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Using Mobile Augmented Reality Applications for Enhancing EFL Writing Skills of Early Childhood Education Students and their Engagement

A Research paper by:

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Abstract:

The current research aimed at investigating the effect of using Mobile Augmented Reality (MAR) applications for enhancing EFL writing skills and engagement of second- year students at Faculty of Early Childhood Education enrolled in the Teaching in English specific program. A quasi-experimental approach using a pre- post administration to two independent groups design was adopted. Instruments of the study included: a writing skills test with an analytical rubric for scoring it, and an engagement in writing scale. Five main writing sub-skills were specified as necessary for target participants: content and development of ideas, organization, accuracy, word choice, and mechanics. Research sample consisted of ninety second- year English specific program female students at the Faculty of Early Childhood, Mansoura University. They were divided into two groups; an experimental group of forty- five students (n= 45) that was taught the proposed MAR treatment, and a control group (n= 45) that was taught using the conventional method. The content of six selected units presented with the integration of ARLoopa application within the activities of pre-, while-, and post- writing stages was taught to students throughout ten sessions. Results revealed that the mobile AR application- based treatment had a large effect on enhancing students' EFL writing skills and engagement in writing as there were statistically significant differences between the experimental and control group students' mean scores on the pre- and post- administrations of the instruments of the research. Finally, recommendations and suggestions for further research were proposed.

Key Words: *Mobile Augmented Reality, EFL writing skills, Engagement, Early childhood Education.*

استخدام تطبيقات الواقع المُعزز على الهاتف النقال لتحسين مهارات الكتابة باللغة الإنجليزية
لدى طالبات كلية التربية للطفولة المبكرة وانخراطهنَّ فيها
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مستخلص البحث

هدف البحث الحالي دراسة أثر استخدام تطبيقات الواقع المُعزز على الهاتف النقال لتحسين مهارات الكتابة باللغة الإنجليزية والانخراط فيها لدى طالبات الفرقة الثانية بكلية التربية للطفولة المبكرة والملتحقات ببرنامج التدريس باللغة الإنجليزية. تمَّ تبني المدخل شبه التجريبي ذي التصميم القبلي- البعدي باستخدام مجموعتين مستقلتين. اشتملت أدوات الدراسة على اختبار مهارات الكتابة مصحوبًا بمقياس أداء متدرج لتصحيحه، وكذلك مقياس الانخراط في الكتابة. تمَّ تحديد خمس مهارات أساسية للكتابة على أنها ضرورية للعينة المستهدفة وهي كالتالي: المحتوى، وتنمية الأفكار، التنظيم، الدقة النحويّة، اختيار المفردات، وفيات الضبط الكتابي. تكوَّنت عينة البحث من تسعين طالبة بالفرقة الثانية ببرنامج التدريس باللغة الإنجليزية بكلية التربية للطفولة المبكرة بجامعة المنصورة. تمَّ تقسيمهنَّ إلى مجموعتين؛ إحداهما تجريبية (ن = ٤٥) تمَّ التدريس لهنَّ باستخدام المعالجة المقترحة باستخدام تطبيق الواقع المُعزز، والأخرى ضابطة (ن = ٤٥) تمَّ التدريس لهنَّ باستخدام الطريقة المعتادة. تمَّ تقديم المحتوى الخاص بست وحدات في الكتابة باستخدام تطبيق ARloopa للواقع المُعزز الذي تمَّ دمج من خلال أنشطة مراحل قبل وأثناء وبعد الكتابة، وذلك على مدى عشر جلسات تدريبيّة. أوضحت النتائج أن المعالجة القائمة على استخدام تطبيق الواقع المُعزز على الهاتف النقال كان لها أثرٌ كبيرٌ على تحسين مهارات الكتابة باللغة الإنجليزية والانخراط فيها؛ حيث كانت هناك فروق ذات دلالة إحصائية بين متوسطات درجات طالبات المجموعتين التجريبية والضابطة في كل من التطبيقين القبلي والبعدي لأدوات البحث. وأخيرًا، تمَّ اقتراح عدد من التوصيات والمقترحات لبحوث مستقبلية.

الكلمات الدالة: تقنية الواقع المُعزز على الهاتف النقال، مهارات الكتابة باللغة الإنجليزية، الانخراط في الكتابة، كلية التربية للطفولة المبكرة.



Introduction:

English, as an international language, plays an imperative role in international communication. Developing strong English writing skills is important for daily communication and workplace interactions. Due to continued advancements in technology, written communication is becoming increasingly important in education, business, and other fields across the globe. However, this skill requires strong linguistic competence and other abilities such as critical thinking, so it is often believed to be more difficult to master than other competencies (Santanatanon& Chinokul, 2022). English writing, as an important form of language output, is not only an important means of expressing emotions, beliefs and ideas, but also indicates learners' level of comprehensive use of the language. English writing skills represent learners' proficiency at both the local level such as vocabulary, grammar, and sentence structure, and at the global level such as text organization, logical reasoning, and argumentation. Therefore, writing in a foreign language is frequently an extremely challenging task for novice language learners.

Myers (2002) and Salem (2017) clarify that writing is a skill that should be mastered by everyone, especially students because it is the final product that crystallizes what learners studied about listening, speaking and reading. Writing is taught to give students discourse competencies to participate in creating text for accessing and transmitting knowledge, and to help them create texts using their own words. The importance of writing results from the fact that language students need to develop the ability to write cohesively and coherently in a foreign language (Scott, 2008). Writing as a skill encourages thinking and learning, motivates communication and leads to reflection of thoughts and ideas (Hussein, El shirbini, & Al Ashri, 2013). As a result, writing skills should be given much more interest to enable students produce good writings.

Although writing is an important skill that must be mastered to effectively transmit new ideas and concepts, writing in a foreign language is considered one of the challenges for most foreign language learners. In this sense, many researchers showed the most common challenges which EFL university students face. Fear of



being corrected by the teacher (Saud, Jufri, Rahman & Salam, 2014), having difficulty planning, composing, revising and evaluating their writings, and inability to produce coherent and well-organized writing texts without errors (Abd-Alfatah, 2013; El-Bassuony, 2017) are among the most common challenges that always lead to students' disengagement in writing activities, tendency to use avoidance strategies and many other problems.

According to Richard and Renandya (2002), the difficulties that EFL students face include generating and organizing ideas using an appropriate choice of vocabulary and putting such ideas into an intelligible text. The first difficulty lies in the fact that English in EFL context is treated primarily as a compulsory subject for exam-driven purposes more willingly than as a tool for communication. The second difficulty lies in the fact that most of the teachers just stress providing their student writers with a rich knowledge of vocabulary relating to the specific topic and some guiding questions in order to help them shape their ideas into the completed paragraphs. In this way, teaching writing only helps them produce error-free texts sticking to the models of correct language. On the other hand, it does not contribute to helping the students realize and master such features as audiences, purpose, context and linguistic conventions of text, which are the important features of any text-types.

According to Wang (2005) writing is a problem for many teachers as well. They spend a lot of time correcting students' compositions. Although teachers do their best, students' composition remain poor, grammatically awkward and deprived of sentence structure variety and use. The reason for all this is that learners have not been involved in their own learning. Furthermore, the ever-evolving nature of technology and digital tools presents its own set of challenges. As new platforms and applications emerge, educators must continually adapt their teaching methodologies and stay up to date with the latest trends and best practices. Thus, students can overcome their difficulties in writing when they learn to write through a process that is engaging, interesting and involves all their



senses (Rostami& Hoveidi, 2014; Saud, Jufri, Rahman & Salam, 2014).

Student engagement is receiving increased attention in educational research (Lee et al., 2021). This attention illustrates a growing understanding of the importance and positive impact of student engagement on student performance and motivation (Guthrie et al., 2012). While engagement is more of a focus in educational research, it is not commonly studied in writing (Ives et al., 2022). Writing engagement is considered an inherent part of the writing process, as engagement is required at every stage of writing wherein students plan, revise and edit their writing (Graham et al., 2018).

Engagement generally refers to the extent of a student's active involvement in a learning activity. It is an umbrella term which brings together students' degree of attention, curiosity, interest and willingness to employ their language proficiency and a repertoire of learning skills to make progress (Reeve, 2012; Philp& Duchesne, 2016). The theory of learner involvement was developed by Alexander Astin in 1984 and then was renamed by him as the "Engagement Theory", where engagement is defined as "the amount of physical and psychological energy that the student devotes to the academic experience". In fact, this theory states that a more successful student is one who has more engagement, and the higher the engagement, the more the learning (Astin, 1993, p. 297; cited in Akbari, Naderi, Simons& Pilot, 2016).

Most researchers agree that it is a meta-construct encompassing multiple dimensions of involvement in school or commitment in learning (Appleton et al., 2008; Fredricks et al., 2004; Jimerson, Campos& Greif, 2003). However, the number and nature of dimensions within this meta-construct remain confusing. Some researchers use a three-part typology and conceptualize it as comprising affective, behavioral, and cognitive dimensions (Fredricks et al., 2004; Jimerson et al., 2003; Lam et al., 2012), whereas some researchers use a four-part typology, adding a social dimension to this meta-construct (Appleton, Christenson, Kim, & Reschly, 2006).



Affective writing engagement is interest and enjoyment in the writing activity; behavioral writing engagement is related to participation, effort, and persistence; cognitive writing engagement includes strategy use and self-regulation; and social writing engagement is the degree to which students collaborate and interact with others during writing (Alexander, 2018; Fredricks et al., 2004; Guthrie et al., 2012; Lee et al., 2021; Parsons et al., 2018). This conceptualization aligns with the presentation of writing engagement as supported by the dominant views of learning and writing as social processes (Graham & Harris, 2013; Ives et al, 2022). Further, with the explosion of social media platforms, young people today have many more venues for written expression (with all of their limitations and affordances), and these experiences have been found to play a role in the development of a writer's skill and identity (Elf, 2016).

One of the most important contributions to writing engagement is effective writing instruction (Graham, 2019). Effective writing instruction enables writing engagement and promotes writing performance. Teaching writing plays a crucial role in developing students' ability to express themselves clearly, persuasively, and creatively. However, with the rapid advancement of technology and the spread of digital communication tools, educators face new challenges in engaging students and fostering their writing skills. The traditional methods of teaching writing, while still valuable, may not be enough to capture the attention and meet the needs of today's digitally native learners.

The importance of language learning in the digital era cannot be underestimated, considering the fundamental role of language in accommodating the challenges and opportunities that arise in this era. First, the necessity of language proficiency is increased by the widespread access that technology offers. With the convenience with which the world is becoming more connected, language proficiency is essential for bridging cultural divides and fostering international cooperation. Second, one of the most important functions of language is helping language learners develop their interpersonal communication abilities. While technology offers a digital



communication platform, proficient speaking and writing abilities continue to be the cornerstone for interacting with people in social and professional settings. Accordingly, language learning in the digital age offers opportunities for global culture and collaboration as well as improved technology usage, comprehension of digital content, and the development of literacy and communication skills that are pertinent to the needs of the modern digital world (McDougall et al., 2018; Chohan& Hu, 2022).

The transformation of education through information technology has brought about profound changes in the way learning and teaching take place. The introduction of mobile learning (M-learning) has changed the traditional paradigm, allowing students to access learning materials from anywhere through virtual classrooms and electronic learning platforms. Digital learning resources, such as e-books and interactive learning applications, increase the possibility of learning in innovative and engaging ways. As a result, Safar, Al-Jafar& Al-Yousefi (2017) indicated that there is a need for schools to keep up with accelerated progress in the field of ICT. It is necessary to develop educational tools that are matched with the technologically advanced society, especially because these techniques contribute to improving the productivity of the teacher and the learner alike. In addition, AR technology's rapid development and progress have made it suitable for many subjects. It also supports required educational goals and innovation in educational activities. AR has been gaining considerable interest in the field of education and language learning since Pokémon Go, the most well-known AR location-based game, was launched. There is no doubt that AR technology could be considered the educational technology of the future.

Several years ago, augmented reality (AR) techniques had just begun to appear, and AR applications were limited to using huge pieces of equipment such as head-mounted displays or a whole suit of wearable devices. Today, the AR hardware and AR development tools have matured and have become flexible with the evolution of information technology, and even basic smart phones or tablets with camera devices can now be used for AR interaction (Chen et al.,



2013). The AR techniques merge elements of the real-world environment with virtual-generated imagery, and present interactive visualizations and simulations next to 2D-based contents (Specht, Ternier& Greller, 2011). Researchers have stated that the use of mobile-based AR apps in education has been proven to be more effective than the use of traditional textbooks (Bitter& Corral, 2014), and benefits students' learning motivation in the learning process. Besides, the features of presenting learning information, textual, video, audio, and three-dimensional learning contents together in real-time interaction might stimulate learners to learn abstract ideas more than only reading a text-based book (Matcha & Awang Rambli, 2011; Specht et al., 2011).

Traditionally, AR has been closely associated with Virtual Reality (VR) as part of a mixed reality continuum, but AR uses the real world to provide digital information, enhancing the user immersive experience, while VR is an artificial "environment created by a computer system that simulates a real situation" (Fernández, 2017, p. 2). In other words, VR provides a fully simulated experience whereas AR is closer to the real environment. The characteristics of AR interaction are that it is real-time interactive, includes static and dynamic contents, blends real and virtual environments, and provides three-dimensional graphics (Rice, 2007; Specht et al., 2011). With the rapid increase in learning technology, the applications of AR could be extended and could work with various learning devices such as tablet PCs and mobile phones.

The use of Augmented Reality (AR) in a learning context has extraordinary relevance. AR presents a new paradigm by bringing together the physical and digital worlds, allowing students to experience more immersive and interactive learning. In an educational context, AR facilitates the visualization of abstract concepts, allowing students to see them in real life. Additionally, this technology provides opportunities for interactive simulation, allowing students to conduct experiments and simulations without actual physical risk. Location-based learning with AR enables the exploration of historical sites or geographic locations directly from



within the classroom. Apart from providing practical skills training, AR also encourages collaborative learning and personalized learning. Through AR, learning not only becomes more motivational and fun but also more inclusive with increased educational accessibility. Better assessment and immediate feedback are also advantages of this technology. Overall, integrating AR in education stimulates creativity, increases student participation, and creates a learning experience that is more relevant to today's demands (Wedyan et al., 2022)

However, several issues should be carefully considered when adopting AR in learning such that there are still barriers to the integration of AR into education such as the practical limitations of the use of AR apps, teacher interest, and administrative support, inexperience of AR system operation and large amounts of information displayed on the AR screen might result in negative learning effects. Besides, the AR learning tools should also fulfill the key learning purpose for the targeted learning subject (Wang, 2017). Further, to the best of the researcher's knowledge, most of the studies carried out to investigate the effectiveness of implementing AR applications in developing language- related variables focused on early educational stages either kindergarten or elementary stages (Chen& Chan, 2019; Redondo et al, 2019; Wu, 2019; Chen, 2020; Tsai, 2020; Wen, 2020; Binhomran& Altalhab, 2021). Thus, there is a research gap related to verifying the effectiveness of using these applications in the university stage. Consequently, it could be concluded that AR technology in language education is a highly new research area, therefore more research studies should be carried out in different educational contexts to be able to see the impacts of AR technology in different aspects and to reach more generalizable results.

Considering the importance of the writing skills for today's EFL learners and the challenges they face in developing and practicing them, and their disengagement during the writing activities, it becomes clear that there is a need for utilizing more engaging, up- to- date techniques for teaching EFL writing skills for a more effective writing instruction.

Context of the problem

Early childhood Education students need to have good command of oral and written communication skills in order to teach the children in the pre- school stage in a simple, competent and fruitful manner. Those students who are enrolled in the specific program for Teaching in English are in dire need to enhance their English language skills as they study most courses of the program in English. They study a course entitled “Composition and Conversation” in the second year of their preparation program. While the researcher was teaching them this course, she observed that their general level in English was very weak and below expectations. They had problems in presenting their ideas and their writing was full of grammar mistakes, and their ideas were disorganized. They lacked the fundamental sub-skills of writing that enabled them to be competent prospective teachers.

A writing skills pilot test was prepared and distributed to students to determine their level in writing skills. A preliminary rubric was designed to score the test. The descriptive statistics of the results of the pilot study are presented in table (1) below:

Table 1: Results of the writing skills pilot study test

skill	Max. score	Mean	SD	Percentage
Content	٤	1.77	0.898	44.25%
Organization	٤	1.73	0.785	43.25%
Accuracy	٤	1.5	0.805	37.75%
Word choice	٤	1.67	0.758	41.75%
Mechanics	٤	1.7	0.877	42.5%
Total	٢٠	8.37	3.487	41.85%

Results in table (1) illustrate that second- year students at Faculty of Early Childhood Education have observable weakness in their EFL writing skills that should be enhanced.

Statement of the problem:

Based on the researcher’s observations, the results of the pilot study, and the review of related literature, the problem of the current research was stated as follows:

Second- year Early Childhood Education students enrolled in "Teaching in English" specific program lack necessary writing skills that they need as students and as future teachers. Students themselves also expressed their disengagement in the writing activities as they express difficulty in performing them. Therefore, an augmented reality application was implemented for enhancing their writing skills and their engagement.

Questions of the research:

The current research sought to answer the following main question:

What is the effectiveness of using mobile augmented reality applications in enhancing EFL writing skills of Early Childhood Education students and their engagement in writing?

The main question was divided into the following sub-questions:

- 1- What are the features of mobile augmented reality applications that could be utilized for enhancing writing skills and engagement of second year Early Childhood Education students?
- 2- What is the effectiveness of mobile augmented reality applications in enhancing the writing skills of Early Childhood Education students?
- 3- What is the effectiveness of mobile augmented reality applications in enhancing engagement in writing of Early Childhood Education students?

Hypotheses:

The current research verified the following hypotheses:

- 1- There is a statistically significant difference between the mean scores of the experimental and control group students on the post-administration of the writing skills test in favor of the experimental group.
- 2- There is a statistically significant difference between the mean scores of the experimental group students on the pre- and post-administrations of the writing skills test in favor of the post-administration.
- 3- There is a statistically significant difference between the mean scores of the experimental and control group students on the post-

administration of the engagement in writing scale in favor of the experimental group.

4- There is a statistically significant difference between the mean scores of the experimental group students on the pre- and post-administrations of the engagement in writing scale in favor of the post- administration.

5- There is a positive correlation between the second-year students' writing skills and their engagement in writing.

Instruments and Materials:

The following instruments were designed and administered by the researcher:

- 1- A writing skills test to assess the students' level in writing before and after applying the proposed treatment.
- 2- An analytical rubric for scoring the writing skills test.
- 3- An engagement in writing scale.
- 4- A teacher's manual for applying the AR application- based treatment for enhancing EFL writing skills.

Purpose of the research:

The present research aimed at:

- 1- Identifying the effectiveness of using mobile augmented reality applications in enhancing EFL writing skills of Early Childhood Education students.
- 2- Identifying the effectiveness of using mobile augmented reality applications in enhancing engagement in writing of Early Childhood Education students.

Significance of the research:

It is hoped that the current research would contribute to:

1. Directing the attention of EFL specialists towards the importance of integrating the AR technology in teaching as a promising means of enriching instruction for better results in student learning.
2. Helping students to develop their writing skills in such an engaging way that is compatible with their interests.
3. Attracting the attention of researchers in the field of EFL to AR technology as a promising approach for developing language skills and its suitability for the current age.

4. Enriching literature concerning the possibility of utilizing AR applications for developing language skills and engagement in learning.

Delimitations of the research:

The current research was delimited to the following delimitations:

- 1- A sample of second- year Early Childhood Education female students enrolled in the “Teaching in English” specific program.
- 2- Some writing skills suitable for those students as determined by the course description where writing skills comprised: content and development of ideas, organization, accuracy, word choice, and mechanics.
- 3- The first term of the academic year 2021/ 2022.
- 4- The ARLoopa augmented reality application.

Definition of terms:

Mobile Augmented Reality Applications

According to Azuma’s original definition (1997, 2016), AR is conventionally described as a system including three key elements: a combination of real and virtual content, the interaction in real time and the registration in 3D.

Specht et al. (2011) defined AR as a system that enhances a person's primary senses (vision, aural, and tactile) with virtual or naturally invisible information made visible by digital means.

Laine (2018) defines mobile AR as a type of AR where a mobile device (smartphone or tablet) is used to display and interact with virtual content, such as three-dimensional (3D) models, annotations, and videos, that are overlaid on top of a real-time camera feed of the real world.

The current research adopted the definition of Laine (2018).

EFL writing skills

Nunan (2003: 88) states that writing is an intellectual activity of finding ideas and thinking about the way to express and arrange them into a statement and paragraph that is clear to be understood by the people. This indicates that student-writers are demanded to show their thoughts and organize them into a good composition.

In addition, Brown (2001) described writing skills as a different set of competencies, EFL learners should have, for example, how to generate and organize ideas coherently, how to use discourse markers and rhetorical conventions cohesively into the composition, and how to revise and edit the composition for clearer meaning, as well as how to produce a final product.

Writing is operationally defined as a set of competencies that should be mastered by EFL learners to be able to express their thoughts and feelings, and be able to effectively communicate with others. These competencies include content and idea development, organization, grammatical accuracy, word choice, and the use of mechanics.

Engagement in writing

According to Wang et al. (2017), engagement in learning can be conceptualized as a multi-dimensional construct with four dimensions: a behavioral, an emotional, a cognitive, and a social. The behavioral dimension would include students' proactive behaviors to support learning. The emotional dimension: students' feelings and acceptance of the teacher's instruction. The cognitive dimension: students' self-regulative abilities, concentration, and higher cognitive functions. The social dimension relates to students' communication, interaction, and sense of support and inclusion in academically oriented learning activities (Bond & Bergdahl, 2022; Wang et al., 2017). The engagement dimensions are overlapping and interdependent:

Affective engagement refers to enjoyment of, positive feelings toward, and sense of competence about an activity.

Behavioral engagement, which can be observed as an active participation in a task or activity, could be seen as the outcome of intrinsic or extrinsic motivation.

Cognitive engagement encompasses thinking about the task at hand, similar to concentration. It refers to the student's level of investment in learning; it includes being thoughtful and purposeful in the approach to tasks and being willing to exert the effort necessary to comprehend complex ideas or master difficult skills.



Social engagement refers to interacting with others to complete a task. Writing, like learning generally, is a social act (Prior, 2006 cited in Parsons et al., 2018).

Engagement in writing is operationally defined as “a multi-dimensional construct that represents cognitive, affective, behavioral, and social involvement in writing tasks. When students are engaged in a writing activity, they feel enjoyment and positive feelings, participate actively in the task, become thoughtful and purposeful in their approach to writing tasks, and collaborate, communicate and actively participate with their peers throughout the writing stages for more support and constructive feedback”.

Review of literature and related studies:

The following section sheds more light on the main variables of the current study which are the EFL writing skills, engagement in writing, and mobile augmented reality.

Writing skill:

Writing skills are an important part of language learning because learners are trained to transform the language they learn in class into specific words for expressing their feelings and opinions through writing. Researchers have suggested that teachers should evaluate students' writing cognition ability and provide them with suitable learning scaffolding to transform their inner thinking into specific words, and to assist them in recalling their experiences related to the writing topics. Since the characteristics of AR such as being real-time interactive, inclusion of static and dynamic contents, and blending real and virtual environments have been proved to be beneficial to learning, AR techniques could be adopted to construct writing internal and operational factors as scaffolding, and to provide learners with opportunities to plan and write articles on their own for self-practice purposes (Wang, 2017).

Writing as a process consists of different stages; planning, writing drafts, responding, revising, editing, evaluating, and publishing. Stages of drafting can be affected by the planning and revision stages can be the formulation stage of writing or vice versa. Thus, the writing process is a series of work- related stages that affect each other. It begins with the planning stage that is carried out



through various activities to arouse the interest of students to write. The second stage is drafting where students begin to focus on writing without seeing their grammatical errors. The next stage is revision and editing that is responded to students' writing and followed by assessment and publication (Saud, Jufri, Rahman & Salam, 2014).

Writing is important for learning, working and conducting everyday life in technology-driven societies where writing is required for various communication media such as tweeting, texting and composing emails. Writing benefits learning because it provides students with a tool for visibly and permanently recording, connecting, analyzing, personalizing, and manipulating key ideas in text. Despite its importance, not every student develops writing proficiency in school (Graham et al., 2018).

Good writing requires complex skills such as the production of clear and organized paragraphs and ideas, developing relevant content, and acquiring linguistic abilities including sentence formation, grammatical competence and lexical knowledge. In addition, writing requires aspects of language fluency and the coordination of many high metacognitive skills to generate specific details and information used to develop a topic of an essay. Therefore, it is necessary to teach those aspects and skills of writing and provide learners with meaningful contexts and authentic purposes for writing (Troia et al., 2013; Graham, 2008; Aydin & Yildiz, 2014).

Moreover, it is important to teach the students the process of writing. Writing as a complex skill goes through different stages and processes such as prewriting, drafting, revising and editing (Tompkins, 2010). In other words, writing is usually a step-by step process. It begins with prewriting, during which students accumulate and generate ideas. In the second stage, outlining, students write and revise their paper several times. Finally, students edit and proofread. Editing involves checking their paper for mistakes in sentence structure. Proofreading involves checking the final copy of their paper for typing or handwriting mistakes (Oshima & Hogue, 2007). Through these stages, students are guided to write essays with clear



organization of ideas in the paragraphs, adequate and relevant content (development) and appropriate sentence fluency (style), and correct conventions (Amin, 2016).

Many studies have investigated the practice of writing through the assistance of learning technology, while the use of AR techniques has rarely been examined. Zaini and Mazdayasna (2015) used computer-based instruction to assist college students in developing their English writing skills. In their study, one group learned with the traditional method and one with the Microsoft Word Office software as a tool for writing. The findings revealed that the learners in the computer-based instruction group outperformed those in the other group were able to produce high-quality paragraphs. Ting (2015) integrated AR techniques to assist elementary school students learning Chinese writing. The study compared the learning effects of using AR instruction and picture-based instruction for guiding learning. The findings indicated that both groups improved their writing performance. The learners in the AR group had better attitudes towards learning writing, while no differences were found in the performance of the learners' writing content and skills. In another study, Jeong (2016) adopted the cloud-based platform, Google Docs, to assist college students in Korea with their English writing. In the experiment, the learners were encouraged to submit their English writing via the cloud system, allowing them to get instant feedback from teachers and peers. The research finding showed that the learners enjoyed the experience of receiving learning feedback through the platform, and it also enhanced active communication and autonomous class participation.

Engagement in Writing:

One of the most essential components of 21st Century education is student engagement. The theory of learning engagement has roots in two very widely known educational theories; John Dewey's "Learning by Doing" and Jean Piaget and the theory of constructivism. They both encourage learners to engage in problem solving and place the majority of the responsibility of learning in the learner's hands (Inman, 2001). It involves a high level of participation and a high quality of effort in the learning process and

thus plays a vital role in leaning a language since passive students are not capable of learning a language well. Research on student engagement in learning and how to boost such engagement has been of interest to both teachers and researchers for many years (Stroud, 2013).

Fredricks, Blumenfeld, and Paris (2004) described engagement as a “multifaceted” or “multidimensional” construct that includes, at the least, three components: cognitive, behavioral, and emotional. Descriptions of engagement tend to highlight characteristics such as interest, effort, concentration, active participation, and emotional responsiveness. That is, engaged students disburse focused energy and attention, and they are emotionally involved. For example, Skinner and Pitzer (2012) characterized engagement as “constructive, enthusiastic, willing, emotionally positive and cognitively focused participation with learning activities in school” (p. 22).

Cognitive engagement is defined as a student’s level of investment in learning. It includes being thoughtful, strategic, and willing to exert the necessary effort for comprehension of complex ideas or mastery of difficult skills. Furthermore, it involves processes such as sustained attention and mental effort (Helme& Clarke, 2001), often including self-regulation strategies. A range of indicators of cognitive engagement can be identified; including questioning, completing peer utterances, exchanging ideas, making evaluative comments, giving directions, explanations, or information, justifying an argument, making gestures and facial expressions, private speech and exploratory talk (Gunn& Hollingsworth, 2012; Philp& Duchesne, 2016; Henrie, Halverson& Graham, 2015)

Behavioral engagement is typically described simply in terms of time on task or participation. Thus being “on-task” is synonymous with behavioral engagement. Behavioral engagement draws on the idea of participation and includes involvement in academic, social, or extracurricular activities and is considered crucial for achieving positive academic outcomes and preventing



dropping out (Fredricks& McCloskey, 2012; Henrie, Halverson& Graham, 2015).

The construct of emotional engagement focuses on the extent of positive (and negative) reactions to teachers, classmates, academics, or school, and consequently defined variously according to the research focus. In relation to the context of the class and the task, Skinner, Kindermann, and Furrer (2009) defined emotional engagement as motivated involvement during learning activities, and they identified enthusiasm, interest, and enjoyment as key indicators of emotional engagement, and at the other end of the scale, anxiety, frustration, and boredom as indicators of negative emotional engagement (disaffection). Emotional engagement may also include purposefulness, autonomy, and students' feelings of connection or disconnection with their peers in the class and, particularly, their task interlocutors (Henrie, Halverson& Graham, 2015; Philp & Duchesne, 2016).

While not included in all models of engagement, Philp and Duchesne (2016) believe that in the context of language learning, the social dimension to interaction should be foregrounded as a dimension of engagement. The social dimension of engagement considers the bonds of identification and belongingness formed between students and their peers and teachers (Pekrun and Linnenbrink-Garcia, 2012; Wentzel, 2012). It generates feelings of inclusivity, belonging, purpose, socialization and connection to persons involved in the shared activities (Eldegwy et al., 2018). Within the classroom, social engagement is characterized by the 'unwritten' rules of the learning environment, such as cooperation, listening to others, attending class on time, and maintaining a balanced teacher–student power structure (Pekrun& Linnenbrink-Garcia, 2012; Wentzel, 2012).

Simply taking part in tasks does not guarantee that students will benefit from the task as much as a teacher might hope. Behavioral engagement involves students actively participating in classwork and the more a student participates, the more work they can finish within a given time period (Coates, 2005). However, the quality of the engagement the students experience within that time



period cannot be confidently measured by a teacher based on the visible actions of the students alone. If a student not only undertakes works given to them (becomes behaviorally engaged), but also experiences positive emotions about the work they undertake and their peers (becomes emotionally engaged), then other benefits are sure to be present. If the same students were not only undertaking work, enjoying the experience, but also investing in trying as many approaches as necessary to understand and master classwork (becoming cognitively engaged), a teacher can confidently state that the students have become truly engaged in tasks (Stroud, 2013).

Having students who are highly engaged in learning will not only be actively participating during tasks but have positive emotions towards classwork and their learning environment, as well as be investing themselves psychologically in mastering skills to complete tasks put before them (Stroud, 2013). There is some evidence linking student engagement with positive academic outcomes, and it is considered an important predictor of student achievement (Fredricks, 2013; Gunn & Hollingsworth, 2012; Kuh et al., 2007; Ladd & Dinella, 2009; Skinner & Pitzer, 2012; Smallwood & Oumet, 2009). Engagement is a critical contributor to students' academic development. It can be seen as a key player in the development of academic assets that takes place across the school year and over the curve of a student's entire educational career. In addition, there is some evidence linking student engagement with positive academic outcomes (Fredricks, 2013; Skinner & Pitzer, 2012). It is equally possible, however, that students who have good academic results may be disengaged from learning tasks and school activities (Willms, 2003; Zyngier, 2008). The lack of consensus over the definition of student engagement lies behind these inconsistent findings.

Kuh (2009) states that student engagement involves a high level of participation and a high quality of effort in the learning process. For every teaching procedure, students have to access and work with it. So, teachers should offer interesting and motivating activities for students to guarantee their positive engagement. According to Janes, et. al (2000), "The teacher acts as a guide



facilitator. The teachers create opportunities for students to work cooperatively, to solve problems, do authentic tasks, and construct their own meaning. They learn along with the students" (p.28). Knowledge of what works best to engage a particular group of learners can enable teachers to tailor lessons that focus on their learners' most prominent characteristics while placing less focus on aspects that are not strongly preferred among the class (Koch Junior, 2015).

There are many strategies and practices that promote and encourage students being highly engaged in their own learning, such as cooperative learning strategies, authentic learning tasks, literature circles (Clarke, 2013), the use of technology within the classroom (Alsowat, 2016), student-led conferences coupled with student portfolios, and student self-assessment (Olson, 2008). Recently, Gunn and Hollingsworth (2012) pinpointed the effectiveness of improving student engagement using 21st century instructional approaches and practices such as the usage of advanced technologies and applications for a more differentiated instruction. All in all, educators should make it a priority to get students involved in the learning process, taking a more facilitative role in guiding students to take a hold of their own learning and make it their own.

Fredricks and McColskey (2012) listed some common methods for measuring engagement. Self-report survey measures are the most common method for assessing student engagement. They are particularly useful for assessing emotional and cognitive engagement which are not directly observable and need to be inferred from behaviors. Experience sampling (ESM) is another technique where individuals carry electronic pagers or alarm watches for a set time period. In response to ESM signals, students fill out a self-report questionnaire with a series of questions about their location, activities, and cognitive and affective responses. Another method for assessing student engagement is teacher checklists or rating scales. Some teacher rating scales include items assessing both behavioral and emotional engagement while others reflect a multidimensional model of engagement. A few studies have used interview techniques to assess engagement in school.



Observational methods at both the individual and classroom level have also been used to measure engagement.

AR in writing instruction:

Technology plays an important role in people's lives especially college students. Thus, with technological advances, the language classroom has moved from the traditional language lab to incorporating digital tools and students are identifying as digital natives. One new technology used to bring language instruction into the 21st Century is Augmented Reality (AR) that can effectively respond to students motivational and technological needs. With an emphasis on the 21st skills, educators are always trying to provide their students with the best instructions through integrating new technologies in their lessons plans (Kannoetsin, 2014, Helwa, 2019)

The relevance of Augmented Reality (AR) in language learning makes a major contribution to a more engaging and effective learning experience. First of all, AR allows teaching words and phrases more visually and contextually. By integrating virtual elements into a physical environment, students can see and interact with objects and situations that create a context for the use of words in more real language. Second, AR facilitates learning through real-life simulations. For example, students can participate in practical communication situations, such as ordering food at a restaurant or interacting in social roles, which enriches everyday communication skills in the target language. Furthermore, AR can increase student engagement through interactive learning. Students can use AR devices to explore additional content such as video, audio, or images, deepening their understanding of cultural and linguistic contexts. They can create their own AR content, such as storyboards, presentations, or AR-based art projects, which allows them to actively contribute to the learning process and improve their expression skills in the target language. By utilizing the advantages of AR in a language learning context, teachers can create learning experiences that are more fun, practical, and relevant, which ultimately improves students' language proficiency significantly (Bozzelli et al., 2019; Wedyan et al., 2022).



Technology has been flourishing day-by-day and AR is a magical technology renewing itself each day. According to Azuma et al. (2001), the goal of AR is to enhance users' interaction with the real world by means of 3D virtual objects in real environments. This is not limited to visual channels but also it appeals to auditory channels. Hence, AR is a great way to bridge virtual and real worlds (Özçelik, Yangin Ekşi& Baturay, 2022). This new approach enhances the effectiveness and attractiveness of teaching and learning (Kesim& Ozarslan, 2012). AR provides a more interesting and interactive learning experience, increasing student motivation to be actively involved in learning. Through AR applications, teachers can create simulative AR content, creating contextual situations where students can practice using language in everyday life. The use of AR can also increase information retention by utilizing visualization and simulation. Students are more likely to remember and understand course material when they are visually engaged and interact directly with the content. In addition, AR enables a more individualized learning experience, according to each student's level of understanding, especially in language learning (Olim& Nisi, 2020; Sanabria& Arámburo-Lizárraga, 2017).

AR and VR are both immersive technologies that alter our perception of the real world (Laghari et al., 2021; Scrivner et al., 2019). AR enhances the perception of reality through an interactive experience that mixes the real world and computer-generated information. VR, on the other hand, creates a completely immersive digital environment that simulates reality and replaces the physical world. Although AR and VR have their own applications and user interfaces, they share the goal of immersing users in interactive digital environments. Both AR and VR can bring significant benefits to traditional learning and online education (Al-Azawi et al., 2019; Liou et al., 2017). AR and VR create an immersive experience and engagement for a learner. The technologies enable the deployment of knowledge and information in a creative and integrated way that incites motivation among students (Tiwari, Bhaskar& Pal, 2023; Rojabi, Setiawan & Munir, 2023).



Santos et al. (2016) clarify that AR is the seamless integration of virtual objects and real environments where the computer-generated information is placed in the world as if they co-exist with real objects. It is an emerging technology that is finding applications in education because of its possible benefits in teaching and learning. Yuen, Yaoyuneyong & Johnson (2011) indicate that AR is used in learning to engage, motivate and stimulate students; teach subjects where it is not easy to gain real-world experience; enhance collaboration between students and instructors, and among students; foster students' creativity and imagination; help students take control of their learning and create an authentic learning environment suitable for various learning styles.

AR is divided into two main types: location-based and vision-based. Location-based AR, also known as GPS-based AR, is a type of AR technology in which interactive digital content is attached to a geographical location to allow users to track the distance from a current location to different ones by using a mobile device accredits with Global Positioning System (GPS). Location information might be combined with data catered through the GPS, gyroscope, compass, or camera, etc. to be able to provide information about the physical surroundings (Dunleavy& Dede, 2014; Godwin-Jones, 2016). The other type is vision-based AR which focuses on image recognition techniques used to determine the position of physical objects in the real environment for appropriate location of virtual contexts related to these objects. Its tracking system has two types i.e., marker-based and markerless. A marker-based tracking system involves using a static image to trigger a visual overlay as superimposed additional content (3D, video, animation, etc.) and requires specific labels such as quick response (QR) code to register the 3D images. A markerless tracking system requires no such labels, any part of the real environment can be used to trigger the virtual images by scanning the surrounding environment. The labels, QR codes, or the virtual images are called as “triggers” or “markers”. The markers or the triggers might be inserted anywhere and anything. Just as the AR application identifies the markers through the camera, 3D images or the other kinds of actions can be



seen on the device screen (Godwin-Jones, 2016; Khoshnevisan & Len, 2018; Khoshnevisan, 2019).

Among various language acquisition and learning theories, constructivism, sociocultural theory (SCT), and connectivism are believed to guide the use of AR, on the ground that some of their features are associated with AR (Sommerauer & Müller, 2018; Zhang, Wang & Wu, 2020). Wang et al. (2018) proposed that AR-supported learning is a contemporary theory, and it is also based on constructivism as it helps learners to gain knowledge in a contextualized environment, and with the help of AR-based language materials, the learners can acquire, internalize, construct knowledge and use it in their productive tasks through using their critical thinking and kinesthetic abilities. Further, one of the core issues of SCT is the role of the Zone of Proximal Development (ZPD). The fundamental relationship between SCT and AR lies relatively with scaffolding. With the help of AR technology, language learners have a chance to work collaboratively in a contextualized environment (Godwin-Jones, 2016). Collaboration in such an environment leads to social interactions and scaffolding between language learners. Finally, Connectivism, which is relatively a new contemporary theory, is about constructing a connection between the technology-enhanced learning environment with learning opportunities for learners while prompting interaction and collaboration (Greenwood & Wang, 2018). By the agency of AR-based technology, which is context-based, learners can have a chance to bridge their learning skills with the real contextualized environment enhanced by different modalities (Godwin-Jones, 2016).

Mobile AR is part of AR with the superimposed virtual object being displayed on a mobile device instead of a personal computer. AR environments on mobile devices are evolving and offer a great deal of potential in terms of learning and training. Therefore, in their research, Jamali, Shiratuddin & Wong (2014) present recent works and applications in several fields related to AR and MAR. MAR is a term used when equipment through which AR can be achieved as it is small in size and easy to carry e.g. a smartphone or a tablet



(Beder, 2012, Karagozlu& Ozdamli, 2017). AR as a technological approach proposes applications that allow students to interact with the real world through virtual information. The use of AR applications on tablets and mobile phones may permit a rapid evolution of AR technology. By combining technology familiar to students with locations where students see as their own, AR has the potential to move learning out of the classrooms and into the spaces where students live. Encouraging informal learning may prove effective in engaging students, extending learning to spaces that might help them form connections with content, the locations that provide the context for it, and the peers that they share it with (Muñoz, 2017). MAR is technology that can mobilize the learning environment irrespective of location and time and offers flexibility based on students' needs.

To be able to bridge real and virtual worlds, many scholars investigated AR in terms of its effects on education. Utilizing various ways and developing technology, the quality of education might be increased. Recently developed technology enabled AR to be used with mobile devices effectively. Various studies on AR in education revealed various features and affordances that would be promising for enhancing education. First, AR offers accessible learning materials anywhere and anytime. Instead of using paper-based textbooks, models, posters, or printed manual, it offers portable and less expensive learning materials. Second, it requires no special equipment. In the current era, most teens own a smartphone with a camera, which means they are immediately available for the use of AR (Özçelik, Yangin Ekşi& Baturay, 2022). Further, it contributes to the understanding of abstract concepts better. By means of visualization, it enables learners to see the visual concepts of abstract things, thus providing a better understanding of subjects with the help of visualization (Wu, 2019; Shelton& Hedley, 2002, Kurniawan et al., 2024). In addition, it offers authentic, contextual, situational, collaborative and social learning environments (Squire& Jan, 2007; Dunleavy et al., 2009; Wu, 2019). It engages the attention of learners and enhances their motivation (Di Serio et al., 2012; Kesim& Ozarslan, 2012;



Elsayed& Al-Najrani, 2021). It makes learners enjoy the learning process and develops the critical thinking and problem-solving skills of learners (Dunleavy et al., 2009). It is not limited to only one case or field of application, so it can universally be applied to any level of education and training.

Concerning the realm of language education, AR proved to be an effective means for developing various language skills at various educational stages. For example, it proved to be effective in eliciting higher levels of engagement, as well as more positive attitudes (Lee, 2021). Finally, Costuchen, Darling, and Uytman (2020) conducted an experimental study focusing on the vocabulary retention with 62 Spanish students in English language teacher training department. The results confirmed the benefits of AR-based instruction on the retention level of learners.

With specific reference to writing skills, in a study conducted by Wang (2017), an AR-based writing support system was provided to a total of 30 twelfth-grade students; the experimental group participated in the writing activity using both AR-based learning material and paper-based supports, while the control group worked with only paper-based writing support materials. The results revealed that the AR techniques helped the intermediate-level students the most in their writing performance. In addition, Helwa (2019) proved the effectiveness of mobile augmented reality applications in improving student teachers' EFL descriptive writing skills and motivation towards English language. Further, Lin, Liu and Chen (2022) examined the effects of AR-enhanced writing applications on students' writing achievement. They designed an AR-enhanced context-aware ubiquitous writing application (ARCAUW) in order to enhance language learners' retention, motivation, and self-regulated cognition for writing development. The results demonstrated that both groups showed positive improvements in terms of writing performance; while the ARCAUW group outperformed in terms of retention, motivation, and self-regulation in writing. In the study, it was reported that the adoption of innovative applications in academic writing courses would lead learners to have better writing outcomes, as it supported

self-regulated writing competence. Finally, the findings of the study conducted by Koç, Altun and Yüksel (2022) indicated that the use of AR-based materials had a medium effect on the selected writing skills of high school students. The results also showed that the students' perceptions of the AR-based writing experience were positive.

Methodology:

Participants:

Participants in the current research were ninety (N= 90) female students enrolled in the second grade of the specific program “Teaching in English” at the Faculty of Early Childhood Education. This specific program qualifies those students to teach kindergarten children in the language, experimental, and international kindergartens in the corresponding schools. Their ages ranged between nineteen and twenty years old. They had almost the same experience in learning English, starting from their first year of the primary stage.

Design of the study:

The current study adopted the quasi-experimental approach using a pre- post administration to two independent groups design to investigate the effectiveness of using a mobile augmented reality application for enhancing EFL writing skills of Early Childhood Education students and their engagement.

procedures

First, designing the instruments and materials of the research

Instruments and materials used in the current research were designed by the researcher as follows: (available with the researcher upon request)

1- The EFL writing skills test:

The test was designed for assessing the level of second year students at the Faculty of Early Childhood Education in EFL writing skills before and after the proposed AR treatment. The difference in their scores on the pre- and post- administrations of the test- if any- would be attributed to the effect of the proposed treatment. The course description was reviewed to check the writing skills prescribed for them. The skills included mechanics of writing, word

choice, accuracy, content and development of ideas, and organization. The initial version of the test included two paragraph writing questions.

To establish validity of the test, it was presented to a group of jurors (N= 5) to evaluate the questions in terms of coverage of the target skills, appropriateness to the participants and clarity of the language used, and to suggest any modifications to its questions. The jurors agreed upon the accuracy and suitability of the questions to assess the target writing skills.

The internal consistency and reliability of the EFL writing skills test were estimated through the test pilot administration to (30) second year students other than participants in the main research. Results of this pilot study were as follows:

First, the internal consistency was estimated through two procedures: a) the correlation coefficient between the score of each question and the total score of the skill being assessed was estimated, and the results are shown in the following table:

Table 2: The correlation between the score of each item and the total score of the skill

Sub-skills	questions	Corr. Coeff.	Sub- skills	questions	Corr. Coeff.
Content and development of ideas	1	0.929**	Word choice	1	0.791**
	2	0.915**		2	0.78**
Organization	1	0.794**	Mechanics	1	0.907**
	2	0.811**		2	0.902**
Accuracy	1	0.808**			
	2	0.85**			

** significant at 0.01 level

Table (2) illustrates that the correlation coefficients between the score of each question and the total score of the skill are positive at 0.01 level which supports the valid internal consistency of the writing skills test.

b) the correlation coefficient between the score of each skill and the total score of the test was estimated. Results are displayed in the following table:

Table 3: The correlation between the score of each skill and the total score of the writing skills test

Sub- skills	Corr. Coeff.	Sig.
Content& ideas	0.8	0.01
Organization	0.81	0.01
Accuracy	0.897	0.01
Word choice	0.791	0.01
Mechanics	0.925	0.01

Based on the results illustrated in table (3), it is clear that correlation coefficients were positive and statistically significant at (0.01) level, which means that the test has a high level of internal consistency.

Second, the reliability of the test was also assessed by estimating the value of Cronbach- Alpha coefficient (α), which refers to the extent to which the test items are related to each other and the correlation of each item with the total score of the test. Results are displayed in the following table:

Table (4): Values of Cronbach- Alpha reliability coefficient for the writing skills test

The writing skills test	No. of subskills	α
	10	0.894

The reliability coefficient of the test as a whole was (0.894) which indicates that the writing skills test is reliable and can be administered as one of the research instruments.

The duration of the test was also calculated by getting the sum of time spent by all the students of the pilot study to complete the test and dividing it by their number (30). Thus, 45 minutes would provide an appropriate time for the students to answer the questions of the test.

2- The EFL Writing Skills Rubric:

A rubric for scoring the writing skills test was designed and attached to the test in its final version. The rubric was of the analytic type where each sub- skill is accurately described at various levels and performance indicator at each level is given a specific score. The rubric had a scale of four score points ranging as 1= poor, 2=

needs improvement, 3= acceptable, and 4= distinguished. The rubric used a 4-point scale since that was believed to distinguish quality and could be easy for grading. Using an odd number of score points was avoided because of the tendency of observers to gravitate to the mean as the middle score tends to become a "dumping ground" (Arter & McTighe, 2001: 31). The poor level was the lowest level where a student did not show an indication of mastering the writing sub-skill being assessed. The second level "needs improvement" expressed a student's performance which needed to provide evidence of making progress toward the accepted level. The acceptable level corresponded to a level of writing where a student would be considered typically mastering the writing sub-skill under observation. The distinguished level, the highest one, was established to recognize the exceptional performance of students who exceed the typical mastery level and who prove to have a real writing mastery.

The rubric in its initial form was presented to jurors for validation. Very few changes were made to the indicators of the rubric, and it was established in its final form.

Reliability of the rubric:

The reliability coefficient of the rubric was calculated using the inter-rater manner for the performance of the same student. The coefficient of agreement was calculated between their estimates using "Cooper" equation:

Percentage of agreement = (number of times of agreement / (number of times of agreement + number of times of disagreement)) × 100

The researcher asked one of her colleagues to be the co-rater after presenting the test and its rubric and reviewing its content and instructions, by assessing the performance of three students- other than the participants in the main study. The agreement coefficient was calculated for each student. The following table shows the coefficient of agreement on the performance of the three students:

Table 5: Coefficient of Agreement on the performance of the three students

Coeff. Agree. For 1 st student	Coeff. Agree. For 2 nd student	Coeff. Agree. For 3 rd student
87%	90%	89%

Based on statistics in the previous table, the mean coefficient of agreement between the two observers is (88.66%); an indication that the rubric was highly reliable.

Results in tables 2, 3, 4 and 5 indicate that both the test and its rubric had a high degree of reliability, which means that they were reliable instruments for measurement.

3- An Engagement in Writing Scale

The engagement scale was designed for assessing engagement in writing of second- year English section students at Faculty of Early childhood Education before and after conducting the experimental treatment. The scale consisted of forty items distributed to the four dimensions of engagement: cognitive, emotional, behavioral, and social engagement. Each dimension included 10 statements. Some negative statements were distributed throughout the scale for the purpose of assuring validity of students' responses. A 5-point Likert scale (1= Strongly Disagree, 2= Disagree, 3= Not sure, 4= Agree, 5= Strongly Agree) was used to reflect students' responses.

To assess how valid the scale is, it was presented to a number of TEFL specialists and psychologists (N= 6) to evaluate the statements in terms of appropriateness and clarity. The jurors provided their points of view indicating that the scale was clear and appropriate to assess students' engagement in writing as a result of using mobile AR applications.

To estimate the construct validity of the scale, it was piloted to a sample of (30) students other than participants in the main study. The internal consistency of the engagement scale was estimated through calculating both the correlation coefficient of the score of each item with the total score of each dimension to which it belongs, and the construct validity (hypothetical consistency) by estimating the correlation between the score of each dimension and

the total score of the scale. The following tables display the values of the correlation coefficients and their significance levels.

Table 6: Values of correlation coefficients between items of the scale and their correspondent dimensions

Dimension	St. No.	r	Dimension	St. No.	r
A. Cognitive Engagement	1	0.812**	C. Behavioral Engagement	1	0.738**
	2	0.774**		2	0.842**
	3	0.94**		3	0.7**
	4	0.825**		4	0.708**
	5	0.749**		5	0.659**
	6	0.848**		6	0.694**
	7	0.628**		7	0.588**
	8	0.681**		8	0.666**
	9	0.667**		9	0.49**
	10	0.91**		10	0.559**
B. Emotional Engagement	1	0.602**	D. Social Engagement	1	0.745**
	2	0.824**		2	0.81**
	3	0.755**		3	0.54**
	4	0.691**		4	0.78**
	5	0.744**		5	0.68**
	6	0.863**		6	0.62**
	7	0.651**		7	0.78**
	8	0.523**		8	0.76**
	9	0.462**		9	0.79**
	10	0.677**		10	0.71**

** significant at 0.01 level

Results in table (6) indicate that correlation coefficients between the items of the scale and their correspondent dimensions were positive and statistically significant at 0.01 level of significance; and this indicates a strong correlation.

Table 7: internal consistency coefficients of the scale

Dimensions	r	Sig.
A. Cognitive Engagement	0.94	0.01
B. Emotional Engagement	0.901	0.01
C. Behavioral Engagement	0.91	0.01
D. Social Engagement	0.89	0.01

Statistics in table (7) indicate that correlation coefficients between the dimensions of the scale and the total score of the scale were positive and statistically significant at 0.01 level; and this indicates that the engagement scale has a high level of internal consistency.

Reliability of the engagement scale was assessed through Cronbach's Alpha method. The values of Cronbach's Alpha coefficient calculated for the scale are demonstrated in the following table:

Table 8: values of Alpha reliability coefficient for the engagement scale

Dimensions	No. of statements	of α
A. Cognitive Engagement	10	0.929
B. Emotional Engagement	10	0.872
C. Behavioral Engagement	10	0.857
D. Social Engagement	10	0.825
Total	40	0.966

Results in table (8) indicate that reliability coefficient for the whole scale was 0.966 which reflects that the reliability of the scale was high, and the scale proved suitable for administration.

Second: The features of the mobile AR treatment:

For achieving the purpose of the research, the researcher designed instructional support materials that would be used as triggers for the Mobile Augmented Reality (MAR) application used in the current research.

Objectives of Mobile Augmented Reality (MAR)- Based treatment:

The treatment aimed at developing EFL writing skills and engagement in writing among second- year students enrolled in English section at Faculty of Early Childhood Education, Egypt. The target writing sub-skills included the following: content and development of ideas, organization, accuracy, word choice, and



mechanics. In addition, engagement in writing comprised four types: cognitive, emotional, behavioral, and social engagement.

Content of Mobile Augmented Reality (MAR)- Based treatment:

The content comprised a variety of topics, situations, tasks and discussions designed for developing EFL writing skills and engagement in writing. They were suitable for the second- year students enrolled in English section at the Faculty of Early Childhood Education, Mansoura University.

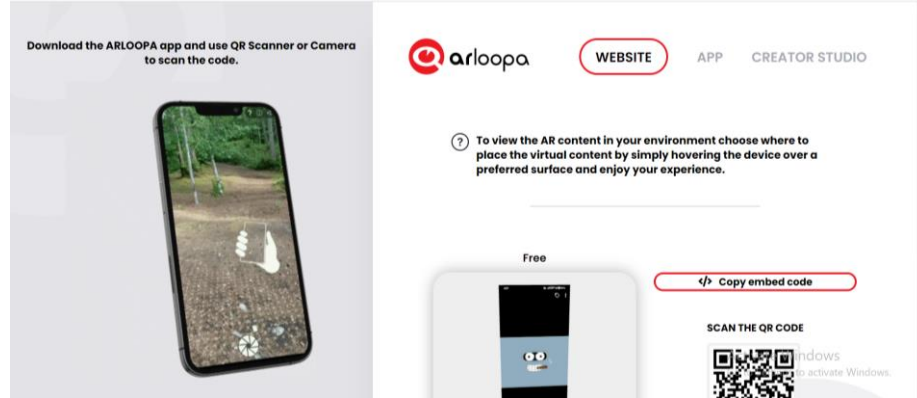
Framework of Mobile Augmented Reality (MAR) Application-based treatment

The treatment lasted for about two months. The researcher met the students for two hours per week for ten weeks and also communicated with them via a what's app group for any inquiries at any time of the day. Week (1) was specified for pre- administration of the research instruments and orientation for using the mobile AR application, while week (10) was allotted for post- administration of instruments. Each session was organized according to the following stages: introducing objectives, procedures which included warm- up, pre- writing, while- writing, and post- writing and finally the feedback and reflection.

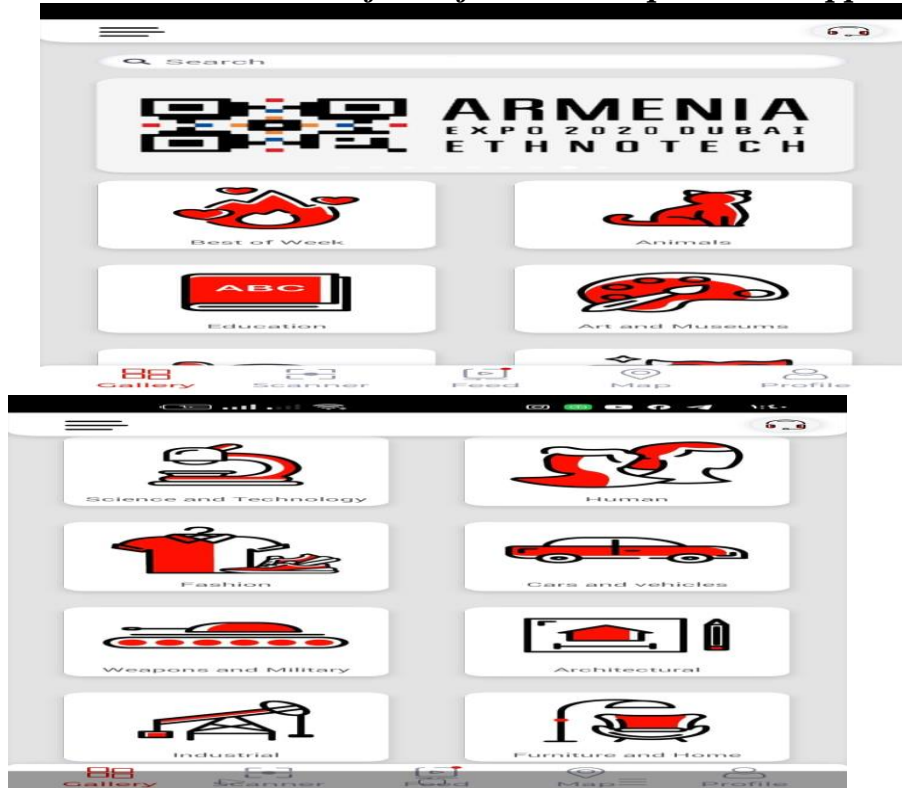
During the instructional procedures, the AR application was integrated within the various writing stages in a way that suited both the purpose of each stage and the activities designed for achieving these purposes. Two modes of vision- based AR writing support materials were utilized: first, marker-based AR, using a static image to trigger a visual overlay as superimposed additional content (3D, video, animation, etc.), and second, markerless AR, allowing real objects to be used as triggers by scanning the surrounding environment. A mobile AR application called ARLoopa was implemented as an easy- to- apply augmented reality application for activating the writing support triggers. ARLoopa is a free app for iOS and Android devices. It uses advanced image recognition to blend the real-world with rich interactive content, such as videos and animation. It also has a gallery where instructors can find ready-made AR projects covering many fields such as science, math, geology and astronomy that can be made use of as enriching

materials for writing activities. The interface of the App. is illustrated in screenshots below:

Screenshot 1: The Interface of the ARLoopa App Website



Screenshot 2: The interface of the ARLoopa mobile app



The Arloopa app. is an AR visualization tool that brings the physical and digital worlds together as one. It places virtual content into real environment, creating fantastic, interactive and valuable

experiences. The app consists of the following sections – AR scanner, 3D Models, Library, Feed, and Map, delivering content with marker- based, markerless, and location- based dimensions that provide varied options for creating AR- supported materials.

On one hand, the marker- based supported writing materials were embedded on learning sheets designed by the researcher using AR techniques so that when the learners used the learning devices such as smart phones or tablets with a camera to scan the triggers on the learning sheets, the writing materials (including video, audio, animation and referable sentences) and writing guidance were presented accordingly. They were utilized with most of the writing activities throughout the various writing stages. On the other hand, the markerless or authentic scene materials were used with topics that relate to outdoor- related topics where students wander around various locations to collect information that would help them in writing about the required topic.

Arloopa mobile application then was downloaded to mobile phones or tablets of students as an easy- to- apply augmented reality application to support them in writing. The AR technique enhanced the information representation as it combined the real scene viewed by the learner and a virtual scene generated by mobile devices to form semi-realistic information services. The interactive and attractive animations and triggers attracted the students' attention and increased their interest in learning writing skills.

The experimental intervention:

An equivalent group design with an experimental and a control group was used in the present research. The following steps were followed:

– Pre- intervention

The second- year students' writing skills and engagement were assessed before conducting the experimental treatment at the beginning of the first semester of the academic year 2021/ 2022. Homogeneity between participants of the control and the experimental groups was established through administering the writing skills test and the engagement scale to both groups before applying the experimental treatment. Tables (9) and (10) display

whether there was any significant difference between the control and experimental groups concerning the pre-administration of the instruments of the research.

Table 9: Comparing control and experimental groups on the pre-administration of the writing skills test

Skills	Groups	N	Mean	Std. Deviation	T Value	Df	Sig																																																								
Content	Experimental	45	2.11	0.804	0.71	88	Not Sig																																																								
	Control	45	2	0.674				Organization	Experimental	45	2.2	0.757	1.421	88	Not Sig	Control	45	2	0.564	Accuracy	Experimental	45	2.44	0.693	0.304	88	Not Sig	Control	45	2.49	0.695	Word choice	Experimental	45	2.18	1.051	0.436	88	Not Sig	Control	45	2.09	0.874	Mechanics	Experimental	45	1.4	1.116	1.66	88	Not Sig	Control	45	1.78	1.042	Total	Experimental	45	10.33	1.907	0.059	88	Not Sig
Organization	Experimental	45	2.2	0.757	1.421	88	Not Sig																																																								
	Control	45	2	0.564				Accuracy	Experimental	45	2.44	0.693	0.304	88	Not Sig	Control	45	2.49	0.695	Word choice	Experimental	45	2.18	1.051	0.436	88	Not Sig	Control	45	2.09	0.874	Mechanics	Experimental	45	1.4	1.116	1.66	88	Not Sig	Control	45	1.78	1.042	Total	Experimental	45	10.33	1.907	0.059	88	Not Sig	Control	45	10.36	1.64								
Accuracy	Experimental	45	2.44	0.693	0.304	88	Not Sig																																																								
	Control	45	2.49	0.695				Word choice	Experimental	45	2.18	1.051	0.436	88	Not Sig	Control	45	2.09	0.874	Mechanics	Experimental	45	1.4	1.116	1.66	88	Not Sig	Control	45	1.78	1.042	Total	Experimental	45	10.33	1.907	0.059	88	Not Sig	Control	45	10.36	1.64																				
Word choice	Experimental	45	2.18	1.051	0.436	88	Not Sig																																																								
	Control	45	2.09	0.874				Mechanics	Experimental	45	1.4	1.116	1.66	88	Not Sig	Control	45	1.78	1.042	Total	Experimental	45	10.33	1.907	0.059	88	Not Sig	Control	45	10.36	1.64																																
Mechanics	Experimental	45	1.4	1.116	1.66	88	Not Sig																																																								
	Control	45	1.78	1.042				Total	Experimental	45	10.33	1.907	0.059	88	Not Sig	Control	45	10.36	1.64																																												
Total	Experimental	45	10.33	1.907	0.059	88	Not Sig																																																								
	Control	45	10.36	1.64																																																											

Results in table (9) prove that there is no statistically significant difference between the mean scores of the control and experimental group students on the pre- administration of the writing skills test, as “t” values were insignificant at (0.05) level of significance.

Table 10: Comparing control and experimental groups on the pre-administration of the engagement scale

Domains	Groups	N	Mean	Std. Deviation	T Value	Df	Sig																																												
A. Cognitive Engagement	Experimental	45	16.04	3.861	0.589	88	Not Sig																																												
	Control	45	16.56	4.357				B. Emotional Engagement	Experimental	45	22.18	2.570	0.886	88	Not Sig	Control	45	21.64	3.113	C. Behavioral Engagement	Experimental	45	20.16	4.833	0.538	88	Not Sig	Control	45	20.71	4.962	D. Social Engagement	Experimental	45	21.6	2.973	0.471	88	Not Sig	Control	45	21.93	3.695	Total	Experimental	45	79.98	9.25	0.373	88	Not Sig
B. Emotional Engagement	Experimental	45	22.18	2.570	0.886	88	Not Sig																																												
	Control	45	21.64	3.113				C. Behavioral Engagement	Experimental	45	20.16	4.833	0.538	88	Not Sig	Control	45	20.71	4.962	D. Social Engagement	Experimental	45	21.6	2.973	0.471	88	Not Sig	Control	45	21.93	3.695	Total	Experimental	45	79.98	9.25	0.373	88	Not Sig	Control	45	80.84	12.557								
C. Behavioral Engagement	Experimental	45	20.16	4.833	0.538	88	Not Sig																																												
	Control	45	20.71	4.962				D. Social Engagement	Experimental	45	21.6	2.973	0.471	88	Not Sig	Control	45	21.93	3.695	Total	Experimental	45	79.98	9.25	0.373	88	Not Sig	Control	45	80.84	12.557																				
D. Social Engagement	Experimental	45	21.6	2.973	0.471	88	Not Sig																																												
	Control	45	21.93	3.695				Total	Experimental	45	79.98	9.25	0.373	88	Not Sig	Control	45	80.84	12.557																																
Total	Experimental	45	79.98	9.25	0.373	88	Not Sig																																												
	Control	45	80.84	12.557																																															

Results in table (10) prove that there is no statistically significant difference between the mean scores of the control and experimental group students on the pre-administration of the engagement scale as “t” values were insignificant at (0.05) level of significance.

Based on the results of the pre-administrations of the research instruments, the homogeneity of both the control and experimental groups was established, and any variance in performance could be attributed to the effect of the proposed treatment.

– **The intervention**

The AR-based treatment was applied to the experimental group. The control group studied the same course “Composition and Conversation” using the traditional lecture-based method without using the mobile AR application. The experimental treatment was conducted throughout the first semester of the academic year 2021/2022. Procedures of the experimental treatment were as follows:

- An orientation session was conducted for the second-year students at the Faculty of Early Childhood Education who represented the experimental group. The researcher explained the objectives of the treatment, its stages and features, and the nature of the Mobile Augmented Reality application. The researcher also presented the instruments of the research for pre-administration.



- The treatment included the implementation of ten sessions in addition to the orientation and the concluding sessions. Students followed the same phases in all sessions, where the mobile AR application was integrated.
- The researcher downloaded the ARLoopa app and created an account and asked her students to download it from the App Store or Google Play and create their accounts.
- The researcher started creating AR triggers to her students. When students scan these cards, an audio, video, or animation would pop-up for them as scaffolds for writing.
- The researcher divided students into five groups (each group consisted of nine students) in order to collaborate, communicate and learn with each other.
- The researcher used the AR-based mobile learning material that assisted the participants with English vocabulary and expressions needed for writing. The learning material installed in mobile phones enabled participants to access information about scenic spots nearby so that they can learn about buildings/places/views of interest in English. For example, if students use the mobile phone to point in a specific direction, their location is rapidly identified, and the embedded camera automatically captures the peripheral images. Thus, the AR-based mobile learning material generates related information (e.g., names and descriptions of the buildings). The captured images and generated information would be displayed on the screen of the mobile phone. If the students want to know more about a certain building or scenic spot, the students can click a specific trigger on the screen, and the details would be displayed. The AR-based mobile learning material enhanced the way of developing and expressing their ideas information expression, provides visual descriptions and increases information accessibility.
- The cards used as triggers stimulated writings, images, videos, or audio files previously integrated and attached to these pre- prepared triggers which contribute to clarifying writing mechanics, a grammatical structure, an idiom or expression to be used in writing, and the like.



- Each session started with a warm- up activity that helped students to get engaged with the topic of the session. Then, the stages of writing proceed in sequence with the utilization of the Mobile AR application. By the end of session, exit tickets are distributed to students for the purpose of assessing the session.
- Students were asked to reflect upon the session in their reflective log to aid the got engaged in their own learning and development.
- A What's App group was created in order to help students post their essays to their colleagues, so that they can interact and communicate with each other.
- The participants read the descriptions that were provided in the AR-based mobile learning material and made use of the information in their compositions.

– **Post- intervention**

The post-administration of the instruments (the writing skills test and the engagement scale) was conducted after finishing the experimental treatment to determine the improvement in the students' writing skills and engagement levels for both the control and experimental groups.

Results:

The results of the study are presented in terms of the research hypotheses as follows:

Testing the first hypothesis:

“t” test for independent groups was used to verify the first hypothesis which is “There is a statistically significant difference between the mean scores of the experimental and control group students on the post- administration of the writing skills test in favor of the experimental group. The following table illustrates (t) values and their statistical significance.

Table 11: Comparing performance of the control and experimental groups on the post-administration of the writing skills test

Skills	Groups	N	Mean	Std. Deviation	T Value	Df	Sig																																																								
Content & ideas	Experimental	45	7.18	0.65	21.78	88	0.01																																																								
	Control	45	4.02	0.723				Organization	Experimental	45	7.11	0.573	21.62	88	0.01	Control	45	3.56	0.943	Accuracy	Experimental	45	7.04	0.706	14.2	88	0.01	Control	45	4.4	1.031	Word choice	Experimental	45	7.07	0.72	16.67	88	0.01	Control	45	3.31	1.328	Mechanics	Experimental	45	7.04	0.737	18.6	88	0.01	Control	45	3.58	1.011	Total	Experimental	45	35.44	2.989	24.67	88	0.01
Organization	Experimental	45	7.11	0.573	21.62	88	0.01																																																								
	Control	45	3.56	0.943				Accuracy	Experimental	45	7.04	0.706	14.2	88	0.01	Control	45	4.4	1.031	Word choice	Experimental	45	7.07	0.72	16.67	88	0.01	Control	45	3.31	1.328	Mechanics	Experimental	45	7.04	0.737	18.6	88	0.01	Control	45	3.58	1.011	Total	Experimental	45	35.44	2.989	24.67	88	0.01	Control	45	18.87	3.375								
Accuracy	Experimental	45	7.04	0.706	14.2	88	0.01																																																								
	Control	45	4.4	1.031				Word choice	Experimental	45	7.07	0.72	16.67	88	0.01	Control	45	3.31	1.328	Mechanics	Experimental	45	7.04	0.737	18.6	88	0.01	Control	45	3.58	1.011	Total	Experimental	45	35.44	2.989	24.67	88	0.01	Control	45	18.87	3.375																				
Word choice	Experimental	45	7.07	0.72	16.67	88	0.01																																																								
	Control	45	3.31	1.328				Mechanics	Experimental	45	7.04	0.737	18.6	88	0.01	Control	45	3.58	1.011	Total	Experimental	45	35.44	2.989	24.67	88	0.01	Control	45	18.87	3.375																																
Mechanics	Experimental	45	7.04	0.737	18.6	88	0.01																																																								
	Control	45	3.58	1.011				Total	Experimental	45	35.44	2.989	24.67	88	0.01	Control	45	18.87	3.375																																												
Total	Experimental	45	35.44	2.989	24.67	88	0.01																																																								
	Control	45	18.87	3.375																																																											

Table (11) shows that the mean scores of the experimental group students in each of the five sub- skills of writing and in the total score were higher than those of the control group. In addition, all *t*-values were significant at (0.01) level which reflects that there was a statistically significant difference between the experimental and control groups in the individual skills and in the total score on the post-administration of the writing skills test in favor of the experimental group. In other words, the experimental group students outperformed their counterparts of the control group in their writing skills as measured by the writing skills test. Consequently, the first hypothesis was verified and accepted.

Testing the second hypothesis:

t-test for dependent samples was used to test the second hypothesis which is “There is a statistically significant difference between the mean scores of the experimental group students on the pre- and post- administrations of the writing skills test in favor of the post- administration”. Results are illustrated in table (12).

Table 12: comparing performance of the experimental group on the pre- and post- administrations of the writing skills test

Skills	Measurement	N	Mean	Std. Deviation	t Value	Df	Sig	(η^2)																																																						
Content	Pre	45	2.11	0.804	37.17	44	0.01	0.969																																																						
	Post		7.18	0.65					Organization	Pre	45	2.20	0.757	36.6	44	0.01	0.968	Post	7.11	0.573	Accuracy	Pre	45	2.44	0.693	31.29	44	0.01	0.957	Post	7.04	0.706	Word choice	Pre	45	2.18	1.051	28.47	44	0.01	0.949	Post	7.07	0.72	Mechanics	Pre	45	1.4	1.116	29.95	44	0.01	0.953	Post	7.04	0.737	Total	Pre	45	10.33	1.907	55.02
Organization	Pre	45	2.20	0.757	36.6	44	0.01	0.968																																																						
	Post		7.11	0.573					Accuracy	Pre	45	2.44	0.693	31.29	44	0.01	0.957	Post	7.04	0.706	Word choice	Pre	45	2.18	1.051	28.47	44	0.01	0.949	Post	7.07	0.72	Mechanics	Pre	45	1.4	1.116	29.95	44	0.01	0.953	Post	7.04	0.737	Total	Pre	45	10.33	1.907	55.02	44	0.01	0.986	Post	35.44	2.989						
Accuracy	Pre	45	2.44	0.693	31.29	44	0.01	0.957																																																						
	Post		7.04	0.706					Word choice	Pre	45	2.18	1.051	28.47	44	0.01	0.949	Post	7.07	0.72	Mechanics	Pre	45	1.4	1.116	29.95	44	0.01	0.953	Post	7.04	0.737	Total	Pre	45	10.33	1.907	55.02	44	0.01	0.986	Post	35.44	2.989																		
Word choice	Pre	45	2.18	1.051	28.47	44	0.01	0.949																																																						
	Post		7.07	0.72					Mechanics	Pre	45	1.4	1.116	29.95	44	0.01	0.953	Post	7.04	0.737	Total	Pre	45	10.33	1.907	55.02	44	0.01	0.986	Post	35.44	2.989																														
Mechanics	Pre	45	1.4	1.116	29.95	44	0.01	0.953																																																						
	Post		7.04	0.737					Total	Pre	45	10.33	1.907	55.02	44	0.01	0.986	Post	35.44	2.989																																										
Total	Pre	45	10.33	1.907	55.02	44	0.01	0.986																																																						
	Post		35.44	2.989																																																										

Table (12) indicates that the t -value is significant at 0.01 level for each particular skill and for the total score. This reflects the statistically significant difference between the mean scores of the experimental group students on the pre- and post-administrations of the writing skills test in favor of the post-administration due to using the mobile AR application. Moreover, the table illustrates that the levels of the effect size of the mobile AR application- based treatment on the target writing skills of the experimental group students were high. Accordingly, since t -values in addition to the effect size confirmed the large positive effect of the mobile AR application- based treatment on students' writing skills, the second hypothesis of the research was proved and accepted.

The third hypothesis stated that "There is a statistically significant difference between the mean scores of the experimental and control group students on the post- administration of the Engagement in writing Scale in favor of the experimental group". In order to verify this hypothesis, the researcher used " t " test for independent groups to identify the significance of the differences. The following table illustrates (t) values and their statistical significance.

Table 13: Comparing between the control and experimental groups on the post-administration of the Engagement in writing Scale

Domains	Groups	N	Mean	Std. Deviation	t Value	Df	Sig																																												
A. Cognitive Engagement	Experimental	45	42.91	4.177	20.62	88	0.01																																												
	Control	45	26.58	3.286				B. Emotional Engagement	Experimental	45	43.60	4.56	14.83	88	0.01	Control	45	29.24	4.623	C. Behavioral Engagement	Experimental	45	45.71	3.389	25.9	88	0.01	Control	45	27.22	3.384	D. Social Engagement	Experimental	45	45.56	3.381	25.573	88	0.01	Control	45	26.93	3.525	Total	Experimental	45	177.78	14.172	25.585	88	0.01
B. Emotional Engagement	Experimental	45	43.60	4.56	14.83	88	0.01																																												
	Control	45	29.24	4.623				C. Behavioral Engagement	Experimental	45	45.71	3.389	25.9	88	0.01	Control	45	27.22	3.384	D. Social Engagement	Experimental	45	45.56	3.381	25.573	88	0.01	Control	45	26.93	3.525	Total	Experimental	45	177.78	14.172	25.585	88	0.01	Control	45	109.98	10.731								
C. Behavioral Engagement	Experimental	45	45.71	3.389	25.9	88	0.01																																												
	Control	45	27.22	3.384				D. Social Engagement	Experimental	45	45.56	3.381	25.573	88	0.01	Control	45	26.93	3.525	Total	Experimental	45	177.78	14.172	25.585	88	0.01	Control	45	109.98	10.731																				
D. Social Engagement	Experimental	45	45.56	3.381	25.573	88	0.01																																												
	Control	45	26.93	3.525				Total	Experimental	45	177.78	14.172	25.585	88	0.01	Control	45	109.98	10.731																																
Total	Experimental	45	177.78	14.172	25.585	88	0.01																																												
	Control	45	109.98	10.731																																															

Results in table (13) illustrate that the mean scores of the experimental group students in each of the three dimensions of engagement and in the total score of the engagement scale are higher than those of the control group. In addition, all *t*-values are significant at (0.01) level which reflects that there is a statistically significant difference between the experimental and control groups' mean scores on the post-administration of the engagement in writing scale in favor of the experimental group. In other words, the experimental group students outperformed their counterparts of the control group in their engagement in writing as measured by the engagement scale. Consequently, the third hypothesis was verified and accepted.

Verifying the fourth hypothesis:

“*t*” test for dependent groups was used to test the fourth hypothesis which is “There is a statistically significant difference between the mean scores of the experimental group students on the pre- and post- administrations of the engagement in writing scale in favor of the post- administration”. Results are illustrated in table (14).

Table 14: comparing between the experimental group on the pre- and post- administrations of the Engagement in writing scale

Domains	Measurement	N	Mean	SD.	t Value	Df	Sig.	η^2																																										
A. Cognitive Engagement	Pre	45	16.04	3.861	30.84	44	0.01	0.956																																										
	Post		42.91	4.177					B. Emotional Engagement	Pre	45	22.18	2.57	26.17	44	0.01	0.94	Post	43.6	4.56	C. Behavioral Engagement	Pre	45	20.16	4.833	27.52	44	0.01	0.945	Post	45.71	3.389	D. Social Engagement	Pre	45	21.6	2.973	33.28	44	0.01	0.962	Post	45.56	3.381	Total	Pre	45	79.98	9.25	35.99
B. Emotional Engagement	Pre	45	22.18	2.57	26.17	44	0.01	0.94																																										
	Post		43.6	4.56					C. Behavioral Engagement	Pre	45	20.16	4.833	27.52	44	0.01	0.945	Post	45.71	3.389	D. Social Engagement	Pre	45	21.6	2.973	33.28	44	0.01	0.962	Post	45.56	3.381	Total	Pre	45	79.98	9.25	35.99	44	0.01	0.967	Post	177.78	14.172						
C. Behavioral Engagement	Pre	45	20.16	4.833	27.52	44	0.01	0.945																																										
	Post		45.71	3.389					D. Social Engagement	Pre	45	21.6	2.973	33.28	44	0.01	0.962	Post	45.56	3.381	Total	Pre	45	79.98	9.25	35.99	44	0.01	0.967	Post	177.78	14.172																		
D. Social Engagement	Pre	45	21.6	2.973	33.28	44	0.01	0.962																																										
	Post		45.56	3.381					Total	Pre	45	79.98	9.25	35.99	44	0.01	0.967	Post	177.78	14.172																														
Total	Pre	45	79.98	9.25	35.99	44	0.01	0.967																																										
	Post		177.78	14.172																																														

Results in table (14) clarify that there is a statistically significant difference between the mean scores of the experimental group students on the pre- and post- administrations of the Engagement in writing scale in favor of the post one. Mean score of the post- administration was (177.78) for the total score of the scale, which is a high value when compared to the Mean of the pre-administration (79.98). The values of "t" were statistically significant at (0.01) level; a result that indicates that the mobile AR program was effective in developing engagement in writing for the targeted sample. Moreover, the table illustrates that the levels of the effect size of the mobile AR application on the engagement of the experimental group students were high. Accordingly, since *t*-values in addition to the effect size confirmed the large positive effect of the mobile AR application on students' engagement, Consequently, the fourth hypothesis was accepted.

The fifth hypothesis stated that "There is a positive correlation between the writing skills and engagement in writing". To verify that hypothesis, the researcher used Pearson simple correlation coefficient for estimating the correlation between the experimental group students' scores on the EFL writing skills test and on the engagement in writing scale. Results are illustrated in the following table:

Table 15: correlation coefficient between EFL writing skills and Engagement

r	Writing skills test	Sig.
Engagement scale	0.872	0.01

Based on the results illustrated in table (15), there is a strong positive correlation between EFL writing skills and engagement in writing as the value of (r) was significant at 0.01 level of significance. Consequently, the fifth hypothesis was verified and accepted.

Discussion:

The current research attempted to investigate the effect of implementing a mobile AR application for enhancing EFL writing skills and engagement in writing of second- year English section students at the Faculty of Early Childhood Education. The results revealed a statistically significant difference at (0.01) level between the mean scores of the experimental and control group students on the post- administration of the writing skills test in favor of the experimental group. Moreover, there was a statistically significant difference between the mean scores of the experimental group students on the pre- and post- administrations of the writing skills test in favor of the post one. This means that the EFL writing skills of second- year English section students at the Faculty of Early Childhood Education improved as a result of applying the proposed treatment based on mobile AR application. Further, the results indicated a statistically significant difference at (0.01) level between the mean scores of the experimental and control group students on the post- administration of the engagement in writing scale in favor of the experimental group and a statistically significant difference between the mean scores of the experimental group students on the pre- and post- administrations of the engagement scale in favor of the post one. Finally, the study highlighted a positive correlation between the EFL writing skills and engagement and that increased engagement can contribute much to enhancing the writing skills and vice versa.



The present research provides evidence for the effectiveness of using mobile augmented reality applications as a framework for developing instructional materials for teaching and developing writing skills of second- year English section students at the Faculty of Early Childhood Education and their engagement in writing. The findings of the current research corroborate the previous relevant studies that investigated the effect of using mobile AR applications on developing various skills and learning dimensions such as developing reading comprehension (Nichols, 2012), improving teaching effectiveness and thus improving students' writing, oral language and total English scores (Short, Fidelman& Louguit, 2012; Koura& Zahran, 2017), and improving reading fluency (Gates& Feng, 2018).

The achieved results could be attributed to the benefits of incorporating the mobile AR applications as innovative and vivid techniques for teaching language skills, and consequently leads to student learning improvement. It has very useful features that aid students to achieve high levels of performance in the language skills as it provides linguistic and content knowledge that help them to write freely and effectively. It also provides students with vocabulary and expressions needed for competent writing. However, some students mentioned that the information on the AR screen would disappear when they moved the camera away from the trigger, and this might be a nuisance when they were learning. This resembles the findings of Di Serio et al., (2012) who found that inexperience of operating the AR system might result in negative learning effects.

Generally speaking, students who participated in the research expressed their satisfaction with and enthusiasm about the way they have practiced the writing skills in the English sessions. They found it different, encouraging, interesting, and engaging. They were especially interested in the idea of having the opportunity to Further, the various activities implemented in the sessions enabled them to interact together and understand the various writing component sub- skills and practise them with the aid of their instructor. In addition, their engagement in writing increased as the



writing activities that were based on mobile AR agitated their enthusiasm to participate and show their full potential in achieving high levels of thinking and learning.

The mobile AR application was convenient and systematic which enabled the students to implement it easily and be able to practice the targeted writing skills. Students gained more confidence and began to write in a better way. Also, through using mobile AR technology, students' writing skills were enhanced. They introduced the topic in a good way and supported their idea with suitable details and examples. They used suitable vocabulary and expressions while presenting their ideas. Students applied correct punctuation marks and capitalization rules. They applied paragraph indentation, leaving spaces between words, syllable division and used correct word spelling. In addition, they conveyed the meaning correctly and clearly, used precise, correct word forms and used correct and appropriate expressions. They also wrote suitable introduction and conclusion to their paragraphs; developed a body that contained one central idea and enough supporting details; used transition words and phrases, lexical connectors and adequate coherence marks; used logical transitions for ensuring smoothness of ideas and logical sequence of sentences or ideas.

Moreover, classroom and time management were challenging for the instructor, yet, when students got engaged in the activities and got motivated to learn and participate in interesting and engaging activities, the issue of classroom and time management become manageable. Further, the atmosphere of the classroom reflected the apparent and prevailing collaboration, communication, and co-operation among students to make progress throughout the experiment. The mobile AR technology provided a non-threatening and engaging learning environment which is one of the essentials of language learning. It offers various means such as sound, animation, pictures when presenting the information. Thus, it made learning more interactive, effective, interesting and fun. Therefore, these results are consistent with Solak and Cakır (2015), Wang (2017), Helwa (2019), Lin, Liu& Chen (2022), and Koç, Altun and Yüksel (2022).



In addition, MAR increased engagement among students through presenting activities and tasks that helped students to participate and interact with each other, get involved with more than one sense with the writing activities, and experience interest and enjoyment while learning. Also, through MAR students could learn by experience and become more confident and autonomous. These results are consistent with Di Serio et al. (2012); Kesim and Ozarslan (2012), Henrie, Halverson, and Graham (2015), Huisinga (2017), Elsayed and Al-Najrani (2021), and Lee (2021).

Conclusions:

The results of the study confirmed that the participants' EFL writing skills developed after the implementation of Mobile Augmented Reality (MAR) Application. In addition, their engagement in writing increased. The effectiveness of Mobile Augmented Reality (MAR) Application- based treatment may be due to the various activities, tasks and strategies that were presented to the students. Through the implementation of Mobile Augmented Reality (MAR) Application, major findings of the study were considered as the students' chances for learning by doing and experiences, their belief that better learning and development of learning skills could be achieved through collaboration with fun and enjoyment.

Actually, the current developments in technology had a positive impact on the interaction of media content and the quality of learning. Thus, there has been an increase in the use of mobile learning tools. The richness of the digital learning resources and communication tools in m-learning promotes engagement in the learning process. In recent years, mobile phones have developed into a platform for AR. Mobile devices have become a part of daily lives and their applications in education have been investigated by researchers all over the world. Mobile applications which can be used in education and mobile Augmented Reality (MAR) applications are all examples of these possibilities of application. Thus, MAR applications for education implement learning support and linking of the real world context of a user and the digital overlay

according to different patterns (Ozdamli & Hursen, 2017, Ternier , et.al. 2012).

In conclusion, mobile AR is becoming an essential field of study for developing EFL language skills and other affective language- related variables in all educational stages.

Recommendations:

In the light of the results of the current research, the following recommendations are suggested:

- 1- There should be much attention directed to orienting student teachers at Faculties of Early Childhood Education and at Faculties of Education in general about the use of AR technology in their academic study and their teaching. Mobile AR is becoming an inevitable demand in the current age and significant for those students in their academic study and language development, and in their future career as teachers.
- 2- Curriculum planners and stakeholders should investigate more possible opportunities for integrating and utilizing mobile AR technology in teaching EFL skills that help teachers in their teaching and save effort through concise and precise procedures with the availability of opportunities to show their creativity in teaching.
- 3- Researchers should give more attention to validating the affordances of AR technology that can be made use of in developing language skills and other affective language- related variables.
- 4- Faculty professors should integrate AR technology in their teaching practices to model its use for their students. They should also highlight its use in their methodology courses in order for their students to be fully aware of its advantages and ways of integration in teaching.

Suggestions for further research:

In the light of results reached and recommendations proposed by the current study, the following research topics are suggested:

- Investigating the impact of mobile AR technology on developing various language skills in various educational stages.
- The effectiveness of AR technology in the realm of professional development in developing EFL teachers' digital creative teaching competence.
- Investigating the effect of AR technology on developing language skills for special educational needs students.



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