced that Assemblr Edu enhanced participants' writing-skill development in terms of organization and structure of paragraphs as well as grammar, vocabulary, and punctuation. This was thanks to the augmented reality elements in 3D, which allowed the designing of teaching material incorporating interactive activities, videos, images, and multimedia elements.

KEYWORDS

Assemblr Edu, augmented reality, distance learning, EFL writing

1 **INTRODUCTION**

Teaching English is challenging, especially if the language is taught in a context where the language is not spoken; therefore, teachers are required to provide learners with an authentic learning environment supported by technology tools to enhance the mastery of English as a foreign language (EFL). Technology, if pedagogically selected and implemented, facilitates the acquisition of linguistic skills for communicating. Research has proved that the use of technology has a positive and significant impact on language-learning development [1], [2], [3], For example, curricular integration of technology in EFL teaching has a lot of advantages since it offers access to a set of digital tools such as internet, email, interactive videos, and the World Wide Web [4]. These advantages range from enhancing motivation to fostering critical thinking skills, boosting communication, encouraging innovation, promoting autonomous learning, establishing interaction, promoting research, encouraging cooperative learning in the language classroom, and boosting students'

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performance on written class assessments. Therefore, technology-aided teaching facilitates the creation of a more engaging, interactive, and lively environment in the EFL classroom.

Regarding writing, technology use leads to more motivation, greater engagement in the writing process, greater productivity, improvement in language usage, and better paragraph structure and composition [5]. Wang [6] affirmed that in order to enrich writing instruction, context-aware technology can be employed to augment context-specific learning experiences and enhance knowledge anywhere and at any time, in both formal and informal settings. In this sense, wireless networks, mobile devices, and sensor technologies enable students to interact in a positive way with objects in their surrounding environment by means of context-aware ubiquitous learning [7].

In this regard, augmented reality (AR) technology is an example of what technology offers to create more immersive and engaging learning environments and opportunities by overlaying digital learning content in text or images over real scenes. Thus, with the use of this type of technology, authentic writing-course design can be achieved [8]. Writing instruction entails grasping complex discipline-specific concepts, retaining and using difficult vocabulary, and acquiring an unfamiliar mode of discourse [9]. From this point of view, Rusman [10] highlighted that distance learners may become more motivated and involved in the writing process and may learn to self-regulate the writing process, utilizing appropriate guidance from context-aware sensing technology if writing-course designers and instructors bring writing closer to real life.

In fact, technology can be used to create immersive learning experiences for students, allowing them to engage with interactive digital content, thus supporting distance students' EFL writing development and helping them to overcome some problems that they face when writing. Among the most common problems are the inappropriate use of terms [11], lack of knowledge of the correct grammar structures [12], lack of motivation to read and write [13], and lack of concentration [14]. Consequently, EFL teachers need to examine the benefits that the multimodal nature of digital writing offers, including ways to engage distance students in learning and improving writing with the use of mobile devices in a context-dependent manner [15]. Given the unclear direction and criticisms of current EFL tools, more effective ways of integrating new technology into the writing classroom should be explored [16] in order to overcome the limitations of the textbook-based approach [17].

There is a wide range of AR platforms that enable students to learn and reinforce writing skills. For the purpose of this study, the Assemblr Edu platform was used because it is a useful and easy-to-use tool. Assemblr Edu is an online educational platform supported by augmented reality, artificial intelligence, and other cutting-edge technologies. This platform permits users to create and edit dozens of existing teaching materials on a variety of topics. In short, Assemblr Edu helps educators to create a more accessible and exciting learning experience in 3D and AR, providing an interactive and intuitive learning environment [18].

Despite the aforementioned ideas of using technology, research conducted on Assemblr Edu to enhance EFL writing for distance students is scarce. Therefore, the present study attempts to analyze the effectiveness of using the Assemblr Edu platform to improve English as a foreign language writing skills in distance learning.

The results of the study will help shed light on the use of AR in the Ecuadorian context through answering the following research questions:

- What is the impact of applying augmented reality to improve EFL writing skills in distance learning?
- How effective is the Assemblr Edu tool in strengthening vocabulary, grammar, punctuation, and writing structure for distance students?
- What are students' perceptions regarding the effectiveness of Assemblr Edu as an augmented reality-based tool for learning EFL writing?

2 LITERATURE REVIEW

2.1 AR in higher education

Lee [19] mentioned that AR is a very efficient technology for higher education such as universities and colleges. Students in universities can improve their knowledge and skills with contextually enriched interaction [20]. Belda [21] stated that AR can be effectively employed as a transformative technology with several educational purposes, such as facilitating mobility and fostering an immersive environment for students and to promote collaborative learning and creative skills among learners and educators. AR also enhances learning in a real-life context since it comprises a wide range of interactive multimedia activities, including both discursive and illustrative representations [21].

Furthermore, students use AR to see things in specific physical spaces, including their own homes [22]. This can make the learning experience more memorable and rewarding because students connect and compare new content with familiar elements. In addition, through AR, learners have the chance to view rare or unique objects for longer periods of time; consequently, they have the opportunity to manipulate objects. For example, they might be able to pick something up, rotate it, and look at it from all angles. In fact, AR allows students to observe objects at a scale within real-world environments This makes AR a great tool for certain pedagogical techniques that seek to aid students to understand systems and interrelations between concepts considering constructivist methods [23].

Cabero and García [24] have noted that AR promotes contextualization and enrichment of information, facilitates the individualization of training to different types of intelligence, offers students the ability to interact by manipulating real objects, favors ubiquitous learning by converting any physical space into a stimulating academic setting, promotes the development of graphic skills through the perception of spatial content, fosters learning through practice, and increases student motivation and satisfaction, improving academic results.

2.2 Implementation of AR in EFL distance education

In recent years, online distance learning has witnessed experiments with innovative technologies, including AR, that place the student in the center of learning processes. Furthermore, it makes substantial use of the potential of hardware and software developed for mobile devices, which enables considerable improvements in learner modeling, resulting in the personalization of learning processes [25]. Saykili [26] mentioned that among the innovative technologies shaping today's land-scape of online distance education, AR has significant potential in enriching learning environments, providing situational learning and personalization of learning.

Undoubtedly, AR offers a great contribution to distance education since it provides flexible education at a suitable cost for all students [27]. Diegmann [28] affirmed that AR can facilitate learning and pedagogical techniques related to processes and course content. For example, AR can be a great tool when instructors apply student-centered learning or an innovative method that lets students learn at their own pace; therefore, it individualizes the learning process, considering individual learners' needs.

In the context of EFL teaching and learning, AR increases the level of performance, intensifies motivation for learning, boosts acquisition of skills, enhances multisensory learning, standardizes information and content, increases the level of engagement, encourages students' interests, and promotes self-learning [29]. Additionally, Wu [30] claimed that augmented reality offers the potential to enable learning content in 3D perspectives; promote ubiquitous, collaborative, and contextual learning; generate a sense of presence; immerse students; visualize the invisible; and connect formal and informal learning.

Regarding the existing resources, the potential of mobile augmented reality offers opportunities for designing virtual learning spaces since mobile devices such as smartphones or tablets offer easier and cheaper access to augmented reality. Wu [30] stated that the positive effects of AR technology by using mobile devices include the development of skills and knowledge, enhancement of learning experiences, and improvement of collaborative learning. In other words, the use of AR in education considering mobile devices improves learning efficiency and a creates more fun experience for students [31].

2.3 Augmented reality-based material for learning EFL writing

According to Liu and Tsai [32], with the support of AR-based material, learners can acquire contextualized linguistic and content knowledge, internalize the knowledge, and use that knowledge for productive tasks. For instance, linguistic expressions from the AR learning material were found in students' essays, providing evidence for their receptive and productive vocabulary knowledge development. In this sense, it is useful to design contextualized and learner-oriented AR-based mobile English learning materials to aid EFL learners write English compositions.

Existing AR tools can deliver relevant and useful information; however, visualization of information must go beyond the mobile phone screen. Users are expected to find the relationship between the vocabulary and their surroundings. Using AR, the presentation method of information is improved by annotating real objects with sound, text, images, and animations that are 3D-registered onto the environment. This kind of visualization is beneficial to situated vocabulary learning (input) because it explicitly illustrates the relationship of the vocabulary with objects found in the user's environment [33].

Thus, when learning English by using 3D models and augmented reality, students can access information to support their learning process [34]. Paat [35] highlighted that there are many software tools to design augmented reality resources, such as Unity, Vuforia Engine, and Android studio. Unity Editor facilitates the creation of augmented reality experiences for hand-held devices and digital glasses. The Vuforia Engine enables users to add advanced computer vision functionality in order to recognize images and interact with real-world spaces. Android studio is a replacement for the eclipse android tool as the primary integrated development environment for native android users.

Regarding Assemblr, users can design augmented-reality sources without experience in software algorithms, programming, and development. After designing an augmented-reality material with this tool, students can access it on their smartphones through a shareable link [35]. The functions, objects, and menus displayed on Assemblr are numerous, easy to use, and supportive of graphic design learning [36]. Sugiarto [37] claimed that users of Assemblr can create pictures with augmented reality, including topics that are difficult to understand, that are focused on real, moveable, and engaging environments. Consequently, the use of Assemblr makes the content easy to comprehend and students increase their interest to learn academic topics.

Slussareff and Boháčková [38] remarked that by using AR, learners can be involved in creating discourse markers by capturing images on their mobile devices. AR helps learners to create augmentation, which can range from text annotations to video animations. The resulting products can be used to learn vocabulary and grammar (input) or used in more creative projects, such as digital storytelling, incorporating the AR objects into the narrative. Typically, in this AR tool, the word to be learned will either be illustrated or will be attached to the physical object it represents or is associated with. The concrete visual connection to the item is likely to help in vocabulary retention [39]. In this sense, Xefteris and Palaigeorgiou [40] asserted that tangible learning defined as learning with the use of physical objects or "manipulatives" offers many educational opportunities that deserve to be exploited. In consequence, tangible interfaces build on tangible learning and transform digital data into a physical form, and a digital entity into physical forms. This coupling of the digital and the physical in a seamless looping feedback enables users to interact naturally with the digital aspect, which benefits the teaching process. Barreira [41] observed that students who use AR have a superior English learning progress than those who use only traditional methods. Hence, the use of AR has a positive pedagogical impact on students' learning process, specifically in the progressive domain of oral recognition of words and their corresponding written form. An important fact is that AR provides teachers with didactic material to explain linguistic topics; therefore, AR is a useful tool for class activities in some areas of education, especially in EFL writing.

2.4 Previous studies

Regarding the use of AR in education, Nicolaidou [42] investigated the effect of MondlyVR on foreign language learning and compared engagement, engrossment, and immersion between two versions of the application: virtual reality and mobile format. Twenty experimental-group undergraduate students used a head-mounted virtual-reality display, and twenty control-group students used a mobile application. Findings revealed a statistically significant difference in the experimental-group students' vocabulary performance when students' pre-test and post-test scores were compared. Engagement, engrossment, and immersion received relatively high scores by virtual-reality participants. In short, preliminary empirical data indicated that virtual reality applications can be both effective and engaging for language learning, even though they were not found to be superior to mobile applications.

Sangmin and Moonyoung [43] investigated how students used the physical context and properties when creating digital stories on a location-based reality app called 7scenes to promote meaningful English learning. In the study, 40 college students created scenes of gamified digital stories on a location-based AR app and shared them with other students. Data was collected from student learning outcomes,

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post-surveys, and reflection papers. The results showed that students employed context in three different ways—a real place, a fictional setting, and a blended reality—and then integrated it with their content and transformed it into a co-constructed meaning-making site. The study also discovered that the technology supported students' language learning in the affective, cognitive, and social domains. All elements found in the three domains were interrelated and ultimately contributed to improving students' learning.

Wu [44] introduced AR through Pokémon Go in an English class to evaluate students' learning attitudes, learning satisfaction, and learning achievements. The quantitative study divided 61 students into experimental and control groups. Questionnaires, a paired-sample t-test, one sample t-test, and ANCOVA were employed to analyze the data. The conclusions indicate that for the learners, the integration of AR mobile games with ICT-based tools makes language learning interesting. Through Pokémon Go, learners could improve their basic knowledge of AR and the use of single-word utterance, prefixes, suffixes, and roots as they the world of Pokémon Go.

Ming [45] conducted an AR-enhanced theme-based contextualized learning study aimed at examining the effects of captions and English proficiency in high school students. Two hundred and four ninth graders from six classes of an urban public junior high school in northern Taiwan participated in the experimental activities voluntarily. Two levels of English proficiency—less and higher proficient—as well as three caption conditions—uncaptioned, English captioned, and Chinese captioned—were examined. A factorial design was employed, and the participants' learning performance, motivation, and attitudes were evaluated. The results indicated that English captions placed a high cognitive load and hindered less proficient learners' knowledge application, but proficient learners performed equally under different caption conditions. In general, students demonstrated positive motivation towards learning from the AR-enhanced contextualized learning. When it came to self-efficacy, proactive learning, and learning value, proficient learners were more motivated.

Lin [46] implemented an AR, context-aware, ubiquitous-writing (ARCAUW) application with the goal of enhancing users' writing progress through long-term memory, motivation, and self-regulated cognition. The proposed ARCAUW writing mode was compared with the standard mobile-assisted and classroom-based writing modes in terms of writing outcomes and learner perceptions. The study included sophomore students from two classes taking the same course, English Composition, from two Taiwanese universities. Results pre- and post-test showed that although both modes led to significant improvement in writing, ARCAUW improved the development of task schema in long-term memory, motivation, and self-regulation in writing. Additionally, cognitive processing during AR-based learning led to mixed results in writing performance. Therefore, ARCAUW is recommended as an effective application to be incorporated into mobile-assisted writing courses to reach optimal instructional outcomes.

3 MATERIALS AND METHODS

3.1 The aim of the study

This study aims to address the following questions related to distance learning:

• What is the impact of applying augmented reality to improve EFL writing skills in distance learning?

- How effective is the material used through the Assemblr Edu tool for strengthening vocabulary, grammar, punctuation, and writing structure?
- What are students' perceptions regarding the effectiveness of Assemblr Edu as AR-based material for learning EFL writing?

3.2 Participants and the context

For this study, non-probability sampling was employed since it enabled specific participants to be selected. According to Creswell [47], this type of sample is used to choose participants who can provide valuable information and insights that are relevant to the research question or aim of the study; in addition, purpose sampling is used to select participants to gain a deeper understanding of a particular phenomenon of interest, rather than to make generalizations about larger populations.

This study lasted 16 weeks and involved 40 EFL university students, 30 women and 10 men, who were enrolled in the *English Language: Reading and Writing I* course of a distance-learning program. The group of participants was diverse in terms of English proficiency level and geographical location. Most of the students came from all around Ecuador, and some of them from international centers such as Rome, New York, and Madrid.

The contents studied in the course involved basic grammar structures, vocabulary, and input acquired from reading comprehension in terms of identifying keywords, main ideas, details, and making inferences. Additionally, students learned basic aspects about writing, including topic sentences, supporting details, conclusions, punctuation, and capitalization that enabled students to improve their writing practice from simple sentences to well-structured paragraphs.

3.3 Design and instruments

This is a mixed-methods case study because the data was approached both qualitatively and quantitatively. The instruments used were a pre-test and a post-test (see Appendix 1) to measure students' knowledge in terms of grammar, vocabulary, and writing skills. The pre-test and post-test were based on a free online A2 Key test commonly known as Cambridge English Key test (KET). Some questions related to reading, grammar, and vocabulary were taken from it. The test is valid and reliable enough since it has been taken by students all over the world for years and is updated on a daily basis by international EFL examiners. The rubric to score students' paragraphs was designed by a group of experienced teachers who have been working in higher institutions for years and have piloted rubrics for decades. The rubric was designed considering grammar, structure, use of appropriate words, punctuation, coherence, cohesion, and capitalization.

The Assemblr Edu platform was used to create AR-based material for the content related to grammar, vocabulary, and aspects related to writing. Another instrument used was a rubric (see Appendix 2) to assess progress of the students' writing skills throughout the study. The rubric included subject content, style, grammar, organization, and originality.

Finally, a survey was applied to the participants to identify their perceptions about the use of the Assemblr Edu platform for enhancing writing development. The survey contained 10 closed-ended questions, which used a Likert scale with the options *strongly agree*, *agree*, *disagree*, and *strongly disagree*.

The pre-test, post-test, and survey were piloted before the administering to the target sample with a group of students with characteristics similar to the target sample; as a result, these instruments were enhanced based on the recommendations and suggestions to assure their validity and reliability.

3.4 Procedure

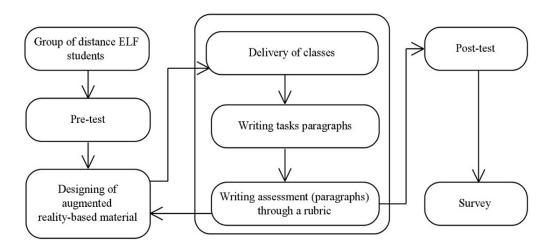


Fig. 1. Research process

The process applied in this intervention using Assemblr Edu is displayed in Figure 1. First, with the group of students selected, a pre-test was implemented to determine the students' starting knowledge. The test consisted of three sections with 18 questions. It included multiple-choice questions about vocabulary, grammar, and reading comprehension. Students were also asked to write a 100–150-word descriptive paragraph about family. The paragraphs were graded by using a rubric.

Several AR materials were designed by using Assemblr Edu. This platform allowed the creation of material to provide input to reinforce students' language knowledge as well as information to produce short sentences and paragraphs. The topics and content language were aligned with the objectives of the course. This teaching material served as a resource for the students to get acquainted with the academic content of the course. The learners had access to the material posted weekly through the institutional virtual platform, called EVA, for students to study and to reinforce the contents taught in the course.

At the end of each class, students were asked to write eight paragraphs applying the contents studied. Students wrote one paragraph per two weeks. The professors graded them by using a rubric and provided feedback in terms of grammar, structure, use of appropriate words, punctuation, coherence, cohesion, and capitalization. Each paragraph was graded out of 10 points.

Lastly, students took a post-test, which was similar in structure and content to the pre-test. They also responded to a survey focused on their perceptions about the use of the Assemblr Edu platform to create AR-based material for helping learners to improve EFL writing.

4 RESULTS AND DISCUSSION

This section describes the results of each research question regarding writing skills development by using Assemblr Edu for creating AR-based teaching material and the results related to students' perceptions.

What is the impact of applying augmented reality to improve English as a foreign language writing skills in distance learning?

Table 1. Students' progress in the written tasks

	Writing Task 1	Writing Task 2	Writing Task 3	Writing Task 4
Average score	6.33	6.72	7.14	7.26

Table 1 shows how the students gradually increased their writing skills with the use of the teaching material designed with AR. The average scores on the tasks were 6.33, 6.72, 7.14, and 7.26 out of 10 points, which shows the students' improvement in their ability to write paragraphs. The use of AR-based teaching materials allowed students to explore a new learning environment in which they were exposed not only to the language content in a more real and authentic context but to practical interactive activities and visuals, videos, and AR elements in 3D.

Consequently, they gained new vocabulary and grammatical and punctuation expertise, as well as inspiration for writing, since learners acquired the necessary input and motivation needed to express their ideas and develop their ability to write coherent paragraphs. These findings were confirmed by the participant surveys. These results are consistent with Barreira [41], who found that the application of augmented reality has a good pedagogical impact on students' learning processes, namely in the developing area of recognition of spoken words and their matching written form. Furthermore, students who used AR had their English learning progress compared with those who used only traditional methods, since the didactic materials contributed to better understanding the content and was applied to writing skills.

Table 2. Pre-test and post-test results

	Pre-Test	Post-Test
Scores	6	7.42

Table 2 show a score of 6 points pre-test and a score of 7.42 post-test. It was observed that the material used kept students attentive and helped them to learn and strengthen the content related to grammar, vocabulary, punctuation, and writing, which was evidenced when the participants had to answer the questions or write the paragraphs. This showed that the material designed through AR favored English learning for distance students. The material permitted involving students through a dynamic learning context, which inspired them to learn and reinforce the content in a more real and interactive way. As Lee [19] stated, augmented reality is a very efficient technology for education in universities and colleges. Students in universities can improve their knowledge and skills with contextually enriched interaction [20].

The eye-appealing content, with a wide range of colors, shapes, figures, and objects, was highly effective. This fostered students' curiosity because they had to explore the material by rotating, moving, and looking at objects from different angles, as learners assimilated knowledge in an authentic way. Through AR, learners had the chance to view rare or unique objects for longer periods of time, as well as manipulate objects in the real world [22].

How effective is the material used through Assemblr Edu for strengthening vocabulary, grammar, punctuation, and writing structure for distance students?

Aspects	Pre-Test	Post-Test
Clarity and coherence (Grammar and vocabulary)	3.80	4.16
Mechanics and punctuation	0.22	0.54
Organization and structure	1.98	2.72
Total	6	7.42

Table 3. Results of the pre-test and post-test regarding the production of a paragraph

Note: Grades for clarity and coherence, mechanics and punctuation, and organization and structure were on scales of 5, 2.5 and 2.5 points respectively.

Table 3 shows how with the teaching material designed through Assemblr Edu students improved their writing skills in aspects including organization and structure, clarity and coherence, and mechanics. The students' progress on writing paragraphs was graded with a rubric designed for that purpose.

On the pre-test, concerning clarity and coherence, students got a score of 3.80 points out of 5 points, while on the post-test, students got a score of 4.16 points out of 5 points. Initially, students were not good at writing mostly isolated sentences; however, after the intervention, most of the students were able to use the appropriate words, phrases, connectors, and transition words to express ideas.

Lack of vocabulary and misuse of grammar structures were identified in the pretest. Students tended to use the same terms or words that were out of context; however, in the post-test, students not only increased their scores in the vocabulary and grammar section but also wrote paragraphs using pertinent vocabulary and correct grammar structures. By watching videos on Assemblr Edu, students learned how to write words correctly, when to use them depending on the context, and how to express their ideas using different tenses.

Taking into consideration mechanics, students scored 0.22 out of 2.5 points in the pre-test but 0.54 out of 2.5 points in the post-test. When students started the course, they did not know how to express their ideas, sometimes cramming as many ideas as possible into just one sentence. Students had similar problems when writing in their native language (Spanish), which causes negative tranfer (i.e. the tendency to pluralize adjectives) into the target language. By using the material on Assemblr Edu, students learned when to use commas, periods, semicolons, question marks, and exclamation points to express thoughts and ideas in a clearer way.

Concerning organization and structure, students initially scored 1.98 points out of 2.5 points, while on the post-test, they scored 2.02 points out of 2.5 points, showing marked improvement in the ability to write well-organized paragraphs including a topic sentence, supporting details, and a conclusion. The improvement is likely attributable to studying the explanations, examples, and resources presented through Assemblr Edu [36].

Table 4. Percentage of students' progress on writing tasks with the use of the material through Assemblr Edu

Writing Aspects	Writing Task 1	Writing Task 2	Writing Task 3	Writing Task 4			
Clarity and coherence	65%	68%	80%	85%			
Mechanics	45%	55%	58%	65%			
Organization and structure	55%	55%	60%	72.5%			

Note: Table 4 shows the results of the four paragraphs presented during the intervention.

Table 4 demonstrates that there was progress in writing tasks after using the material on Assemblr Edu. When students started the course, their grades for the first task were not good in comparison to the final task. After using Assemblr Edu, the students showed improvement in all three writing aspects..

Assemblr Edu was effective for improving vocabulary, in particular, clarity and coherence. By watching videos on Assemblr Edu, students were exposed to subject content, words, phrases, and terms, which helped them to strengthen their vocabulary. Students also learned the correct spelling of words and how to use them in specific contexts and situations. On writing tasks, students learned to write the words correctly and use appropriate word order, depending on the situation and circumstance. Through AR, the presentation of information is improved by annotating real objects with sound, text, images, and animations that are 3D-registered onto the environment. This kind of visualization is beneficial to learning vocabulary learning (input) because it explicitly illustrates the relationship of the vocabulary with the objects found in the current environment [28].

Moreover, material used through Assemblr Edu was fruitful for enhancing grammar skills in terms of clarity and coherence. Assemblr Edu reinforced distance students' grammar skills because material contained visual aids to support the idea of how English syntax works. In particular, videos included explanations of when to use specific grammar structures and how to use them correctly. Slussareff and Boháčková [38] remarked that by using AR, learners are involved in creating markers by capturing images, which can range from text annotations to video animations. It is widely known that learning grammar is difficult for EFL students; nonetheless, students' retention of grammar can increase when using visual connection items [39]. Figure 2 illustrates the utility of Assemblr Edu to design interactive, authentic, real, and eye-catching material to teach linguistic aspects in a more tangible way.

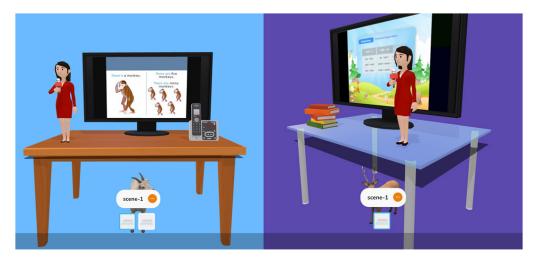




Fig. 2. Sample of teaching material designed with Assemblr Edu

Furthermore, the material used through Assemblr Edu was helpful for improving punctuation and mechanics, proving that it was an excellent tool to encourage distance students to practice these writing aspects. The enriched teaching material presented in the format of videos and multimedia material was appealing and contained diverse colors, shapes, objects, and examples in context, which drew students' attention to learning. In other words, AR intensified the motivation for learning, enhanced multisensory learning, standardized information and content, increased the level of engagement, encouraged student interest, and promoted self-learning [29]. Additionally, AR has positive effects on learning environments in terms of providing engagement and motivation for students to learn linguistic aspects and gain experiences by exploring different situations [48].

The teaching material in Assemblr Edu was also effective for improving paragraph structure since explanations regarding the organization and structure of descriptive, informative, and opinion paragraphs were taught in the format of videos as well as images with examples of paragraphs as models to follow.

Liu and Tsai [32] confirmed that learners can gain contextualized language and content knowledge, internalize it, and apply it in practical tasks with the support of AR-based materials. Thus, the use of AR had a positive pedagogical impact on

the learning process concerning distance students. An important fact to highlight is that AR provides teachers with didactic material to explain linguistic topics; consequently, AR is a useful tool for class activities in some areas of education, especially in EFL writing.

What are students' perceptions regarding the effectiveness of Assemblr Edu as augmented reality-based material for learning EFL writing?

Table 5. Students' perceptions of Assemblr Edu as augmented reality-based material for learning EFL writing

Items	Strongly Agree	Agree	Disagree	Strongly Disagree
Assemblr Edu platform is easy to use. Accordingly, advanced technological knowledge is not required to use it.	26.32%	68.42%	5.26%	0.00%
Assemblr Edu platform presents content or topics in an eye-appealing way.	26.32%	63.16%	10.53%	0.00%
Assemblr Edu platform is flexible because it allows creation of a wide variety of authentic teaching materials to enhance writing.	31.58%	52.63%	15.79%	0.00%
Assemblr Edu platform encourages my attention since augmented reality presents an authentic and original context with a wide range of colors, shapes, and objects.	22.22%	61.11%	16.67%	0.00%
Assemblr Edu platform allows me to watch short and interactive videos, which increases my concentration and provides me input for writing.	36.84%	57.89%	5.26%	0.00%
Assemblr Edu platform encourages my motivation for writing as it permits exploration of objects and environments from different perspectives.	31.58%	63.16%	5.26%	0.00%
Created material on Assemblr Edu platform allows me to remember words and grammar structures in a better way since the contents are presented interactively.	26.32%	68.42%	5.26%	0.00%
Assemblr Edu platform allows me to learn EFL writing aspects at my own pace as I can independently pause and continue videos.	42.11%	57.89%	0.00%	0.00%
Assemblr Edu platform supports student-centered learning since I can have access to the material at any time on any device with an internet connection.	31.58%	68.42%	0.00%	0.00%
Assemblr Edu platform helps me to improve my writing skills due to the materials it contains.	10.53%	73.68%	15.79%	0.00%

As it can be seen in Table 5, 52.63 % of students agreed, and 31.58 % of learners strongly agreed that Assemblr platform was flexible because it allowed creation of a variety of authentic teaching materials to enhance writing. It was observed that many materials—including the one created for teaching the present tense with the verb to be and other verbs, sentence structure, and simple past tense with the verb to be and other verbs—can be created by using the platform. Distance students can use a wide range of materials on Assemblr Edu in order to improve their writing skills. Sugiarto [37] claimed that Assemblr Edu is useful to create real, moveable, and engaging learning environments through visual AR, specifically to teach those topics that are more difficult for students to understand. In fact, the use of Assemblr Edu made the learning content easy to comprehend, increasing EFL students' interest in learning academic topics. Users can also design AR resources with little or no experience in software development, algorithms, or programming. And students can easily access them on their smartphones through a shareable link [35]. In other words, digital technologies including AR promote the inclusion of new methods, means, and forms of classroom organization that make the learning process effective, flexible, and adapted [49].

In relation to the type of material that can be incorporated into the Assemblr Edu platform, such as short and interactive videos, the students' opinions were positive, since most of them (94.73%) found this interactive tool increased their concentration and provided input in a dynamic way, which inspired them to write texts. Distance students learned better when the content was taught in a dynamic and contextualized way; that is, by watching videos, students got acquainted with new words, such as *coach*, *mature*, *recommend*, and *adventure*; idioms, such as *black sheep*, *call the shots*, *hog the ball*, *get the ball rolling*, adjective and preposition combinations, such as *afraid of*, *embarrassed about*, *happy about*, and *interested in*; and other terms that enable them to write sentences and paragraphs. Liu and Tsai [32] affirmed that with the support of AR-based material, learners can acquire contextualized linguistic and content knowledge, internalize the knowledge, and then use the obtained knowledge in productive tasks. For example, linguistic expressions from the AR learning material were found in students' essays, providing evidence for their receptive and productive vocabulary knowledge development.

A total of 63.16% of students agreed and 31,58% of them strongly agreed that the Assemblr Edu platform enhanced their motivation for writing through the exploration objects and environments from different views. Distance students were exceedingly eager to write sentences and paragraphs after using the materials on the Assemblr Edu platform due to the fact that the teaching material activated their imagination and creativity since they were taken to different real places where they could rotate objects, move them, look at them from different angles, and experience the learning process by moving away from their comfort zone. These results align with those of Cabero and García [24], who found that AR offers students the ability to interact by manipulating real objects, favors ubiquitous learning by converting any physical space into a stimulating academic setting, promotes the development of graphic skills through the perception of spatial content, fosters learning through practice, and increases motivation with very positive values of satisfaction improved academic results.

All the distance students (100%) who participated in this study strongly agreed that the Assemblr Edu platform facilitated their learning since they are able to study EFL writing aspects at their own pace, manipulating the teaching material independently, and pausing and repeating the content, especially videos, to reinforce their writing skills. It was observed that Assemblr Edu supported student-centered learning because students had access to the materials at any time, on any device with an internet connection. Distance students learned at remote locations and in an autonomous way, as Assemblr Edu suited their needs. AR and remote training increased the effect on performance due to the fact that AR technologies can be adapted to the students' needs and environment. Learners were likely to feel satisfied and, consequently, motivated to learn academic content [50].

AR is a technology in which layers of virtual information are added to the reality of the physical world, making it richer, more interesting, and useful [51]. The goal of augmented reality is not to exclude the real world but to blend additional information or computer-generated information with real-time information from the real world around a viewer [52]. Accordingly, mobile AR technology in combination with interactive activities enables the design of new kinds of technology-enhanced learning and entertainment applications [53].

Cabero and García [24] found that AR promotes contextualization and enrichment of information, and allows the individualization of learning according to the different types of intelligence and learning styles. Diegmann [28] affirmed that AR can facilitate learning and pedagogical techniques related to processes and course

content. For example, AR can be a great tool to apply student-centered learning or an innovative method to enable students to learn independently, individualizing the learning process in a more effective way.

Materials created on Assemblr Edu support distance students' improved writing skills, with the students' paragraphs not containing many grammar, spelling, or punctuation mistakes. And 73.68% of students surveyed agreed.. Hence, Assemblr Edu was an effective tool to involve distance EFL students in an active writing process, considering that today students learn better if the teaching-learning process is pedagogically supported with technological tools. Learners require teachers to present the content and provide feedback focused on individual needs to improve their writing skills.

5 CONCLUSIONS

The use of AR-based teaching materials created through Assemblr Edu proved to be an effective tool in enhancing distance students' writing skills since they provided a more realistic and authentic learning environment. This technology offered a more interactive and engaging way of presenting information for teaching writing, forcing students to leave their comfort zone to assimilate and accommodate knowledge in an authentic way and reinforcing language learning. Therefore, it intensified students' motivation for learning, enabled multisensory learning, increased the level of engagement, and promoted self-learning. The interactive and visual elements, including 3D AR fostered students' curiosity, inspiring their learning of new vocabulary, grammatical structures, and punctuation, which led to an overall improvement in the production of different types of paragraphs.

Assemblr Edu was effective for improving both language knowledge and writing skills. The implementation of eye-appealing and interactive material for teaching EFL content, vocabulary, grammar, and punctuation was strengthened and consolidated. Students had access to contextualized information through videos with subtitles and visual aids, giving them a better idea of how English syntax works and the input they needed to write pieces of text, thus improving their writing skills. All this boosted students' writing performance, particularly in their ability to organize and structure paragraphs.

Distance students confirmed that the teaching material created by using Assemblr Edu platform supported their learning and contributed to deepening their linguistic and writing knowledge. The platform was flexible, which facilitated study at their own pace and let them manipulate the material in an independent way and have the opportunity to pause and repeat the content as needed, especially when working with videos. The versatile features of this type of material helped learners to have access to the materials at any time and on any device with an internet connection. Overall, according to distance EFL students' view, Assemblr Edu was an effective tool to involve learners in an active writing process with positive results.

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8 APPENDIX 1: PRE-TEST AND POST-TEST

8.1 Grammar and vocabulary

Read the following text and choose the correct option. Today most people [1] Lewis Carroll as the author of two books: *Alice's Adventures in Wonderland* and *Through the Looking Glass*. In the second book, Alice falls asleep one evening. In her dream, she goes [2] a mirror to the world on the other side. She [3] out that the countryside there is a giant board in a game of chess, and she must move across it to become a queen. She [4] people and animals from the first book and some new ones. A few are frightening, but others are [5] to her. The story ends when Alice becomes a queen and finally [6] back home.

- 1. A return B repeat C remember
- **2.** A through B along C away
- 3. A looks B finds C learns
- **4.** A knows B meets C speaks
- 5. A kind B careful C real
- 6. A looks up B gets up C wakes up

8.2 Grammar and vocabulary

Read the following text and choose the correct option. Helen Keller was born in the USA in 1880. When she was nineteen months old she was very sick and nearly [1]. She got better, but she lost the use of her eyes and ears, so she could not see or [2]. Her [3] life was very difficult. She couldn't go to school with other children, but her parents [4] a teacher for her. When she was seven, she finally began learning to [5] sign language, and her life changed. Helen studied hard and went to university. This was an amazing achievement for a person like Helen. As an adult, she spent a lot of

time talking to people about her life. Helen became [6] during her lifetime and there are many books and films about her.

- 1. A finished B passed C died
- 2. A hear B listen C watch
- **3.** A young B child C early
- 4. A found B looked C caught
- 5. A use B have C be
- 6. A favorite B famous C known

8.3 Grammar and vocabulary

Read the following text and choose the correct option. Diwali is an [1] Indian festival. It takes place every year in October or November during the autumn, and it lasts for five days. The word "oiwali" [2] from Sanskrit, an ancient Indian language, and it [3] "row of lights". During the festival, people clean their homes, decorate them with lights and oil lamps, and enjoy [4] time with friends and family. They give each other gifts and sweets, eat delicious food, [5] fireworks and wear new clothes. Many people in the UK also celebrate Diwali. In the city of Leicester, thousands of people go out into the [6] to enjoy light shows, music and dancing.

- 1. A excellent B interested C important
- 2. A comes B goes C looks
- 3. A seems B means C looks
- 4. A making B spending C doing
- 5. A listen B look C watch
- 6. A streets B areas C paths

8.4 Writing

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9 APPENDIX 2: RUBRIC FOR GRADING PARAGRAPHS

		Achievement Level	
Criteria	Does not Meet Expectations	Meets Expectations	Exceeds Expectation
Clarity and coherence	A basic understanding of the subject matter is demonstrated. Student's performance does not relate to the competences of the course and to the objective of the activity. More than 8 grammar errors hinder communication.	A partial understanding of the subject matter is demonstrated. Student's performance relates to some of the competences of the course and to the objective of the activity. Up to 4 grammar errors are presented.	A total comprehensive understanding of the subject matter is demonstrated. Student's' performance relates to the competences of the course and to the objective of the activity. The task is clear, readable, and sometimes memorable. It is free of grammar errors.
Mechanics and punctuation	More than 8 errors of spelling and punctuation hinder communication	4 errors of spelling and punctuation are presented	The task is clear, readable, and sometimes memorable. It is free of spelling and punctuation errors
Organization and structure	The organization is simply deficient: topic sentence and supporting details are not clearly marked or functional, the paragraph is neither coherently developed nor arranged.	The organization is fairly clear. The reader could outline the presentation, despite the occasional lack of clear sentences. The paragraph has a partial adequate development and it is not structured appropriately.	The organization is appropriate for the purpose and subject of the task. The task is clear. The reader could outline the presentation easily. The paragraph has adequate development and is structured appropriately.
Total	2.5	6	10

10 AUTHORS

Fernando Carrión-Robles holds a Bachelor's degree in English Language Pedagogy at Universidad Técnica Particular de Loja. He has been an undergraduate teaching assistant at Universidad Técnica Particular de Loja for three academic periods. Currently, he is studying a Master's program in Neuropsychology and Education at Universidad Internacional de La Rioja.

Verónica Espinoza-Celi holds a Master's degree in Management and Leadership in Education as well as Pedagogy of National and Foreign Languages at UTPL. She is a researcher in the acquisition of second language with the use of technology.

Alba Vargas-Saritama holds a Master's in Teaching English as a Foreign Language at Nova Southeastern University-Florida, United States and a Master's in Distance Education at Universidad Técnica Particular de Loja. She has fifteen years of teaching experience at Universidad Técnica Particular de Loja.