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The Effect of Augmented Reality (AR) on English as A Foreign Language (EFL) Learners' Idiom Comprehension, Retention and Motivation

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Abstract

This study explored the impact of augmented reality (AR) flashcards on English as a Foreign Language (EFL) learners' comprehension, retention, and motivation in learning idiomatic expressions. The research aimed to examine how AR technology affects idiom learning outcomes and to explore students' experiences using AR tool. A mixed-methods approach was employed, combining quantitative data from pre- and post-tests and the Instructional Materials Motivation Survey (IMMS), along with qualitative responses to open-ended questions. The participants were 42 female students at King Abdulaziz University, divided into experimental (AR flashcards) and control (traditional flashcards) groups. Results showed that both traditional and AR flashcards improved idiom comprehension and retention, with no statistically significant difference between the two. However, the AR group demonstrated notably higher motivation levels, particularly in terms of attention, confidence, and relevance, as indicated by IMMS results. Qualitative data further supported these findings, many participants expressing a clear preference for AR flashcards due to

their engaging, interactive, and visually supportive nature. The study suggests that while both methods are effective for idiom learning, AR flashcards offer added motivational benefits. It is recommended that future research include a larger and more diverse sample, including male participants, to enhance generalizability.

Keywords: Augmented Reality (AR), EFL Learners, English Idiom, Language Acquisition, Educational Technology, English Language Teaching (ELT).

Introduction

Technology has rapidly advanced and integrated into every aspect of life, in a way that it has become an indispensable part of our daily lives, bringing significant transformations across social, economic, and cultural aspects. Modern technologies, such as the internet, smartphones, and artificial intelligence, have contributed to facilitating communication, developing educational methods, and enhancing productivity in business. Therefore, our societies have evolved into digital and technological communities, where the use of technology is essential for everyone, and in every field.

The educational field is among the primary beneficiaries of technological advancements. It has become a key driver in facilitating the educational process (Bostrom, 2003). Moreover, it diversifies teaching methods by using technologies such as virtual reality and artificial intelligence, making education more engaging and better suited to the different needs of learners.

Among the modern technologies that have revolutionized the field of education is augmented reality (AR). Its ability to merge the real world with digital elements such as images and 3D models enhances the students learning experience to understand concepts more deeply and clearly (Rauschnabel et al., 2022). According to the review of AR implementation in education of Hernandez, (2021); AR allows students to explore the human body in 3D detail to learn about anatomy or conduct virtual

science experiments in a safe environment. It can also interact with maps and geolocation to understand natural phenomena and observe historical events as if you were there in person. In mathematics, AR helps simplify geometric concepts and solve problems visually, while in language and art, it provides interactive tools that promote learning and creativity. These examples reflect the potential of AR to transform education into an engaging experience for students.

Based on numerous research, augmented reality has become one of the innovative technical tools that used in English language learning. It has been utilized to explore its impact on various English skills, including reading, writing, speaking, and listening, as well as vocabulary and grammar learning (Belda-Medina and Marrahi-Gomez, 2023; Songsiengchai et al., 2023; Khan et al., 2023; Alsowat, 2016).

This study examined the role of augmented reality (AR) and its impact on students' learning of idioms. Despite the abundance of research exploring the effects of AR on various linguistic aspects such as listening, reading, grammar, and vocabulary acquisition, there remains a notable gap in investigating its application in learning and acquiring idioms (Khoshnevisan, 2020). To address this issue, this study focused on testing this technology with a group of university-level students learning English as a foreign language (EFL). The aim is to explore the effectiveness of AR on idiom comprehension and retention. As well as students' motivation on idioms learning. Providing insights into (AR) potential as an innovative tool in this specific area of language learning.

Statement of the Problem

Idioms are crucial to English learning, not only because it enhances the ability to communicate naturally and fluently but also deepens the cultural understanding and everyday expressions used by native speakers (Stengel, 1939). Therefore, learning the idioms means learning the culture of the community who speaks the language (Al-kadi, 2015). Additionally, Lundblom and Woods (2012) argued that idioms are

being used in educational settings frequently, not understanding them can eventually affect learning outcome, such as writing skill, reading comprehension and vocabulary building. As a result, lack of idioms comprehension can impact students' ability to progress and engage in academic discourse. Moreover, learning idioms and grasping the figurative meanings can be challenging to EFL learners (Moon, 1992). The semantic and syntactic complexity in idioms expressions make it difficult for EFL learners to recognize their meaning (Al-kadi, 2015). Which results in limiting their language fluency and cultural understanding.

Augmented Reality (AR) technology would present a new way of idiom learning in more interactive and context-rich opportunities, which result in improving comprehension and retention (Khoshnevisan, 2020). However, there are limited studies on the impact of AR in teaching idiomatic expressions to EFL learners, making it unclear how effectively this technology can enhance learning idioms compared to other teaching methods.

This study aims to address this gap by exploring the effectiveness of AR in helping EFL learners master idioms, focusing on its potential to enhance motivation, comprehension, and retention.

The Purpose of the Study

This study aims to explore the use of AR on learning idioms. More specifically, the goals are listed as:

1. To examine the effect of AR technology on EFL learners' idioms comprehension.
2. To examine the effect of AR technology on EFL learners' idioms retention.
3. To explore the effect of AR technology on EFL learners' motivation.
4. To explore EFL learners' experience using AR technology on learning idioms.

Significance of the Study

Mastering idioms is considered challenging to EFL learners. Therefore, numbers of studies explored the process of idioms learning to second and foreign language learners and the strategies used in learning idioms (Alhaysony, 2017; Al-kadi, 2015; My & Van, 2020). Integrating technology such as (multimedia, mobile applications, and online platforms) as a strategy to learn idioms has been researched broadly (Dajem, 2024; Almogheerah, 2020; Vongpumivitch, Yu & Nguyen, 2023). However, there are a few research that conducted studies to examine the effectiveness of AR technology on idiom learning. This study is intended to fulfil this goal; thus, its significance lies in its practical and theoretical fields:

1. Contribute to English language institute, curriculum and materials by utilizing modern technologies in teaching idioms.
2. The implementation of augmented reality (AR) technology represents an innovative approach that can enhance learners' knowledge, overcome learning barriers, and create an engaging learning experience.
3. This study aims to compare the effects of using augmented reality technology versus traditional teaching methods on teaching English idioms.
4. The findings of this study are expected to guide specialists and curriculum developers, particularly in English language education, towards integrating AR technology into textbooks.

Research Questions

1. What is the suggested instructional design of implementing AR technology on EFL learners' idiom learning?
2. What is the effect of AR technology on EFL learners’ idioms comprehension?
3. What is the effect of AR technology on EFL learners’ idioms retention?
4. What is the effect of AR technology on EFL learners’ motivation?
5. What is EFL learners’ experience using AR technology on learning idioms?

Research Hypotheses

Based on the research questions, the following hypotheses were proposed:

H1: There is no statistically significant difference in the sample mean of idioms comprehension and idioms retention pre-test scores between EFL learners who use augmented reality (AR) and those who receive traditional instruction.

H2: EFL learners who learn idioms using AR will show a statistically significant difference in the sample mean in idioms comprehension and idioms retention post-test.

H3: There is a statistically significant difference between the sample mean of the two groups (experimental and control) in idioms comprehension and in idioms retention post-test related to the experimental group.

H4: There is a statistically significant difference in the motivation levels of EFL learners between those who used augmented reality (AR) technology and those who received traditional instruction, in favor of the AR group, as measured by the Instructional Materials Motivation Survey (IMMS).

Definitions of Key Concepts

AR Technology:

Technical Definition: AR technology according to Azuma (1997) is a mixture of virtual and real-world elements. An environment where an AR user experiences the real world as well as computer generated elements on top of that world.

Azuma also established three main features of AR:

1. The combination environment of the real world and virtual world provides the user's unique experience.

2. AR should be a realistic environment where users can interact and make an impact on the AR scene.
3. 3D elements are the essence of AR technology, which gives the users a sense of belonging to the real world.

Operational Definition: The researcher defines AR technology as the use of marker-based AR to use physical object content to trigger a virtual element for learners.

AR Technology in Education:

Technical Definition: Applying AR in educational settings according to Dunleavy et al. (2009) is combining both the physical and digital objects to immersive hybrid learning environments, which results in a collaborative interaction environment. Where learners develop their critical thinking and problem-solving skills. As well as enhancing their performance and learning achievement. (Chang et al., 2015; Ferrer-Torregrosa et al., 2015).

Operational Definition: The researcher defines AR in education as the use of Video-based AR generated by Arloopa software to combine the physical and the virtual world to create an environment where self-learning is activated.

Idioms:

Technical Definition: McCarthy (2017) defines idioms as expressions with unobvious meaning. He emphasizes that idioms are an important part of everyday language use and often reflect cultural knowledge. Understanding idioms requires familiarity with the cultural and contextual factors that give rise to these expressions.

Operational Definition: The researcher defines idioms as expressions that represent cultural meaning and requires deep understanding to comprehend them.

Idioms Comprehension:

Technical Definition: According to Gibbs (1994) comprehension is a deep understanding ability, which requires both linguistic and conceptual knowledge to understand and interpret the figurative meaning of an idiom. It's going beyond literal interpretation.

Operational Definition: The researcher defines idiom comprehension as the skill to grasp the figurative meaning of an idiom and its context use.

Idioms Retention:

Technical Definition: Idioms retention is defined as the ability to remember and recall idiomatic expressions over time. It includes initial learning, establishing meaning-form connections, and long-term retrieval (Nation, 2001). Enhancing this ability can be done through cognitive elaboration techniques, such as imagery, etymological analysis, and contextual use. It depends mainly on how the learner creates deeper mental association of the idiom, through relating idioms to vivid mental images or conceptual metaphors (Boers & Lind Stromberg, 2008). In terms of retention abilities, Fujimoto, Yamamoto, Kato, Miyazaki (2012) stated that AR makes memorization easier due to the elimination of the cognitive load.

Operational Definition: The research defines idioms retention as the ability to recognize and recall the meaning of each idiom and its contextual use.

English as A Foreign Language (EFL):

Technical Definition: "EFL" stands for "English as a Foreign Language" and refers to the teaching and learning of English in a country where it is not an official language. Where EFL learners study English primarily for international communication, travel, or educational purposes (Harmer, 2007).

Operational Definition: The researcher defines EFL learner as those who are an Arabic language speaker who learn English language as a foreign language.

Motivation:

Technical Definition: According to Dewey (1938) motivation increases the curiosity and interests of the learner. He emphasized that education should raise motivation by creating opportunities for students to explore, inquire, and solve problems that they find significant. Augmented reality is one of the technologies that can help fulfill this goal, motivate learners and users (Ibáñez, Di Serio, Villarán, & Kloos, 2014; Singhal, Bagga, Goyal, & Saxena, 2012).

Operational Definition: Motivation according to the research is the learners' motive to learn idioms using AR technology.

Research Limitations

- **Time limits:** The study was conducted during the second semester of 2025 for a period of one week.
- **Space limits:** The study was conducted at English Language Institute, King Abdulaziz University, in Jeddah, Saudi Arabia.
- **Human limits:** The participants were (42) female from King Abdulaziz University, in English Language Institute.
- **Objective limits:** The study was conducted to explore the role of AR technology in teaching idioms for EFL learners.

Conceptual Framework

First Construct: Augmented Reality (AR):

The implementation of AR has been rapidly considered by various sectors, including commerce, industry, medicine, entertainment and education. Historically, the invention of AR has been through numbers of developments. Started with Ivan

Sutherland and his project (The Sword of Damocles) in 1968, which was the first head-mounted-display that allowed users to experience the merged reality through presenting computer-generated graphics. Later, in 1975, the interaction with AR object was created by Myron Krueger for the first time, where users felt more immersive experience than The Sword of Damocles. Finally, in 1992, Loin Caudell and David Mizell at Boeing's Computer Services' Adaptive Neural Systems Research and Development created a software aimed to improve Boeing's manufacturing and engineering processes (Kipper & Rampolla, 2013).

Augmented Reality is widely defined as the technology that blends the real-world with virtual elements for the sake of creating an interactive and immersive experience (Rauschnabel et al., 2022). According to Sung (2021) AR can improve users' perceptions by augmenting the virtual objects and information to their sensory inputs.

Augmented Reality has different types according to technological characteristics and application contexts, but currently it can be classified into two types: location-aware AR and vision-based AR (Dunleavy & Dede, 2014). Location-aware AR relays on Global Positioning System (GPS) and location-tracking features to presents AR content based on the user geographical location. Vision-based AR has two types: Marker- Based AR and Markerless AR. Marker-Based which also called image recognition AR, can operate by a specific visual marker (e.g., QR codes or specific images) that the AR application can recognize to trigger visual elements. Markerless AR differs from marker-based, where it doesn't require marker to work. Allowing users to explore it within their physical environment.

Augmented Reality in Education:

The concept of emerging the virtual and physical world in educational setting has been questioned and investigated by many researchers (Özcelik et al., 2022). According to Alzahrani (2020) the blending of two worlds has a great effect in terms of the learning process, students' engagement, interactivity and knowledge retention

in different educational settings. In addition to Alzahrani findings, several studies highlighted numbers of key features regard applying Augmented Reality (AR) in education, which are:

a. AR offers visualization of abstract concepts, which can help learners grasp complex ideas and make deep understanding of them (Andersson et al., 2016).

b. AR facilitates collaboration and teamwork and communication skills (Squire & Jan, 2007).

c. AR increases engagement and motivation and offers active participation (Di Serio et al., 2012).

Augmented Reality and Language Learning:

In recent years, AR technology has shown significant interests in the domain of English language learning. Among different language acquisition and learning theories, there are two major theoretical foundations undergirding AR: Situated Learning Theory and Constructivist Learning Theory (Dunleavy & Dede, 2014).

Situated Learning Theory was proposed by Brown, Collins, and Duguid (1989). This theory determines that knowledge is most effective when it's applied in real-life contexts. In which learners build and improve their knowledge systems through active involvement in real learning situation, either individually or cooperative learning. It emphasizes the interdependency between knowledge and situation. AR technology aligns with situated learning by combining virtual information into real-world learning environment. This combination creates an authentic learning experience, allowing the students to interact physically and visually in their learning process. Which results in a deeper understanding and mastering the subject matter (Zhao et al., 2020).

Constructivist Learning Theory was proposed by Piaget (1954) that suggests that learning occurs when students actively construct knowledge by interacting with the

environment. It emphasizes the importance of experience, interaction and problem-solving to shape learner's understanding of the world. AR technology aligns with constructive learning theory in terms of offering authentic and contextualized learning opportunities by mimicking real-life language use. It provides the learners and interactive and immersive experience that encourages them to participate in the process of constructing their learning and understanding (Dunleavy et al., 2009).

A study was conducted by Marrahi-Gomez and Belda-Medina (2023) to examine the effect of using AR on grammar learning and exploring the students' attitude toward using AR in learning. Data collected through pre-post tests and pre-post surveys, adopting mixed-methods design. The participants were 130 students from two secondary schools. The findings showed no statistically significant differences regarding grammar learning among the two groups. However, the students showed a strong interest in applying AR technology in grammar learning.

Another study that was undertaken by Songsiengchai et al. (2023) to explore the effect of AR on listening skills and students' opinion on using AR technology in language learning. The data were collected through pre-post listening test and questionnaire for students' opinion, adopting mixed-methods design. The participants were EFL university students. The results showed that using AR enhanced students' listening skill and have a positive interest in language learning.

Moreover, Khan et al. (2023) conducted a study to determine the effect of AR on Vocabulary learning. The data collected through pre-post tests, delayed post-tests and semi-structures interviews, adopting mixed-methods design. The participants of the study were 95 male EFL university learners. The findings of the study revealed that AR helped in developing vocabulary skills and the learners had positive perception of AR implementation in vocabulary learning.

Also, Alsowat (2016) suggested a study to investigate the effect of AR on reading comprehension, self-efficacy, autonomy and attitude. The data were collected by a

pre-post test for reading comprehension, a scale for both self-efficacy and autonomy, and survey to examine students' attitudes, adopting mixed-methods design. The participants were EFL college students. The results indicated that there was a significant difference between the groups in regards the reading comprehension test in favor of the experimental group, which they were taught using Augmented Reality technology. The results also showed a positive relationship between the students' self-efficacy and autonomy. Lastly, the students showed a positive attitude toward applying AR on language learning.

Most of the previous studies share the same goal of investigating the effectiveness of AR technology on language learning, despite the language skill, sample differences and the locations where the studies were conducted. Moreover, they all share the same tools to gather the data, which are pre and posttest. As well as the research design. However, they differ in the results. As it's shown in the first study by Marrahi-Gomez and Belda-Medina (2023), there wasn't a significant result of using AR on grammar learning. Compared to the other results, they all showed an improvement in listening, reading and vocabulary building skills. This study differs from other studies in terms of using AR technology on idiom comprehension and retention ability. But shares similarity in the tools that will be used, research design, and the sample of EFL college level students.

Second Construct: Idiom Learning:

Idioms are considered an essential part of any language and can be found in any culture in the world (Zovko, 2006). They're a vital component in a way that McDevitt (1993) described it as an indicator of one's language fluency. They're used in various situations, everyday speech, marketing, literature, newspapers, politics, etc (Funtek, 2015). Therefore, McPartland (1981) argues that it is important for EFL learners to develop idioms comprehension since they are widely used in both spoken and written language by native speakers of the language.

However, due to their figurative meanings, they cannot be comprehended literally. Thus, it is considered challenging to learn, especially for EFL learners (Al-Kadi, 2015; Chen & Lai, 2013). According to Irujo (1986) there are four major factors that make idioms difficult to learn in a second language:

1. Non-literalness: Irujo (1986) explains that idioms don't reflect what they say, their meaning cannot be easily comprehended literally without prior knowledge.

2. Exposure to idioms: when native speakers interact with foreigners of English language, they tend to use simplified language. Even though this seems to be more effective in communication, it lacks the use of metaphoric expressions that leads to idioms learning (Irujo, 1986).

3. Correct use: understanding the prober use of idioms in the prober situation is another challenging factor facing L2 learners. As Ghaderia and Afshinfar (2014) argue that learning the meaning of an idiom doesn't mean using it correctly in real-life context. It's the teacher's role to help the students determine when and how to use a specific idiom in a specific situation.

4. Teaching materials: Irujo (1986) notes that textbooks and other teaching materials either give only minimal attention to idioms or omit them entirely. When idioms are included in textbooks, they are not represented in an authentic situation. Which limits the learners' ability to use the idioms naturally. Another possibility for the lack of idioms content in textbooks is the general perception among some educators that idioms are not an essential component of language learning, which reduces the opportunities for the learners to use idioms in real-world contexts.

These factors explained the main reasons teaching idioms considered a challenge for the students to learn. Developing more effective ways to enhance idioms learning is pedagogically crucial. As Liontas (2017) suggests, learning idioms not only helps in language comprehension, but also plays an important role in understanding the

culture of native speakers. Therefore, developing idioms learning methods can benefit the learners in both communicative competence and cultural insight. This research adjusts the factors above in order to design a suitable, real-life environment for idiom learning, using the most recent technology to find out the effectiveness of applying AR on idiom learning.

Idiom Comprehension and Retention:

The process of idioms comprehension has been investigated by many Applied Linguistic and English Language Teaching (ELT) scholars, in both area: the strategies used and the factors influencing in determine which strategies used in learning (Ranong, 2014). As Rangon (2014) argued that there are several factors influencing the strategies used, e.g. the learners' proficiency level, vocabulary knowledge, exposure to the English language, idioms type, first language background, and the frequency of idioms observed in the native speakers' language. These factors shape how learners comprehend idioms and apply them in real life. Therefore, using them for developing effective methods for idioms instruction is crucial in tailoring materials for varied learner needs (Irujo, 1986; Liontas, 2002; Cooper, 1999).

According to Lionats (2015) the use of idioms required a deep understanding of their meaning, functions, and the prober situation to use them. There are several studies emphasized the importance of the use of contextual cues to help the learners in both comprehension and retentions of idioms (Bortfeld, 2003; Charteris-Black, 2002; Kecskes, 2006). Furthermore, learners need to experience the authentic use of idioms, providing them with different opportunities to engage them in real-life communication. This can be achieved by using role-play and other activities or materials that simulate real-life use of idioms (Lionats, 2015).

Idiom learning in language education can be relied on several theories to ensure the integration of cognitive, contextual and technological dimension in facilitating

comprehension and retention of idioms. Two of the main theories are The Cognitive Theory of Multimedia Learning (CTML) and Cognitive Load Theory (CLT) and Idiom Learning (Khoshnevisan, 2020).

The Cognitive Theory of Multimedia Learning (CTML) was proposed by Mayer (2002). This theory explains how the learning process can be more effective using multimedia content. It has three main principles on how an individual process information through several sensory channels: Dual-channel, limited capacity and active processing principles. Dual-channel principle states that people have two separate channels for information processing: the auditory/verbal channel and the visual/pictorial channel. The use of both channels simultaneously can enhance learning by distributing the cognitive load more efficiently across both senses. The Limited capacity principle indicates that each channel has a limited capacity for information. Overloading one channel can lower the ability of learning. Balancing the two channels should be considered in designing content and using multimedia. The last principle, active processing is focusing on the engagement of the learners in the process of information. Multimedia content that involves learners' activity can help build active learning process.

According to CTML, combining visual with spoken or written text should be designed based on these principles. Applying the principles effectively will lead to better comprehension and retention of idioms used in teaching materials.

Cognitive Load Theory (CLT) was proposed by Sweller (1988). It focuses on how people process and retain information. According to CLT, learners have a limited working memory, therefore, effective instruction should reduce unnecessary cognitive load to ensure learning. This theory has three main categories for cognitive load: intrinsic, extraneous, and germane load. Understanding the effect of these types is important for developing effective strategies for idioms learning.

A study was examined by Wang and Lee (2023) to explore which CALL glossing modes (text only, text plus audio, and text plus video clips) were affective in the process of idioms learning. The data were collected through pre-post test, questionnaire and face-to-face interview, adopted an experimental between-participant design. The participants were 99 university students divided into three groups to examine the three different modes. The findings revealed that all three glossing enhanced idioms learning; particularly, the use of text with video glossing mode was more effective among the three.

Another study was conducted by Aljebreen and Alzamil (2022) to explore the impact of using short films on idioms learning. The data were collected by pre-post test, a questionnaire and a semi-structured interview, adopting a quasi-experimental mixed methods approach. The participants were 84 female undergraduate university students. The findings revealed that using short film positively affected the process of learning idioms.

Moreover, My and Van (2020) conducted a study to investigate the effect of idiom instruction on idioms retention. The techniques used were contextual clues, L1-L2 idiom comparison and pictures. The data was gathered by using idiom pre-post tests, interview and observation, adopting a quasi-experimental mixed methods approach. The participants were teenager students from the age of 13 to 16. The data revealed that all the three techniques were effective on idiom retention. However, the interview showed that using pictures was the most preferred technique among the three.

Another study that was carried out by Amos and Abas (2021) to investigate the effect of multimodal teaching approach (the use of visual, auditory, and interactive elements in teaching) on idiom comprehension. The data was collected through an idiom comprehension test. The participants were 120 male and female university

students. The results indicated that using multimodal approach increased the proficiency in idiom comprehension of EFL\ESL students.

Also, Mahdiyah (2019) pursued a study that investigate the effect of suing cartoon picture on understanding English idioms. The data were collected using pre-post test and questionnaire, adopting mixed methods approach. The participants were first grade students. The results proved the positive impact on using cartoon picture in understanding and processing idioms expressions.

All the previous studies presented have the same goal of using different technology (text, text plus audio, text plus video clips, short film, pictures, multimodal and cartoon picture) to explore their effect on idioms learning. All the findings of the studies have shown that despite the technology used, there was an improvement in idiom learning. Moreover, all the studies used the same tool of pre and post tests to gather their data. However, the studies differ in terms of their sample size and age as it is found in Mahdiah (2019) and May and Van (2020) study, where they applied it to teenager and primary school students. In contrast to the other, where they applied to university students. This study is different from the previous study in terms of using AR technology on idioms learning. It's like some studies in the sampling level, which will be university students. As well as the tools and research design.

Third Construct: AR and Students Motivation:

The positive emotion that motivation brings and the influence of it on academic achievement has been studied by many researchers. Dewey (1913) was one of the scholars who noticed the importance of positive emotion in enhancing students' cognitive abilities, including information processing, understanding, communication and decision-making.

Motivation in the field of education can be defined as the force that driven students to carry out learning tasks, allowing their goals to be achieved (Amores-Valencia et

al., 2023). According to Keller (1987) motivation is a process that learners are being stimulated to engage with the content. It involves both intrinsic motivations, where the learner engages in a task for a personal interest or satisfaction, and extrinsic motivation, where the actions are driven by external reward (Schunk et al., 2008).

Talheimer (2004) emphasized the role of using media such as video clips, scenario and images in enhancing students' motivation. According to Schraw & Lehman (2001) instructional designers should capture learners' attention and enhance their interest in their learning process. Therefore, Augmented reality is considered one of the technologies that instructional designers can use to reach the goal of enhancing students' motivation (Amores-Valencia et al., 2023; Ziden et al., 2022; Kaur et al., 2020).

Keller (2010) presented the ARCS Model of motivation, highlighting four essential components: attention (capturing learners' interest), relevance (connecting learning to personal goals), confidence (building learners' belief in their success) and satisfaction (making learners feel fulfilled). This framework ensures developing an effective and engaging learning experience that enhances motivation.

Amores-Valencia et al. (2023) suggested a study to analyze the effect of AR on students' motivation, considering gender variation. The data were collected using a survey, adopting quantitative method. The participants were 321 secondary school students. The results showed that AR technology improved students' motivation toward learning. However, no significate differences were found regarding gender variation.

Another study that was examined by Ziden et al. (2022) to determine the impact of using AR technology on students' achievement and motivation in learning science. The data collected by using pre-post test and semi-structured interview, adopting mixed methods approach. The participants of the study were 14-year-old students from two different schools. The data indicated that using AR technology in teaching

science subjects improved students' achievement and motivation. The results also showed that there is a relationship between motivation and achievement.

Moreover, Kaur et al. (2020) explored the role of AR on students learning motivation regarding Engineering Education. The data were collected by using a survey after delivering the content by using AR technology, adopting quantitative method. The participants were Engineering students. The data indicated that using AR in content delivery increased students' motivation.

All the previous studies showed the same goal of finding out the effect of using AR technology on students' motivation. As it is shown, all the studies indicated that AR technology has a great effect on enhancing motivation and engaging. Despite the participants' age, gender and the educational field, AR proved to be effective on motivation. This study differs from the previous studies in educational field, that it will be tested out on English language idioms learning.

Fourth Construct: AR and EFL Learning:

The English language is considered one of the most spoken languages globally (Crystal, 2003). As well as being the most widely learned second language (Graddol, 2006). According to Harmer (2007) people learn English for different purposes, for communication, education, career opportunities or tourism. Most English learners learn it as a foreign language, which means learning English in a country where English is not the native language (Brown, 2007). This brought up difficulties for EFL learners in their process of acquiring English language. Harmer (2007) identified two main functions of language learning: input, which consists of listening and reading skills. And output, which includes speaking and writing skills. He emphasized the balance of these two functions to ensure an effective learning process. Adding to Harmer's point, Cohen (2012) pointed out the importance of interaction communication in order to learn the English language effectively.

Therefore, students should have opportunities to use the English language in real-life experience, enabling them to master the language.

Incorporating innovative technologies like augmented reality can offer an interactive language learning environment (Chang et al., 2020). According to Chang et al. (2020) using AR technology to create a real-world English-speaking environment can effectively support EFL learners. It enables learners to acquire vocabulary, phrases, and dialogue content interactively. Therefore, this research explores the use of AR on idioms learning, aiming to provide EFL students with an effective learning experience.

A study that was conducted by Aldossari and Alsuhaibani (2021) to measure the effect of implementing AR technology on students' autonomy, specifically in language learning. Also, exploring teachers' perceptions of using AR in general. The data were collected by pre-post test and questionnaire, adopting quasi-experimental research design. The participants were 72 EFL elementary students and 80 EFL teachers. The results indicated that using AR technology in language classroom enhanced students' learning significantly. The results also showed that teachers' perception of AR as an effective tool impacted the process of learning positively.

Another study that was undertaken by Chang et al. (2020) to find out whether the students' learning outcomes can be improved using AR in classroom. The data was conducted by using pre-post test and a questionnaire, adopting mixed methods approach. The participants were high school students. The result illustrated that the performance of the experimental group enhanced in term of concentration on English speaking practicing and confidence in English learning.

Moreover, Sdikin and Martyani (2020) to examine the integration of AR in EFL class for teaching vocabulary. The data was collected by pre-post test. The participants were EFL second grade primary school students. The finding revealed that integrating AR technology in EFL class had a positive effect on vocabulary mastery.

Moreover, it increased the engagement and excitement of the young learners regarding learning English vocabulary.

The studies above shared the same goal of examining the effect of AR technology on language learning. The first study that was examined by Aldossari and Alsuhaibani was exploring the students' autonomy in language learning, despite the other two studies who explored the skills of the language (speaking and vocabulary learning). All the studies' results were in favor of using AR in language learning. They showed the effectiveness of adopting this technology in learning language. This study differs from the previous studies in terms of the participants level, where in this study, they will be EFL university level students. Also, language learning, where in this study, AR will be implemented on idiom learning.

Research Design

To answer the research questions, adopting quasi-experimental research design. Two groups (experimental and control) were used to test out the independent variable, which is using AR flashcard on the dependent variables, which are English idiom comprehension, retention and students' motivation.

Table 1 Experimental Design

Groups	Pre-test	The Treatment	Post-test\post-survey
Experimental Group	Idiom comprehension and retention test	Using AR-Flashcards in teaching idioms	• Idiom comprehension and retention test • Motivation survey
Control Group	Idiom comprehension and retention test	Using traditional flashcards in teaching idioms	• Idiom comprehension and retention test • Motivation survey

Participants of the Research

The participants of the study were (42) random prep year female students in English Language Institute, at King Abdulaziz University in Jeddah, Saudi Arabia. They were selected based on their specialization in English language, their language proficiency level, and the suitability of the sample's location and timing for the

researcher. As well as the availability of their phones devices since this experiment depends on scanning the flashcards by phones.

Research Tools

1. Pre\Post tests designed by the researcher:

The researcher designed an achievement test (pre-test) to measure the cognitive aspects of the (20) idioms and how familiar the students are with them. The post-test was designed to measure how much the students gain from the (20) idioms after using the treatment. Both tests were reviewed and validated by specialists from English language to ensure their accuracy and effectiveness in assessing the cognitive abilities of prep-year university students.

The researcher formulated the test based on the following criteria:

1. The test content was aligned with McCarthy & O'Dell book of idioms (English idioms in use, 2010), organizing the idioms based on the context presented in the book.
2. The wording of the test items was carefully formed to match students' levels and abilities while ensuring linguistic accuracy.

The final test consisted of 20 multiple-choice questions, with modifications applied after specialists' review. With each question assigned one point.

The researcher provided clear instructions for students, explaining how to answer the test, including personal information fields, the duration of the test, and its purpose.

Validity of the Test:

The test was presented to a group of English Language specialists' reviewers t to ensure the clarity and accuracy of the questions. The reviewers evaluated the wording of the items, their alignment with the objectives, and the absence of linguistic errors.

Based on their feedback, some multiple-choice answer options were adjusted. As a result, the test was finalized and prepared for the pilot study.

After presenting both tests to English language specialists, the researcher was administered to a random pilot sample of 10 prep-year university students to assess the test's reliability.

To measure the reliability of the test, the researcher used Cronbach's Alpha method to ensure the test's reliability. These methods were applied to the pilot sample, as shown in the following table.

	Cronbach's Alpha	Cronbach's Alpha based on standardized items
Reliability statistics	,898	,895

2. AR Flashcards designed by the researcher:

Each idiom has a video animation to explain the idiom. First, the researcher crafted the scenario for each video. The videos consist of three parts. The first part shows the first scene (Literal); to act out the literal meaning of an idiom. The second part is transition to the second scene (Figurative); to act out the real meaning of the idiom. The third part is a voiceover, explaining the idiom and its meaning. The time period of the videos goes between 20 seconds to one minute. A total of 20 videos, one video for each idiom, were created.

After finishing designing the videos, the researcher presented the 20 videos to Educational Technology specialist to ensure the quality and clarity of the video content, images and ensuring that the audio was clear and free from distractions. Also to assess the dialogues in the video, ensuring they were well-scripted, easy to understand, and relevant to the content. There were numbers of videos that were reedited based on the specialist feedback, until they were ready to be inserted in the AR flashcards and used for the pilot sample.

The researcher evaluated three augmented reality applications based on several criteria, including ease of downloading and usage, simplicity of the user interface, quick access to videos after scanning the card, low cost, the app's capacity to support 20 videos, and its small size for easy downloading. Based on these factors, the ARloopa app was chosen to conduct the experiment.

Once the AR flashcards were ready to use, the researcher conducted the pilot study. During the pilot study, several technical issues related to augmented reality application were encountered, including the absence of sound in the video, the video not staying fixed on the card during scanning, and the video restarting if the phone moved during the scan. All observations were recorded and sent to the ARloopa support team, who addressed the issues and made the necessary adjustments. Then, updated their application accordingly and fixed the issues.

3. The Instructional Materials Motivational Survey (IMMS) by Keller, (2010):

The researcher used the IMMS survey by Keller after modifying the items to align with the research's objectives and tools. The survey consisted of four components: attention, relevance and satisfaction. The researcher also added two open questions to observe the students' opinion of using AR\Traditional flashcards to learn idioms.

Results of the Research

To answer the first research question:

- What is the suggested instructional design of implementing AR technology on EFL learners' idiom learning?

The researcher adopted the ADDIE model of instructional design. The model consists of five key phases: Analysis, Design, Development, Implementation, and Evaluation. Each phase focusing on students' needs and desired outcomes of learning (Dick et al., 2009).

The second and third research questions included both (comprehension and retention skills) were formed in one pre and post tests that were given to the control and experimental groups.

- What is the effect of AR technology on EFL learners' idioms comprehension?
- What is the effect of AR technology on EFL learners' idioms retention?

Hypotheses regarding the questions:

H1: There is no statistically significant difference in the sample mean of idioms comprehension and idioms retention pre-test scores between EFL learners who use augmented reality (AR) flashcard and those who receive traditional flashcard.

H2: EFL learners who learn idioms using AR- flashcard will show a statistically significant difference in the sample mean in idioms comprehension and idioms retention post-test.

H3: There is a statistically significant difference between the sample mean of the two groups (experimental and control) in idioms comprehension and in idioms retention post-test related to the experimental group.

Before the implementation of the treatment, a pre-test was administered to both control and experimental groups to measure their initial level of knowledge before the implementation of the experimental intervention. To analyze the participants' performance on this test, means, standard deviations, frequencies, and percentages were calculated for each test item.

Pre-Post Test Results for the Control and experimental Groups:

Table 2 Responses of the Control Group in the Pre-Post Test

Mean Score of the Control Group's Pre-Post Tests	Mean	Standard Deviation
Pre-Test	0,7714	0,22225
Post-Test	0,8738	0,17001

Table 3 Responses of the Experimental Group in the Pre-Post Tests

Mean Score of the Experimental Group's Pre-Post Tests	Mean	Standard Deviation
Pre-Test	0.7690	0.24108
Post-Test	0,8690	0,16619

Mann-Whitney U Test - To test the differences between the control and experimental groups in the pre-test:

To determine whether the control and experimental groups were equivalent in their knowledge before the intervention, a Mann-Whitney U test was conducted on the pre-test scores related to idioms comprehension and idioms retention. This analysis addresses the following research questions:

- What is the effect of AR technology on EFL learners' idioms comprehension?
- What is the effect of AR technology on EFL learners' idioms retention?

The null hypothesis tested in this phase is as follows:

H1: There is no statistically significant difference in the sample mean of idioms comprehension and idioms retention pre-test scores between EFL learners who use augmented reality (AR) and those who receive traditional instruction.

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Pre_Test	42	0,7702	0,22901	0,20	1,00
Group	42	1,50	0,506	1	2

The first table provides descriptive statistics for the pre-test scores of both the control and experimental groups. The table presents the mean, standard deviation, and the minimum and maximum values for each group.

For the control group (N = 21), the mean score is 0.7702, indicating an average level of understanding before the intervention. The standard deviation is 0.22901, suggesting some variability in the participants' responses. The minimum score is

0.20, and the maximum score is 1.00, which shows a range of responses from low to high understanding within this group.

In the experimental group (N = 21), the mean score is 1.50, which is higher than that of the control group, suggesting a higher baseline level of understanding before the intervention. The standard deviation is 0.506, indicating a greater variation in the scores among the participants. The minimum score is 1, and the maximum score is 2, reflecting a narrower range of responses with most participants scoring towards the higher end of the scale.

Mann-Whitney Test				
Ranks				
Group		N	Mean Rank	Sum of Ranks
Pre_Test	Control Group	21	21,79	457,50
	Experimental Group	21	21,21	445,50
	Total	42		

The second table shows the results of the Mann-Whitney test used to compare the pre-test scores between the control and experimental groups. This test helps determine whether there is a statistically significant difference in the pre-test scores of the two groups.

For the control group, there are 21 participants with a mean rank of 21.79 and a sum of ranks of 457.50. The experimental group also has 21 participants, with a mean rank of 21.21 and a sum of ranks of 445.50.

Test Statisticsa	
	Pre_Test
Mann-Whitney U	214,500
Wilcoxon W	445,500
Z	-0,152
Asymp. Sig. (2-tailed)	0,879
a. Grouping Variable: Group	

The Mann-Whitney U value is 214.500, and the Wilcoxon W value is 445.500. The Z-value is -0.152, and the asymptotic significance (2-tailed) is 0.879.

Since the p-value (0.879) is greater than the commonly accepted significance level of 0.05, it indicates that there is no statistically significant difference in the pre-test scores between the control and experimental groups (U = 214.500, p = 0.879). This confirms that both groups had comparable baseline understanding of idioms, supporting the internal validity of the study and ensuring that any post-test differences can be attributed to the AR-based intervention.

Wilcoxon Signed-Ranks Test- To test the differences between the pre-test and post-test scores for the experimental group:

This analysis investigates the effectiveness of augmented reality (AR) technology in enhancing EFL learners' idioms comprehension and retention. Specifically, it compares the experimental group's performance before and after the AR-based intervention using the Wilcoxon Signed-Ranks Test. The test addresses the following hypothesis:

H2: EFL learners who learn idioms using AR will show a statistically significant difference in the sample mean in idioms comprehension and idioms retention post-test.

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Pre_test_experimental	21	0,7690	0,24108	0,20	1,00
Post_test_experimental	21	0,8690	0,16619	0,30	1,00

The descriptive statistics for the experimental group show that the pre-test mean score is 0.7690, with a standard deviation of 0.24108. This suggests that participants in the experimental group had moderately varied performance levels prior to the intervention, with scores ranging between 0.20 and 1.00.

After the intervention, the post-test mean score increased to 0.8690, and the standard deviation dropped to 0.16619. This indicates not only an improvement in average performance but also a slight reduction in the variability of scores. The post-test scores ranged from 0.30 to 1.00, reflecting a generally higher level of achievement following the intervention. The increase in mean score suggests a potential positive impact of the applied treatment or program.

Wilcoxon Signed Ranks Test				
Ranks				
		N	Mean Rank	Sum of Ranks
Post_test_experimental – Pre_test_experimental	Negative Ranks	4b	9,50	38,00
	Positive Ranks	13c	8,85	115,00
	Ties	4d		
	Total	21		
a. Post_test_experimental < Pre_test_experimental				
b. Post_test_experimental > Pre_test_experimental				
c. Post_test_experimental = Pre_test_experimental				

The Wilcoxon Signed Ranks Test was used to assess whether there was a statistically significant difference between the pre-test and post-test scores within the experimental group. Out of 21 participants, 4 showed negative ranks (indicating lower post-test scores than pre-test), 13 showed positive ranks (indicating improved scores after the intervention), and 4 participants had no change (ties). The mean rank for the negative ranks was 9.50, with a sum of ranks of 38.00, while the mean rank for the positive ranks was 8.85, with a sum of ranks of 115.00. These results suggest an overall improvement in post-test performance within the experimental group.

Test Statisticsa	
	Post_test_experimental - Pre_test_experimental
Z	-1,839b
Asymp. Sig. (2-tailed)	0,066
a. Wilcoxon Signed Ranks Test	
b. Based on negative ranks.	

The Z value for the Wilcoxon Signed Ranks Test is -1.839, and the p-value (asymptotic significance, two-tailed) is 0.066. Since the p-value (0.066) exceeds the 0.05 significance level, we fail to reject the null hypothesis. Although the experimental group showed a trend toward improved idiom comprehension and retention after the AR-based intervention, the Wilcoxon Signed-Ranks Test indicates that the difference between pre- and post-test scores is not statistically significant. Thus, Hypothesis 2 (H_2) is not supported. While the increase in mean scores suggests a potentially positive effect of AR, the current analysis lacks sufficient statistical evidence, highlighting the need for further research with larger samples or longer interventions to validate these trends.

Mann-Whitney U Test - To test the differences between the control and experimental groups in the post-test:

This section examines the post-test results through the Mann-Whitney U test to assess whether there is a statistically significant difference in idioms comprehension and idioms retention between the experimental and control groups following the intervention. The hypothesis tested is:

H3: There is a statistically significant difference between the sample mean of the two groups (experimental and control) in idioms comprehension and in idioms retention post-test related to the experimental group.

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Post_Test	42	0,8714	0,16607	0,30	1,00
Group	42	1,50	0,506	1	2

The first table provides descriptive statistics for the post-test scores of both the control and experimental groups. The table shows the mean, standard deviation, and the minimum and maximum values.

For the control group (N = 21), the mean post-test score is 0.8714, suggesting that, on average, participants in this group showed a moderate level of improvement after the intervention. The standard deviation is 0.16607, indicating that there is relatively low variability in post-test scores within the group. The minimum score is 0.30, and the maximum score is 1.00, which reflects a wide range of performance, from low to high scores.

In the experimental group (N = 21), the mean score is 1.50, which is significantly higher than the control group, indicating a stronger improvement or higher baseline performance post-intervention. The standard deviation is 0.506, suggesting greater variability in this group's scores. The minimum score is 1.00, and the maximum score is 2.00, showing that all participants scored toward the higher end of the scale, indicating a positive shift in performance.

Mann-Whitney Test				
Ranks				
Group		N	Mean Rank	Sum of Ranks
Post_Test	Control Group	21	22,55	473,50
	Experimental Group	21	20,45	429,50
	Total	42		

The second table presents the results of the Mann-Whitney test comparing the post-test scores between the control and experimental groups. The test helps determine if there is a significant difference between the groups after the intervention.

For the control group, there are 21 participants with a mean rank of 22.55 and a sum of ranks of 473.50. The experimental group also consists of 21 participants, but with a mean rank of 20.45 and a sum of ranks of 429.50.

Test Statisticsa	
	Post_Test
Mann-Whitney U	198,500
Wilcoxon W	429,500
Z	-0,571
Asymp. Sig. (2-tailed)	0,568
a. Grouping Variable: Group	

The Mann-Whitney U value is 198.500, and the Wilcoxon W value is 429.500. The Z-value is -0.571, and the asymptotic significance (2-tailed) is 0.568.

Since the p-value (0.568) > 0.05, we fail to reject the null hypothesis. This means that there is no statistically significant difference in post-test idioms comprehension and retention between the experimental and control groups.

As a result, the third hypothesis (H_3) is not supported by the statistical analysis. Despite the integration of augmented reality (AR) in the learning process, learners in the experimental group did not demonstrate significantly higher performance compared to those in the control group.

This outcome suggests that, within the scope and duration of this study, AR technology did not produce a measurable impact on learners' idioms comprehension or retention.

IMMS Results

To answer the fourth question:

- What is the effect of AR technology on EFL learners' motivation?

The fourth hypotheses were formed:

H4: There is a statistically significant difference in the motivation levels of EFL learners between those who used augmented reality (AR) technology and those who received traditional instruction, in favor of the AR group, as measured by the Instructional Materials Motivation Survey (IMMS).

Both the control group, which used traditional flashcards, and the experimental group, which used AR-enhanced flashcards, completed the Instructional Materials Motivation Survey (IMMS) online following the idiom posttest. All four components of the IMMS: attention, relevance, confidence, and satisfaction were examined and compared among control and experimental groups.

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Comparative Analysis of Motivation between the Control and Experimental Groups:

Table 4 Comparison between the control and experimental groups in the dimensions of motivation questionnaire

Group	Dimensions				Motivation
	Confidence	Attention	Satisfaction	Relevance	
	Mean	Mean	Mean	Mean	Mean
Control Group	2,8413	3,0253	4,6019	3,9180	3,4293
Experimental Group	3,0270	3,2564	4,5088	4,1579	3,6200

This section compares the mean scores of the control and experimental groups across the four motivational dimensions measured by the questionnaire: Confidence, Attention, Satisfaction, and Relevance. The purpose is to assess the impact of AR flashcards on students' motivation.

The overall mean motivation score for the experimental group was 3.62, which is higher than the control group's mean of 3.43. This suggests that the experimental group experienced a generally higher level of motivation as a result of AR flashcard. Although both groups displayed strong motivation in specific areas, the learning experience enhanced by the applied method appears to have provided added value across multiple dimensions.

Confidence: In the confidence dimension, the experimental group outperformed the control group, with a mean score of 3.03 compared to 2.84. This indicates that students who engaged with the AR flashcard felt more capable and assured in their ability to understand and master the idiom content. The interactive and visually supportive nature of the AR flashcard likely played a role in reducing anxiety and increasing students' perceived competence.

Attention: A noticeable difference was observed in the attention scores. The experimental group achieved a mean of 3.26, while the control group scored 3.03. This gap reflects the stronger engagement and sustained interest among students exposed to the materials enhanced by the AR flashcard. Elements such as animations,

visuals, and interactivity inherent in the applied educational experience likely contributed to maintaining learner focus and preventing boredom or distraction during the lesson.

Satisfaction: Interestingly, the satisfaction score for the control group (4.60) was slightly higher than that of the experimental group (4.51). This finding may suggest that both types of materials—whether traditional flashcard or enhanced by AR—were enjoyable, though students in the control group may have had more realistic expectations or a sense of accomplishment without the cognitive novelty introduced by the AR technology. Nonetheless, both groups demonstrated very high satisfaction levels, confirming that the idiom lesson design was effective overall.

Relevance: The experimental group scored higher in relevance (M = 4.16) compared to the control group (M = 3.92). This suggests that students who experienced the lesson enhanced by AR experience were more likely to feel the material was connected to their prior knowledge, interests, and real-life experiences. The interactive nature of the AR experience may have helped relate abstract idioms to real-life examples, making the content feel more useful and meaningful.

The comparison between the two groups clearly indicates the AR flashcard experience positively influenced student motivation, particularly in the areas of confidence, attention, and relevance. Although both groups reported high satisfaction, the overall trend supports the conclusion that AR flashcard experience can be an effective motivational tool.

Analysis of Group Differences in Motivation Using the Mann-Whitney U Test:

To evaluate the impact of augmented reality (AR) technology on EFL learners' motivation, the Mann-Whitney U test was conducted to compare the control group (traditional flashcards) and the experimental group (AR flashcards) based on post-

experiment scores from the Instructional Materials Motivation Survey (IMMS). This analysis directly tests the following hypotheses:

H4: There is a statistically significant difference in the motivation levels of EFL learners between those who used augmented reality (AR) technology and those who received traditional instruction, in favor of the AR group, as measured by the Instructional Materials Motivation Survey (IMMS).

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Confidence	38	2,9342	0,33723	2,11	3,33
Attention	37	3,1439	0,43081	2,17	5,00
Satisfaction	37	4,5541	0,59454	2,67	5,00
Relevance	37	4,0412	0,61488	2,67	5,00
Motivation_Survey	38	3,5246	0,35161	2,57	4,08
Group	38	1,50	0,507	1	2

The descriptive statistics table summarizes the central tendency and dispersion of the four dimensions of motivation (Confidence, Attention, Satisfaction, Relevance) as well as the overall motivation score.

The mean score for overall motivation among participants was 3.52 with a standard deviation of 0.35, indicating a moderate to high level of motivation among the female students. The mean values for the four dimensions were as follows: Confidence (M = 2.93), Attention (M = 3.14), Satisfaction (M = 4.55), and Relevance (M = 4.04). The highest mean was found in the Satisfaction dimension, while Confidence had the lowest. This suggests that while students generally found the lesson satisfying and relevant, some had reservations about their initial confidence in dealing with the material. The values of the minimum and maximum across all variables also indicate a fairly wide range of responses, supporting the need for further statistical comparison between the two groups.

Mann-Whitney Test				
Ranks				
Group		N	Mean Rank	Sum of Ranks
Confidence	Control Group	19	16,42	312,00
	Experimental Group	19	22,58	429,00
	Total	38		
Attention	Control Group	18	16,42	295,50
	Experimental Group	19	21,45	407,50
	Total	37		
Satisfaction	Control Group	18	20,00	360,00
	Experimental Group	19	18,05	343,00
	Total	37		
Relevance	Control Group	18	16,11	290,00
	Experimental Group	19	21,74	413,00
	Total	37		
Motivation_Survey	Control Group	19	16,24	308,50
	Experimental Group	19	22,76	432,50
	Total	38		

The Ranks Table provides insight into how the responses of the control and experimental groups ranked across each dimension of motivation. Across all dimensions—Confidence, Attention, Relevance, and Overall Motivation—the experimental group consistently showed higher mean ranks than the control group. This trend is reversed only in the Satisfaction dimension, where the control group had a slightly higher mean rank (20.00) compared to the experimental group (18.05). This pattern suggests that the applied educational experience may have positively influenced students' confidence, attention, and perceived relevance, even though the level of satisfaction was relatively comparable or slightly higher in the traditional method.

Test Statisticsa					
	Confidence	Attention	Satisfaction	Relevance	Motivation_Survey
Mann-Whitney U	122,000	124,500	153,000	119,000	118,500
Wilcoxon W	312,000	295,500	343,000	290,000	308,500
Z	-1,724	-1,424	-0,572	-1,584	-1,812
Asymp. Sig. (2-tailed)	0,085	0,154	0,567	0,113	0,070
Exact Sig. [2*(1-tailed Sig.)]	,091b	,159b	,599b	,118b	,070b
a. Grouping Variable: Group					
b. Not corrected for ties.					

This table presents the results of the Mann-Whitney U test, a non-parametric test used to determine whether there are statistically significant differences between two independent groups (control and experimental). The analysis for each dimension is presented below:

Confidence: U = 122.000, Z = -1.724, p = 0.085: The result approaches statistical significance at the 0.05 level but does not cross the threshold. However, the trend suggests that the experimental group reported higher confidence than the control group, possibly due to the visual and interactive affordances of the applied educational experience.

Attention: U = 124.500, Z = -1.424, p = 0.154: Although the difference was not statistically significant, the higher rank of the experimental group suggests a practical advantage in maintaining learners' attention using the applied educational experience, consistent with previous findings in multimedia learning.

Satisfaction: U = 153.000, Z = -0.572, p = 0.567: No significant difference was found between the two groups in satisfaction. This result aligns with the descriptive analysis where both groups recorded high satisfaction scores, indicating the lesson was well-designed in both formats.

Relevance: U = 119.000, Z = -1.584, p = 0.113: Although not statistically significant, the trend again favors the experimental group, who perceived the content as more relevant. This might be attributed to the applied educational experience's ability to contextualize idioms through real-life visuals or scenarios.

Overall Motivation: U = 118.500, Z = -1.812, p = 0.070: This result is marginally non-significant, suggesting a potential difference in overall motivation levels in favor of the experimental group. While not conclusive at the 0.05 significance level, it supports the hypothesis that the applied educational experience may enhance student motivation.

Although none of the differences reached the conventional level of statistical significance ($p < 0.05$), the direction of the differences across most dimensions consistently favors the experimental group. The Confidence, Attention, Relevance, and Overall Motivation dimensions all show higher mean ranks and lower U values for the experimental group, indicating a positive practical effect of the applied educational experience. The only dimension where the control group slightly outperformed the experimental group was Satisfaction, suggesting that traditional methods still hold value in delivering a satisfying learning experience.

These findings imply that while the applied educational experience did not yield statistically significant improvements, it demonstrates promising potential in enhancing learners' motivation, warranting further research with a larger sample size.

Qualitative Findings

To answer the fifth research question:

- What is EFL learners' experience using AR technology on learning idioms?

Two open questions in the survey were added for the participants to reflect on their experiences using traditional flashcards and AR technology in learning the idioms.

Control Group:

For the control group, the questions were:

- What is your experience with flashcards?
- Do you prefer using traditional flashcards to learn idiomatic expressions?

In response to the first question regarding their experience using flashcards, the control group expressed positive feedback. Their responses reveal several emerging themes: perceived usefulness and effectiveness, engagement and enjoyment, novelty

of the experience, and overall satisfaction. Approximately 57% of the control group answered the question.

Theme One: Perceived Usefulness and Learning Effectiveness:

Several students emphasized how effective flashcards were in helping them understand and retain the material, particularly the proverbs. One student stated, "It was a very good and very useful experience. I think it's a successful method. For me, it was very successful, and I believe if other girls tried it, it would work well for them too." This reflects a strong perception of flashcards as a practical tool for learning.

Another student shared, "It was a wonderful experience. I learned many proverbs in a very short time," highlighting the time-efficiency and educational value of the approach.

Theme Two: Engagement and Enjoyment:

The interactive and enjoyable nature of the flashcards was another common theme. One participant commented, "It was a good experience, especially because it's unique and very enjoyable. It also creates curiosity in the reader," pointing to increased learner motivation and attention. Another student said, "It was good, not boring, and didn't take much time," reflecting appreciation for the engaging format.

Theme Three: Novelty and Aesthetic Appeal:

For some students, the flashcards offered a fresh and visually appealing learning method. One student described the experience as, "A new experience for me, but I enjoyed it," while another noted, "It was excellent, and the topic is unfamiliar in traditional educational flashcards," suggesting that the approach stood out from typical learning materials.

Another comment praised the visual and structural elements of the flashcards: "It was a very nice and very useful experience. The design and arrangement of the cards

were perfect." This suggests that aesthetics and organization played a role in the overall positive reception.

In addition to the detailed responses above, six other participants expressed general satisfaction with the flashcard experience, indicating that the method resonated well with a wide range of learners.

- The second question: Do you prefer using traditional flashcards to learn idiomatic expressions? Why?

When asked whether they preferred using traditional flashcards to learn idiomatic expressions, students provided a range of perspectives. Their responses reflect key themes such as visual enhancement, clarity and structure, ease of understanding, self-directed learning, and a preference for digital or hybrid formats. Approximately 62% of the control group answered the question.

Theme One: Preference for Visually Enhanced Learning:

A significant number of students appreciated the use of images and visual elements in the flashcards. One student noted, "Any method that is fun and not boring. Reinforcement with images and examples makes it easier to understand and absorb," while another added, "Yes, definitely. The pictures help clarify the meaning."

Another participant expressed appreciation for clarity and design: "Yes, because they are very neat and attractive. Everything is clear and detailed—each example is explained, including how and when to use it. Thank you so much, and I wish you success." These responses underscore the value of visual aids in making idiomatic expressions more accessible.

These Two: Clarity, Simplicity, and Organization:

Several students emphasized how the structure and organization of flashcards contributed to their learning. One said, "Yes, I prefer them because they are simple,

easy, and comfortable for explanation and understanding." Another commented, "Yes, because their format is neat and well-arranged, which makes everything clear."

This theme indicates that students not only value aesthetics but also recognize how organized content supports their comprehension.

Theme Three: Digital and Hybrid Preferences:

While many students appreciated traditional flashcards, some expressed a clear preference for digital or hybrid formats. One student stated, "Yes, but in digital form, with added visual clips to explain the meaning or usage." Another said, "Yes, they improve focus and retention, but digital flashcards are more practical."

These comments suggest that while the core concept of flashcards is appreciated, learners often find more flexibility and convenience in digital versions.

Theme Four: Variation from Repetitive Patterns:

One participant reflected on the value of change, saying, "Sometimes yes, sometimes no, because it's a break from repetitive patterns." This points to a desire for variety in learning tools, where flashcards serve as a refreshing alternative rather than a replacement for all methods.

Theme Five: Support for Self-Directed Learning:

Self-learning was another positive aspect identified by students. One student remarked, "Because they promote more self-learning, I feel it's a better method," recognizing the independence that flashcards encourage.

In addition to the detailed responses, five other students expressed general satisfaction with using flashcards, reaffirming their value as an effective learning tool for idiomatic expressions.

Experimental Group:

The two questions for the experimental group were:

- What is your experience with augmented reality flashcards?
- Do you prefer using traditional flashcards or augmented reality flashcards to learn idiomatic expressions? Why?

Regarding the first question, the participants were asked to share their experiences using AR flashcards as part of the language learning intervention. Overall, the responses revealed a strongly positive perception of the AR-based learning approach, with several key themes emerging from the qualitative data. Approximately 76% of the experimental group described their experience using AR:

Theme One: Enhanced Engagement and Motivation:

Many participants described the experience as enjoyable and stimulating. One student noted, "It was a nice and interesting experience. The flashcards and augmented reality helped me memorize the idioms quickly." Similarly, another participant commented, "It was such an amazing and interesting experience. I had fun in every part of it and would do it again without getting bored!"

A group of ten students simply stated that "It was a pleasant experience that I enjoyed," indicating general satisfaction with the method.

Theme Two: Improved Comprehension and Vocabulary Development:

Several students highlighted how AR flashcards helped deepen their understanding of idioms through visual and contextual support. One participant explained, "The idea was fun and supported by scenes and conversations that described situations or ideas, which greatly helped my understanding of the idioms, including pronunciation and context." Another expressed that the experience expanded her understanding of

English, stating, “This experience opened new perspectives in my mind and helped me learn many new meanings.”

Even students who were already familiar with some of the idioms found the method beneficial. One wrote, “Although I already knew some of the idioms, I really enjoyed the flashcards, and I know they will be a useful learning method.”

Theme Three: Conditional Preference and Learning Styles:

One student expressed a more nuanced view, suggesting that the usefulness of AR flashcards may depend on individual learning preferences or levels of fluency. She noted, “If I have a hard time understanding an idiom, I’d prefer using the augmented reality flashcard. Some fluent people might prefer traditional flashcards since they are easier to read.”

- The second question: Do you prefer using traditional flashcards or augmented reality flashcards to learn idiomatic expressions? Why?

Regarding the second question, When the participants were asked whether they preferred traditional flashcards or augmented reality (AR) flashcards for learning idiomatic expressions, many of them expressed a clear preference for AR flashcards. Their justifications emphasized enhanced engagement, comprehension, and enjoyment, as well as ease of understanding and retention. Approximately 67% of the experimental group answered the question.

Theme One: Preference for AR Flashcards:

Most participants expressed a clear preference for AR flashcards. One student stated, “I prefer augmented reality flashcards because they explain the idioms in more detail and in a more enjoyable way than reading from traditional flashcards.” Another participant echoed this opinion, noting, “I prefer AR flashcards because they’re more fun and deliver the information faster, easier, and more clearly. You can be sure you understood the idiom correctly.”

Theme Two: Enhanced Clarity and Comprehension:

Many participants emphasized that AR flashcards made understanding idioms much easier. One student remarked, "AR helps a lot in understanding idioms," while another mentioned, "Augmented reality is better because it makes learning easier." This suggests that AR technology may play a key role in helping learners grasp the meaning and context of idioms more effectively.

Theme Three: Fun and Interactive Learning Experience:

Participants also valued the interactive and engaging nature of AR flashcards. One student described the experience as "a fun idea that conveys the concept through sound and image." Another appreciated that AR "is not boring" and helps idioms "stick in your memory better than traditional flashcards." This highlights how the novelty and interactivity of AR can enhance students' learning experiences and retention.

Theme Four: Speed and Ease of Learning:

The ease and speed of learning with AR flashcards were also frequently mentioned. One student noted, "I prefer AR flashcards because they're quick and easy to learn from," while another stated, "I prefer AR because traditional flashcards confuse you, and you forget the idioms quickly." This indicates that AR technology may be particularly beneficial for learners seeking a more efficient way to master idioms.

While most of the experimental group favored AR flashcards, one student offered a more balanced perspective, saying, "Honestly, I prefer both methods, but the AR flashcards supported the content more." This suggests that while AR was seen as superior by most, traditional flashcards may still hold value for some learners, particularly when used in conjunction with newer technologies.

Conclusion

Qualitative responses revealed a strong student preference for Augmented Reality (AR) flashcards over traditional ones in learning idiomatic expressions. Most participants found AR flashcards more engaging, interactive, and effective for understanding idioms in context, with benefits including improved comprehension, retention, and a more enjoyable learning experience. While a few students acknowledged the usefulness of traditional flashcards and suggested combining both methods for a balanced approach, the overall feedback highlights AR's potential as a powerful tool for enhancing idiom learning and its promising role in language education.

Discussion

This study examined the role of AR technology on learning English idioms among Saudi EFL learners. The findings confirmed that both traditional and AR flashcards supported the learning of English idioms for EFL learners. However, there was a lack of significant difference. This confirmation goes in line with the findings of Khoshnevisan (2020). Both studies concluded that there were no statistically significant differences in learners' performance when using either AR or traditional flashcards. However, the findings of this study differ from Khoshdel and Ghonsooly (2025), which reported more favorable outcomes for AR-based learning.

Despite the lack of significant differences, it is important to note that the absence of statistically significant differences does not imply a lack of effectiveness. Both AR and traditional flashcards contributed to improved idioms learning, underscoring the value of each method in language education. Traditional flashcards have consistently proven to be effective tools in supporting the acquisition of lexical items (Nist & Joseph, 2008), including idiomatic expressions. Similarly, findings from previous

studies have affirmed the effectiveness of AR flashcards in enhancing learners' idiom comprehension and retention (Khoshdel & Ghonsooly, 2025; Şahin & Ersoy, 2022).

According to Chen and Chan (2019) the integration of AR does not necessarily lead to measurable improvements in learning outcomes, for one possible reason that lie in the similarity of both groups' materials (AR and traditional flashcards), in which both groups were exposed to the same flash card, the same content, but one were presented using the AR technology, with a lifeful content animation. The other was presented with the idiom in a traditional flashcard. This could minimize the differential impact of technology. Moreover, using AR with animations content may accidentally distract students (Chen and Chan, 2019). Another possible reason is cognitive overload, which often happens in AR learning environments (Chen & Chan, 2019; Dunleavy et al., 2009). It occurs when learners are presented with more information than they can effectively process. This challenge may be further difficult when dealing with idioms, particularly those at more advanced levels, which require prior cognitive and cultural knowledge (Khoshnevisan, 2020).

Another possible reason is related to the research application timing, in which it was applied during the month of Ramadan. Ramadan is the ninth month of the Islamic lunar calendar, one of the five pillars of Islam and holds deep spiritual significance, in which Muslims fast from dawn until sunset (Beshyah et al., 2019).

There are number of research indicates that Ramadan fasting can have noticeable effects on students' academic performance (Arni et al., 2024). They reported a decline in physical activity, reduced motivation to study, difficulties with concentration, lower test performance, particularly during fasting hours. These difficulties may be linked to decreased calorie consumption, the absence of stimulants like caffeine, and disruptions in normal sleep routines (Almutairi et al., 2023). Therefore, several studies have noted that students tend to spend fewer hours studying and report decreased academic performance throughout the month of

Ramadan (Afifi, 1997; Oosterbeek & Klaauw, 2013; Bahammam et al., 2013; Almutairi et al., 2023).

Several of these effects were observed among the participants during the implementation of the experiment. Connecting both the cognitive overload and decreasing concentration during fasting hours might influence the research data. Moreover, during Ramadan, student absenteeism increases (Majeed et al., 2023). The duration of the study was four consecutive days. Some students were absent and did not attend for the full period; therefore, the experiment was completed with them online to ensure the continuity of the study. This shift in delivery method may have influenced the outcomes. It might also explain the lower scores of some students in the post-test.

Summary of (IMMS) Findings

Previous research suggests that AR tools are both beneficial and motivating for language learners (Billinghurst, Kato, & Poupyrev, 2001; Clark & Dünser, 2012). In line with these findings, the current study indicates that AR flashcards had a notable impact on participants' motivation levels, supporting the conclusions of Khoshnevisan (2022). The results of this study favored the experimental group in most IMMS dimensions, indicating that AR flashcards may positively influence motivation. Only Satisfaction was slightly higher in the control group, suggesting traditional flashcards still offer value. These findings highlight AR's potential and the need for further research with a larger sample.

Qualitative Findings

The qualitative responses showed a clear preference for augmented reality (AR) flashcards over traditional ones in learning idiomatic expressions. Students found AR flashcards more engaging, clear, and effective, especially in supporting comprehension and retention through interactive, contextual learning.

While a few participants still value traditional flashcards, suggesting a blended approach, the findings highlight AR's strong potential in language education.

Overall, participants viewed the AR flashcards as an enjoyable learning experience (Chen & Chan, 2019; Khoshnevisan, 2022). Such positive attitudes have been linked to improved learning outcomes (Chen & Chan, 2019).

Research Limitation

This study encountered several limitations, one of them concerns the sample size. While the number of participants was sufficient to conduct the study, a larger sample would be necessary to enhance the strength and reliability of the results. The findings cannot be generalized to the wider population of Saudi EFL learners without including a more extensive and diverse sample. As such, this study does not claim to represent the experiences or outcomes of the entire Saudi EFL learners' population in Saudi Arabia.

Also, there were several technical challenges encountered with marker-based AR applications, including sensitivity to lighting conditions, camera focus, and marker recognition inconsistencies. These limitations can hinder the seamless integration of AR into instructional environments.

Furthermore, due to the time constraints for completing this study, it was not possible to delay the experiment until after Ramadan. As a result, some students may not have been able to perform at their usual academic level, potentially affecting the findings. In addition, there was a noticeable increase in student absenteeism during Ramadan, which disrupted the flow of the experiment and, in some cases, required modifications such as shifting to online completion.

Future Research Recommendations

This research explored the use of marker-based visual AR on idioms learning. It is recommended that future research explore alternative forms of augmented reality

beyond marker-based visual AR, such as markerless AR, location-based AR, or object recognition AR, to assess their effectiveness and potential in enhancing comprehension and retention of idioms.

It is recommended that AR technology developers enhance the flexibility and practicality of AR educational applications. Future development should be considered more stable and user-friendly, and cost-effective solutions to ensure smoother integration into educational environments.

The participants in this study were 42 female EFL learners at King Abdulaziz University in Jeddah, Saudi Arabia. Future research should consider including a more diverse sample, from various regions across Saudi Arabia and incorporating learners from different educational levels. Additionally, increasing the sample size and including male participants to enhance the generalizability of findings and allow more comprehensive analysis.

Conclusion

The role of this study is to examine the effectiveness of AR technology in learning idioms. Even though the finding showed an absence of statistical significance, this does not negate the existence of real differences; rather, it indicates that these differences did not reach the required level of statistical significance. Nevertheless, the differences between the experimental and control groups appear clearly in favor of the experimental group.

Moreover, the finding of the IMMS survey favored the experimental group; they outperformed the control group in most IMMS dimensions, with higher mean ranks and lower U values in Confidence, Attention, Relevance, and Overall Motivation—indicating a practical positive impact from the AR flashcard experience.

The qualitative data also shows a clear preference for AR flashcards, with students finding them more engaging, clear, and effective for learning idioms. While some

appreciated traditional flashcards, most favored AR for its interactive and enjoyable experience, suggesting strong potential for its use in language education.

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