

EFL STUDENTS' ATTITUDES TOWARD AUGMENTED REALITY– BASED VOCABULARY LEARNING AT THE UNIVERSITY OF PRINCE MUQRIN PREP YEAR PROGRAM

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ABSTRACT

This research investigated female EFL preparatory-year students' attitudes toward integrating Augmented Reality (AR) in vocabulary learning at the University of Prince Muqrin in Medina, Saudi Arabia. Grounded in the Technology Acceptance Model (TAM), the study adopted a descriptive correlational survey design. The target population consisted of 152 Level 2 female preparatory-year students, and the final sample included 117 valid responses. Data were collected through a structured questionnaire covering four dimensions: perceived usefulness, ease of use, enjoyment, and willingness to continue using AR. Before data collection, six AR-based vocabulary activities were implemented using Unity and QR-code-supported image-tracking technology. The data were analyzed using descriptive statistics and correlation analysis through SPSS. The findings showed that students generally held positive attitudes toward AR integration in vocabulary learning. Perceived usefulness recorded the highest mean score, followed by ease of use, enjoyment, and then willingness, with all four dimensions remaining at a high level. Significant positive correlations were also found between perceived usefulness, ease of use, enjoyment, and students' willingness to continue using AR. The study concludes that AR can provide engaging and interactive vocabulary learning experiences in EFL classrooms.

Keywords: Augmented Reality, vocabulary learning, EFL learners, students' attitudes.

1.0 CHAPTER ONE

1.1 Introduction

In contemporary language education, effective communication depends largely on learners' ability to develop the four core language skills, which is difficult to achieve without sufficient vocabulary knowledge (Richards & Rodgers, 2014; Binhomran & Altalhab, 2021; Nabil et al., 2023). Vocabulary is central to language proficiency across contexts (Amin, 2025; Maysaroh, 2024) and directly influences EFL learners' ability to master the language (Khan et al., 2023; Lutfiyah et al., 2022). However, vocabulary learning remains challenging because it involves meaning, pronunciation, spelling, appropriate use, and syntactic and semantic features (Tsai, 2020; Rohmatillah, 2014; Lutfiyah et al., 2022), while EFL learners often face limited exposure to English outside the classroom and rely on rote memorization methods that lack meaningful context (Alqahtani, 2015; Aljasir, 2025; Amin, 2025). Since successful vocabulary learning requires motivation, noticing, retrieval, and meaningful contextual connections (Nation, 2001), modern technologies such as Augmented Reality (AR) may offer promising opportunities by

blending virtual and real-world elements to create rich and interactive learning experiences (Hikam et al., 2025; Khan et al., 2023; Binhomran & Altalhab, 2021), particularly as the gap between students' technology-rich lifestyles and traditional teaching practices may reduce their motivation and interest in learning (Shaman, 2023).

Therefore, this study aims to investigate female EFL prep-year students' attitudes toward the integration of AR into EFL classrooms to enhance vocabulary learning. It also explores perceived usefulness, ease of use, enjoyment, and willingness to continue using AR in the future.

1.2 Statement of the Problem

Vocabulary is a core component of language proficiency, yet its acquisition remains challenging because it involves not only meaning but also pronunciation, spelling, writing, grammar, and appropriate use (Tsai, 2020; Rohmatillah, 2014). Based on seven years of EFL teaching experience, the researcher observed that maintaining students' attention and engagement is particularly difficult during long afternoon sessions, especially with excessive phone use, which may contribute to weak vocabulary retention and difficulty acquiring new vocabulary. To address this issue, educational technology can make vocabulary learning more attractive and engaging, and Augmented Reality (AR) may provide interactive, immersive, and context-based environments that enhance learners' engagement and vocabulary retention (Binhomran & Altalhab, 2021). However, limited attention has been given to EFL students' attitudes toward using AR to enhance vocabulary learning and engagement in Saudi higher education. Therefore, there is a need to identify students' attitudes toward using AR to enhance vocabulary learning and engagement in this context.

1.3 Research Questions

1. What are EFL students' attitudes toward the integration of AR in vocabulary learning?

From the main question, the following sub-questions emerge:

1.1 To what extent do EFL students perceive AR as useful for improving vocabulary acquisition?

1.2 To what extent do EFL students perceive AR as easy to use within the classroom context?

1.3 To what extent do EFL students find the use of AR for vocabulary learning enjoyable?

1.4. To what extent are EFL students willing to continue using AR for vocabulary learning in the future?

2. Is there a significant correlation between the three dimensions (perceived usefulness, ease of use, and enjoyment) and EFL students' willingness to continue using AR for vocabulary learning?

1.4. Research Hypothesis

1. There is a statistically significant positive correlation between the three dimensions (perceived usefulness, ease of use, and enjoyment) and EFL students' willingness to continue using AR for vocabulary learning.

1.5 Significance of the Research

1.5.1 Theoretical Significance

1. This research may provide theoretical insights that enhance learners' autonomy, contextualized learning and real-world application via AR integration (Aldossari & Alsuhaibani, 2021; Khan et al., 2023).
2. It may provide a foundation for further research regarding Mobile-Assisted Language Learning (MALL).

1.5.2 Practical Significance

1. For Teachers: Applying AR technology in the field of learning, especially in English classes, increases EFL learners' engagement, interest, and motivation (Amin, 2025; Belda-Medina, 2022).
2. For Institutions: Being a practical model for other EFL classrooms in institutions that seek achievement of the learning outcomes with the latest approaches of pedagogy.
3. For Curriculum Designers: Encouraging curriculum designers and publishers to integrate AR activities within the books of students via embedded QR codes.
4. For Other Researchers: Providing insights to other researchers who are interested in exploring EFL learners' perceptions toward AR practices in EFL classes.

1.6 Definitions of the Terms

1.6.1 Augmented Reality

According to Shaman (2023), AR is defined as 'mixed realism' in which there is "an interactive browser experience superimposed promptly over a live, physical setting with seamless integration." She added, "It combines both the real and virtual world." (p. 323). Users can have a chance to interact with virtual objects that are integrated into real scenes around them.

Procedurally, AR technology refers to the combination of the virtual and real worlds, using a smartphone as a medium to scan markers and run AR applications such as Assembler Edu, HP Reveal, or JigSpace. Through these applications, EFL learners interact with texts, 3D models, and videos related to the target vocabulary.

1.6.2 Attitudes toward AR Integration

This term refers to "the relatively stable overt behavior of a person which affects his status" (Bain, 1928, p. 940). It is also defined "as an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Davis et al., 1989, p. 984). Ajzen (1989) explains that 'attitude' must be inferred from measurable responses which can be categorized into various subgroups, which are: cognition 'beliefs', affect 'feelings', and conation 'behavioral intentions.'

In this research, ‘attitude’ refers to the evaluative effect, beliefs, and behavioral intentions that students associate with using AR in vocabulary classes.

1.7 Delimitations of the Research

The research is delimited to investigating students’ attitudes towards AR in vocabulary learning. It is delimited to 152 female EFL prep-year students at the University of Prince Muqrin (UPM), Medina, Saudi Arabia. It is conducted in the third quarter of the academic year 1447 H (2026).

2.0 CHAPTER TWO

2.1 Vocabulary Learning

2.1.1 Significance of Vocabulary Learning

Vocabulary is widely recognized as the foundation of language learning and effective communication, as it supports learners’ ability to understand, express ideas, and use language successfully. Wilkins (1972) emphasized its importance by stating that “without vocabulary nothing can be conveyed” (p. 111), while Schmitt (2000) and Nation (2001) highlighted the central role of lexical knowledge in second language learning. Since the four language skills cannot be developed effectively without sufficient vocabulary knowledge (Binhomran & Altalhab, 2021), vocabulary is essential for language development, academic progress, confidence, motivation, and overall understanding.

2.1.2 Common Challenges in Vocabulary Learning

EFL learners may face several challenges in vocabulary learning, especially when traditional teaching methods are used. In conventional classrooms, teachers are often the main source of information, while students receive knowledge passively (Alessa & Hussein, 2023). Vocabulary instruction may also rely heavily on lectures, textbooks, repetition, memorization, and direct instruction, which can limit students’ active engagement and contextual use of words (Durga & Sekhar, 2025). Although these methods may provide structure, they may give limited attention to meaning, collocation, and word use in context (García Castañeda, 2020).

Since vocabulary learning requires noticing new words, connecting them with meaning, and retrieving them later, rote memorization and long word lists may increase cognitive load and reduce retention (Weerasinghe et al., 2022). EFL learners may also struggle with pronunciation, sound-spelling mismatches, collocations, idiomatic expressions, register, and words with multiple meanings (Amiryousefi & Dastjerdi, 2010). These challenges highlight the need for more engaging and effective approaches to vocabulary learning in the 21st century.

2.1.3 Potential Solutions for Vocabulary Learning

Effective vocabulary acquisition requires learners to notice, retrieve, use, and negotiate word meanings in meaningful contexts while remaining motivated (Nation, 2001; Weerasinghe et al., 2022). Accordingly, modern student-centered methods are needed to support interaction, collaboration, meaningful practice, learner responsibility, and higher-order thinking skills

(Alessa & Hussein, 2023). Technology can support these goals by providing rich and interactive EFL learning environments that enhance engagement and motivation (Sari, 2024). Within Mobile-Assisted Language Learning (MALL), Augmented Reality (AR) has recently gained increasing attention in vocabulary learning.

2.2 Definitions, Benefits, and Limitations of MALL

Mobile-Assisted Language Learning (MALL) refers to language learning supported by mobile technology (Jabbar, 2024). It allows EFL learners to study anytime and anywhere, work at their own pace, access learning applications, receive feedback, and practice language skills through multimedia resources (Martínez et al., 2025). However, MALL may also create challenges such as distraction, reduced face-to-face interaction, technical difficulties, excessive phone use, and small screen limitations that may affect reading and writing tasks (Kukulska-Hulme, 2018). Therefore, educators need to evaluate mobile applications carefully to ensure their pedagogical suitability and alignment with language learning objectives. Although MALL provides flexible language learning opportunities, AR may offer more interactive and immersive experiences for vocabulary learning.

2.3 Augmented Reality Definitions and Historical Development

Augmented Reality (AR) refers to a technology that superimposes digital content, such as text, images, and animations, onto the user's view of the real world (Peddie, 2017). It is also described as a form of mixed reality that combines real and virtual worlds, allowing users to interact with digital objects embedded in physical settings through smartphones or tablets (Asadi & Ebadi, 2025; Emilia et al., 2025; Nabil et al., 2023; Shaman, 2023). Historically, AR developed from early head-mounted systems in the 1960s to mobile-based applications and games, such as Pokémon GO, which helped pave the way for its educational use (Schmalstieg & Höllerer, 2016; Turns, 2024). There are two major types of AR: vision-based and location-aware. In this research, vision-based AR was used, where a visual marker or QR code triggers digital content when scanned by the student's device (Moran & Rice, 2021).

2.4 AR-Based Vocabulary Learning

2.4.1 Significance and Limitations of AR-based Vocabulary Learning

AR integration into vocabulary classrooms offers several pedagogical benefits. It can help learners understand abstract concepts and difficult vocabulary by presenting information visually and contextually, which may improve vocabulary retention and student satisfaction (Idul & Syaiful, 2024; Maysaroh, 2024; Sadikin & Martyani, 2020). AR also enhances students' engagement, motivation, autonomy, and problem-solving skills by creating a more dynamic and interactive learning environment (Amin, 2025; Khan et al., 2023; Shaman, 2023). In addition, AR supports multimodal learning through audio, video, images, and interactive 3D representations, helping learners understand difficult vocabulary, figurative meanings, and story details more effectively (Asadi & Ebadi, 2025; Moran & Rice, 2021). It may also support critical thinking, collaboration, social interaction, and reduced anxiety in language learning contexts (Bamanger, 2025; Jamrus & Razali, 2019).

The implementation of AR in vocabulary classrooms may face several challenges. Technical and financial constraints, such as the need for internet access and smartphones, can create equity issues if some students cannot afford the required devices (Belda-Medina, 2022; Moran & Rice, 2021; Salehi, 2025). In addition, AR elements such as moving images and animations may distract learners, disrupt natural classroom interaction, or be difficult for some students to use (Jamrus & Razali, 2019). AR may also increase cognitive load and create device-related technical difficulties, while students' engagement may be influenced by the novelty effect rather than the instructional value of the technology itself (Ebadi & Ashrafabadi, 2022).

2.4.2 Learners' Attitudes toward AR Integration

To consider integrating a new method, it is essential to understand how learners view it. Previous studies show that EFL students generally hold positive attitudes toward AR because it can make abstract concepts more tangible, increase engagement, and create immersive learning experiences. Students have reported enthusiasm, motivation, low anxiety, willingness to use AR in future courses, and interest in multimedia interaction through 3D images, videos, and songs (Belda-Medina & Marrahí-Gómez, 2023; Küçük et al., 2014; Moran & Rice, 2021). However, some studies also reported cautious or less positive attitudes toward AR integration. Some students may become overly amused, fail to follow instructions, experience cognitive overload, or prefer to wait until others successfully use the technology before adopting it themselves (Hoang et al., 2022; Ironsi, 2025; Moran & Rice, 2021).

Accordingly, the present research explores EFL students' attitudes toward AR integration in vocabulary learning through the lens of the Technology Acceptance Model (TAM).

2.5 Theoretical Framework (TAM)

This research has been framed within the Technology Acceptance Model (TAM), which is a well-known theory used in studies of technology acceptance and adoption. The model traces back to Davis (1987), who examined users' acceptance or rejection of information systems and explained the relationships between system design features, perceived usefulness, perceived ease of use, attitude toward using, and actual usage behavior. TAM aims to explain and predict users' technology acceptance and to guide practitioners before implementing new systems.

According to Marikyan and Papagiannidis (2024), TAM follows a three-stage process in which external factors influence cognitive responses, such as perceived usefulness and perceived ease of use, which then affect users' attitudes, intentions, and actual use behavior. In the present research, TAM is directly connected to AR-based vocabulary learning. Perceived Usefulness (PU) refers to students' beliefs that AR helps them learn vocabulary more effectively, while Perceived Ease of Use (PEOU) refers to how easy they find AR to use. Attitude Toward Use (ATT) reflects their overall feelings toward AR as a learning tool, and Behavioral Intention (BI) refers to their willingness to continue using AR in future language learning.

TAM is relevant to this research because the adoption of mobile-based educational technologies is often influenced by learners' perceptions of usefulness and ease of use. Since AR is delivered through mobile technology, MALL principles also support TAM by emphasizing autonomy, interactivity, personalization, and portability. However, TAM has been criticized for focusing mainly on cognitive factors while giving less attention to emotional

variables such as enjoyment, which is particularly important in AR-based learning environments.

2.6 Relevant Studies on AR in EFL Classrooms

Augmented reality has received growing attention in EFL classrooms due to its potential to create interactive and engaging learning experiences. The following section reviews previous studies based on the following themes:

2.6.1 Applications used in Previous Studies

Previous studies have employed different AR platforms for vocabulary learning, such as Assemblr Edu, JigSpace AR, HP Reveal, Storybooks Alive, BlippAR, UniteAR, and Wikitude. This variety shows that AR has been implemented through different tools, but it also makes it difficult to determine which applications are most effective across contexts. Therefore, after reviewing available applications, the researcher collaborated with an AR development team using Unity due to time constraints and the limitations of existing applications. Further details are provided in Chapter 3.

2.6.2 Participants and Samples in Previous Studies

The samples in the reviewed studies varied across educational levels and contexts. Several studies focused on school students, including elementary, middle, and high school learners (Bamanger, 2025; Binhomran & Altalhab, 2021; Hikam et al., 2025; Maysaroh, 2024; Sadikin & Martyani, 2020; Shaman, 2023). Other studies examined college students, preparatory-year male students, intermediate and upper-intermediate EFL learners, teachers, or reviewed previous AR-related research (Amin, 2025; Asadi & Ebadi, 2025; Belda-Medina, 2022; Ebadi & Ashrafabadi, 2022; Idul & Syaiful, 2024; Khan et al., 2023; Salehi, 2025). This variation shows that AR has been explored in different educational settings.

Despite the positive findings, several limitations remain. Many studies used small or moderate samples, gender-specific groups, context-limited settings, or short implementation periods, which may limit the generalizability of their findings and may not fully reflect the long-term impact of AR on vocabulary learning (Binhomran & Altalhab, 2021; Khan et al., 2023; Sadikin & Martyani, 2020). Some studies also reported that AR effects may decrease over time, especially in delayed or follow-up assessments (Binhomran & Altalhab, 2021; Salehi, 2025).

2.7 Gap in Literature

Although AR has been widely reported to enhance vocabulary learning, three key gaps remain. First, most studies focus on school-level learners, limiting the applicability to higher education contexts. Second, existing research predominantly measures learning outcomes rather than learners' attitudinal acceptance, a crucial factor for sustained technology integration. Third, few studies adopt a well-established theoretical framework, such as the TAM, to explain how and why students accept AR tools. Therefore, this study addresses these gaps by examining Saudi university EFL students' attitudes toward AR-based vocabulary learning through TAM.

3.0 CHAPTER THREE

3.1 Methodology

3.2 Research Design

The research employs a descriptive correlational survey design to investigate EFL students' attitudes toward the integration of AR in vocabulary learning. This design is appropriate because it provides a quantitative description of students' attitudes and allows the researcher to examine relationships among the main TAM constructs (Creswell, 2012). The research was grounded in TAM, which explains technology acceptance through perceived usefulness, perceived ease of use, and behavioral intention. A structured questionnaire based on TAM dimensions was used to collect quantitative data, which were analyzed using descriptive statistics and correlation analysis.

3.3 Research Population

The target population consisted of all female EFL prep-year students enrolled in Level 2 at UPM, Medina, Saudi Arabia. The total number of Level 2 students was 152, and they were classified as pre-intermediate learners enrolled in the ENGL002 course.

3.4 Research Sample

The research used a census sampling technique, which includes a complete count of the population (Rao, 2000). All female Level 2 students enrolled in ENGL002 were invited to participate. Students who were absent, submitted incomplete responses, or declined participation were excluded from the final analysis.

The study was delimited to female students because classes at the University of Prince Muqrin are organized according to gender, and access was granted only to female prep-year sections during the data collection period. This delimitation ensured consistency in the instructional environment and learning conditions; however, it limits the generalizability of the findings to male students or mixed-gender contexts.

3.5 Research Instrument

Before the main data collection, a preliminary survey was distributed to 26 EFL students to explore their familiarity with AR. The results showed that most students were familiar with AR but had not used it in formal educational contexts, which supported the implementation of AR-based activities in this research. A structured questionnaire titled "AR for English Vocabulary Learning" was adapted from Alsakaker's (2025) TAM-based study after obtaining official permission. The terminology was modified from "AI tool" to "AR tool" to align with the current research. The questionnaire used a five-point Likert scale and included 20 items across four dimensions: usefulness, ease of use, enjoyment, and willingness to continue using AR. It was translated into Arabic and reviewed by a bilingual Arab linguist for clarity and accuracy.

Finally, a pilot study was conducted with 28 female EFL prep-year students who were not included in the main sample. The purpose was to examine the clarity of the questionnaire items and ensure the instrument's validity and reliability.

3.6 Instrument Validity

To ensure the instrument's validity, three procedures were followed. First, the questionnaire was adapted from Alsakaker's (2025) validated instrument, which was originally based on Davis's (1987) TAM and designed to measure EFL learners' perceptions of AI tools. Since both AI and AR are technology-based instructional tools, the main TAM constructs, including perceived usefulness, perceived ease of use, and behavioral intention, were considered applicable to the current research context. Second, content validity was ensured after modifying the terminology from "AI tools" to "AR tools" by asking four experts in Computer-Assisted Language Learning, Applied Linguistics, and TESOL to review the adapted instrument (See Appendix A). Their evaluation confirmed that the revised items reflected AR integration in vocabulary learning without changing the conceptual meaning of the original constructs. Third, construct validity was assessed by calculating Pearson's correlation coefficients between each dimension and the overall scale. The results showed that all four dimensions were significantly correlated with the overall scale at the .01 level, confirming the questionnaire's construct validity.

Table 1 Construct Validity: Mean Corrected Item-Dimension and Dimension-Total Correlations

Dimension	Items	M Item-Dimension r	Dimension-Total r
Perceived Usefulness	4	.845	.712**
Ease of Use	4	.761	.635**
Enjoyment	8	.548	.827**
Willingness	4	.663	.544**
<i>Overall Scale</i>	20	.673	—

Note. N = 28. **p < .01.

3.7 Instrument Reliability

Cronbach's alpha was used to examine the reliability of the questionnaire. The results indicated good to high internal consistency across all dimensions, with Cronbach's alpha values ranging from .820 to .933 and an overall alpha of .843.

3.8 Data Collection Procedures

3.8.1 Distribution Method and Time

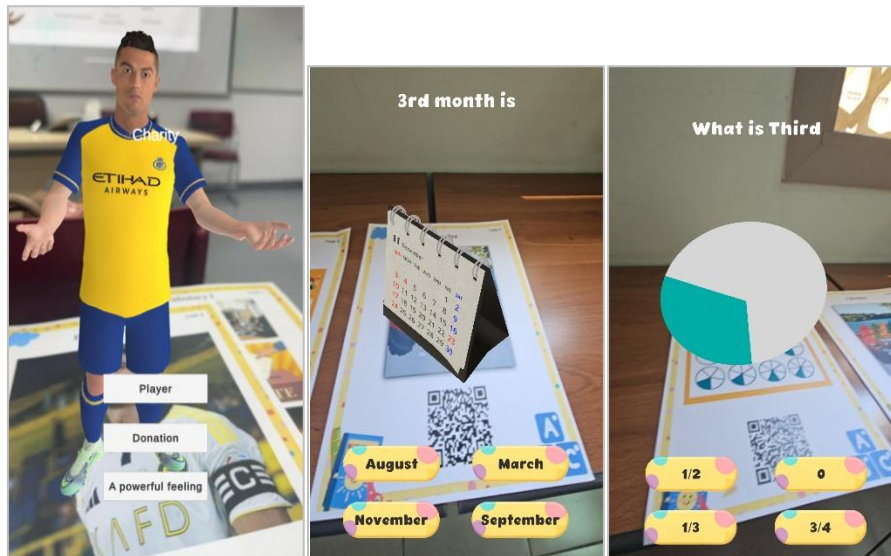
Participants' responses were collected through an online questionnaire created using Google Forms in Week 6. The questionnaire was distributed by Level 2 instructors during morning classes under the researcher's supervision to ensure a smooth data collection process.

The implementation began in Week 1 with an orientation session for Level 2 instructors and the distribution of AR handouts. From Weeks 2 to 6, six AR-based vocabulary activities from the Level 2 textbook were implemented. The activities were designed using Unity in collaboration with an AR development team and reviewed by a UPM faculty member with

extensive teaching experience. At the end of Week 6, the online questionnaire was distributed to collect students' responses.

Figure 1

Examples of AR Vocabulary Activity Using QR Code



3.8.2 Response Rate Handling

The questionnaire was distributed to 152 students and administered during morning classes under the supervision of Level 2 instructors to ensure a high response rate. A total of 126 responses were received; however, 9 responses were excluded due to straight-lining patterns, including responses to the reverse-coded items. Therefore, the final sample consisted of 117 valid responses used in the statistical analysis.

3.9 Data Analysis Techniques

The quantitative data were analyzed using SPSS, a statistical software program for data management and analysis. The reliability of the survey instrument was examined based on Cronbach's alpha. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to summarize students' responses. Moreover, Pearson and Spearman correlations were calculated to examine construct validity and to test the relationships specified in the research questions.

3.10 Ethical Considerations

This research followed educational research ethical standards and obtained ethical approval from the university beforehand. Thus, informed consent was obtained from all participants via a questionnaire. They were clearly informed about the purpose of the research and their rights as participants. Participation was fully voluntary, and students had the right to withdraw from the research if they were not interested. The research ensured participants' anonymity, and all data collected were used solely for research purposes.

4.0 CHAPTER 4

4.1 The Results of the First Research Question

To answer the first question, which stated, ‘What are EFL students’ attitudes toward the integration of AR in vocabulary learning?’, statistical analyses were conducted, including means, standard deviations, frequencies, and percentages, which also applied to the sub-questions.

Table 2: Descriptive Statistics of the AR Questionnaire Dimensions

Dimension	Items	M	SD	Level
Perceived Usefulness	4	4.26	0.70	Very High
Ease of Use	4	4.15	0.67	High
Enjoyment	8	4.06	0.65	High
Willingness	4	4.01	0.79	High
<i>Overall Scale</i>	20	4.11	0.60	High

Note. N = 117. M = mean; SD = standard deviation.

The results presented provide an overall summary of students’ attitudes across the four dimensions of the AR questionnaire. As shown, all dimensions recorded high to very high mean scores, ranging from 4.01 to 4.26, indicating generally positive attitudes.

Discussion

The overall results showed a high level of acceptance of AR across all dimensions, including perceived usefulness, ease of use, enjoyment, and future use intention. This finding is consistent with Küçük et al. (2014), who found that students had positive attitudes toward AR-assisted English learning and were willing to continue using AR in future courses. Similarly, Belda-Medina and Marrahí-Gómez (2023) reported that learners valued the multimedia and interactive features of AR, as these features offered learning experiences beyond traditional materials.

Therefore, the positive attitudes in the current research may be attributed to AR’s interactive, visual, and multimodal nature, which supports contextualized learning and learner autonomy. However, the willingness mean score suggests that some students may prefer a balanced approach between AR and traditional instruction. This interpretation is supported by previous studies that reported concerns related to distraction, cognitive overload, and cautious attitudes toward adopting new technologies (Ironsi, 2025; Moran & Rice, 2021; Hoang et al., 2022).

4.2 The Results of the First Sub-Question

The first sub-question stated, ‘To what extent do EFL students perceive AR as useful for improving vocabulary acquisition?’.

Table 3: Descriptive Statistics of EFL Students' Responses to AR Questionnaire 1

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	M	SD	Exp.
<i>Dimension 1: Perceived Usefulness</i>								
1. AR tools help me to learn English vocabulary more effectively.	56 (47.9)	46 (39.3)	13 (11.1)	2 (1.7)	0 (0.0)	4.33	0.74	Strongly Agree
2. AR tools provide me with better vocabulary learning resources compared to traditional methods.	54 (46.2)	44 (37.6)	18 (15.4)	0 (0.0)	1 (0.9)	4.28	0.79	Strongly Agree
3. Using AR tools improves my overall performance in learning English vocabulary.	51 (43.6)	46 (39.3)	16 (13.7)	3 (2.6)	1 (0.9)	4.22	0.84	Strongly Agree
4. I find that AR tools assist me to recall new vocabulary.	54 (46.2)	37 (31.6)	21 (17.9)	5 (4.3)	0 (0.0)	4.20	0.88	Agree

Note. N = 117. Frequencies are shown with percentages in parentheses. Exp. = Explanation.

The results presented indicate highly positive attitudes toward integrating AR into vocabulary learning. This is evident from the overall high mean scores, which range from 4.20 to 4.33, indicating strong agreement.

In terms of perceived usefulness, items (1–4) received the highest mean scores, with item 1 (M = 4.33) and item 2 (M = 4.28) indicating strong agreement. This shows that students perceived AR as a useful tool for supporting vocabulary learning and recall. These results suggest that students viewed AR as a valuable educational resource for supporting vocabulary learning.

Discussion

This finding is consistent with earlier studies suggesting that AR can support vocabulary learning by providing richer and more meaningful contexts. In the present study, students perceived AR as useful for learning and recalling vocabulary more effectively. Sadikin and Martyani (2020), Maysaroh (2024), and Idul and Syaiful (2024) reported that AR helps students

acquire new vocabulary through richer and more meaningful contexts, leading to better retention and improved learning outcomes; however, the current research measured students' attitudes rather than actual vocabulary achievement.

One possible explanation is that AR uses visual, auditory, and interactive features to connect abstract vocabulary with real-life representations, provide multimodal input, and support different learning preferences (Asadi & Ebadi, 2025; Moran & Rice, 2021). Unlike traditional vocabulary learning, which often relies on memorization and lacks meaningful context, AR offers more interactive and student-centered learning opportunities (Alessa & Hussein, 2023; García Castañeda, 2020).

4.3 The Results of the Second Sub-Question

The second sub-question stated, 'To what extent do EFL students perceive AR as easy to use within the classroom context?'

Table 4: Descriptive Statistics of EFL Students' Responses to AR Questionnaire 2

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	M	SD	Exp.
<i>Dimension 2: Ease of Use</i>								
5. I find AR tools easy to use for learning English vocabulary.	52 (44.4)	44 (37.6)	19 (16.2)	2 (1.7)	0 (0.0)	4.25	0.79	Strongly Agree
6. It is easy to use AR tools and practice vocabulary activities.	45 (38.5)	50 (42.7)	19 (16.2)	3 (2.6)	0 (0.0)	4.17	0.79	Agree
7. I feel comfortable utilizing AR tools without needing assistance from others.	38 (32.5)	51 (43.6)	24 (20.5)	4 (3.4)	0 (0.0)	4.05	0.82	Agree
8. Learning to use AR tools for vocabulary practice doesn't take much effort from me.	43 (36.8)	51 (43.6)	20 (17.1)	3 (2.6)	0 (0.0)	4.15	0.79	Agree

Note. N = 117.

Regarding ease of use, items (5–8) also showed high mean scores ranging from 4.05 to 4.25, indicating agreement to strong agreement. This supports the assumption that easy-to-use technological tools are more likely to be accepted by learners.

Discussion

This result aligns with previous studies that report that AR applications are generally easy to use and accessible to students in educational contexts. For instance, Binhomran and Altalhab (2021) reported that learners experienced positive experiences when using AR applications due to their simplicity and ease of use.

This result may also reflect the nature of AR as part of MALL, which is designed to be flexible, accessible, and easy to use. As the literature indicates, MALL enables learners to access learning materials anytime and anywhere via mobile devices, making the learning process more convenient and manageable (Jabbar, 2024).

Furthermore, the findings also align with the assumptions of TAM, which suggests that technologies perceived as easy to use are more likely to be accepted by users. Thus, the high mean scores in this dimension indicate that ease of use played an important role in shaping students' acceptance of AR in vocabulary learning.

4.4 The Results of the Third Sub-Question

The third sub-question stated, 'To what extent do EFL students find the use of AR for vocabulary learning enjoyable?'.

Table 5: Descriptive Statistics of EFL Students' Responses to AR Questionnaire 3

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	M	SD	Exp.
<i>Dimension 3: Enjoyment</i>								
I enjoy utilizing AR tools to learn English vocabulary.	54 (46.2)	44 (37.6)	18 (15.4)	1 (0.9)	0 (0.0)	4.29	0.75	Strongly Agree
I feel good about utilizing AR tools in my vocabulary learning routine.	46 (39.3)	50 (42.7)	18 (15.4)	3 (2.6)	0 (0.0)	4.19	0.79	Agree
I am excited about the potential benefits of utilizing AR tools for learning vocabulary.	45 (38.5)	45 (38.5)	23 (19.7)	4 (3.4)	0 (0.0)	4.12	0.84	Agree
I believe that AR tools make learning	53 (45.3)	50 (42.7)	13 (11.1)	1 (0.9)	0 (0.0)	4.32	0.71	Strongly Agree

vocabulary more
engaging.

I find utilizing AR tools for vocabulary learning annoying at times.	1 (0.9)	6 (5.1)	32 (27.4)	54 (46.2)	24 (20.5)	3.80	0.85	Disagree
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I feel that AR tools can make the process of vocabulary learning more difficult.	2 (1.7)	5 (4.3)	21 (17.9)	53 (45.3)	36 (30.8)	3.99	0.90	Disagree
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I often favor traditional methods over AR tools for learning vocabulary.	4 (3.4)	9 (7.7)	37 (31.6)	41 (35.0)	26 (22.2)	3.65	1.02	Disagree
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I feel that utilizing AR tools could stop me from learning vocabulary effectively.	1 (0.9)	3 (2.6)	19 (16.2)	55 (47.0)	39 (33.3)	4.09	0.82	Disagree
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Note. N = 117. Negative items (Items 13–16) were reverse-coded prior to analysis to ensure consistency.

The third dimension, enjoyment, revealed high mean scores ($M = 4.12$ – 4.32). This indicates that students found AR enjoyable. The high score for item 12 ($M = 4.32$) emphasizes the interactive nature of AR, which appears to enhance students' learning experience.

Items (13–16), which showed negative attitudes and were reverse-coded, also yielded relatively high mean scores ($M = 3.65$ – 4.09). This indicates that students do not believe AR prevents them from learning, nor do they prefer traditional methods over AR, confirming their positive perceptions of its effectiveness and usability.

Discussion

These findings align with previous studies showing that AR can enhance learners' engagement, motivation, and interest through its interactive features (Moran & Rice, 2021; Khan et al., 2023). This supports the current research findings, in which students viewed AR-based vocabulary learning as enjoyable, interactive, and engaging.

AR may also support different learning styles through its visual, auditory, and interactive features, helping students connect vocabulary with more concrete and meaningful representations (Asadi & Ebadi, 2025; Moran & Rice, 2021). However, some concerns remain, as students may focus more on the technology than the learning content (Moran & Rice, 2021), and animations or moving images may distract learners from instructional goals (Jamrus &

Razali, 2019). Therefore, AR should be carefully designed to keep students' attention focused on vocabulary learning.

Finally, the high enjoyment scores highlight a possible limitation of TAM, which focuses mainly on cognitive factors such as usefulness and ease of use while giving less attention to affective factors like enjoyment. This suggests that emotional engagement should be considered an important factor in evaluating AR-based vocabulary learning.

4.5 The Results of the Fourth Sub-Question

The fourth sub-question states, 'To what extent are EFL students willing to continue using AR for vocabulary learning in the future?'.

Table 6: Descriptive Statistics of EFL Students' Responses to AR Questionnaire 4

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	M	SD	Exp.
<i>Dimension 4: Willingness</i>								
17. I plan to use AR tools regularly to enhance my English vocabulary learning.	36 (30.8)	48 (41.0)	23 (19.7)	9 (7.7)	1 (0.9)	3.93	0.94	Agree
18. I am likely to recommend AR tools to my classmates for vocabulary practice.	45 (38.5)	48 (41.0)	20 (17.1)	3 (2.6)	1 (0.9)	4.14	0.85	Agree
19. I plan to explore more AR tools for learning English vocabulary in the future.	44 (37.6)	54 (46.2)	14 (12.0)	4 (3.4)	1 (0.9)	4.16	0.83	Agree
20. I will focus on utilizing AR tools instead of other resources for vocabulary learning.	39 (33.3)	30 (25.6)	38 (32.5)	8 (6.8)	2 (1.7)	3.82	1.03	Strongly Agree

Note. N = 117.

Items (17–20) showed moderately high mean scores ($M = 3.82$ – 4.16), indicating that students are willing to continue using AR in the future. However, item 20 ($M = 3.82$) had the lowest

mean score among all items, suggesting that although students appreciate AR, they may not fully replace traditional learning methods with it.

Discussion

The results on willingness indicate that students were generally positive about continuing to use AR for vocabulary learning. This finding aligns with previous studies showing that learners are willing to adopt AR for its engaging, interactive features (Shaman, 2023; Binhomran & Altalhab, 2021). However, willingness had the lowest mean score among the four dimensions, suggesting that students may prefer to use AR alongside traditional methods rather than rely on it completely.

This interpretation is supported by previous research that identified several limitations affecting long-term AR adoption, including technical issues such as internet access and device availability (Belda-Medina, 2022; Salehi, 2025), the possible decline of motivation after the novelty effect fades (Ebadi & Ashrafabadi, 2022), and challenges related to mobile learning, such as distraction, overuse, and usability limitations (Kukulska-Hulme, 2018). In addition, the rapid development of mobile applications may require continuous adjustment from both students and instructors (Martínez et al., 2025).

4.6 The Results of the Second Research Question

The second research question was 'Is there a significant correlation between the three factors (usefulness, ease of use, and enjoyment) and EFL students' willingness to continue using AR for vocabulary learning?' Spearman correlations were calculated to examine the relationships between perceived usefulness, ease of use, enjoyment, and students' willingness to continue using AR for vocabulary learning.

Table 7: Spearman Correlations Between Attitude Dimensions and Willingness

Dimension	Spearman ρ
Perceived Usefulness	.583**
Ease of Use	.627**
Enjoyment	.675**

Note. N = 117.

The results indicate significant positive correlations among the three dimensions (perceived usefulness, ease of use, and enjoyment) and students' willingness to continue using AR for vocabulary learning, thereby confirming the research hypothesis. All correlations are strong, with enjoyment showing the highest correlation ($\rho = .675$), followed by ease of use ($\rho = .627$) and perceived usefulness ($\rho = .583$).

Discussion

These findings suggest that students are more likely to continue using AR when they perceive it as useful, easy to use, and enjoyable. This is consistent with TAM, which explains that perceived usefulness and ease of use influence users' intention to adopt technology. However, enjoyment showed a slightly stronger correlation, suggesting that affective factors may play an important role in students' willingness to use AR for vocabulary learning.

This finding aligns with previous studies showing that AR can increase students' motivation, engagement, and interest in learning (Moran & Rice, 2021; Shaman, 2023; Khan et al., 2023). However, the correlations should be interpreted carefully, as correlation does not imply causation and other contextual factors may also influence students' willingness.

Overall, these findings address a gap in previous research by applying TAM to explain students' attitudes toward AR integration and by providing empirical evidence of the relationships among TAM constructs in AR-based vocabulary learning.

4.7 Conclusion

1. Overall, the study concluded that students had positive attitudes toward integrating AR into vocabulary learning, as reflected in the high overall mean score ($M = 4.11$). Among the dimensions, perceived usefulness received the highest mean score ($M = 4.26$), followed by ease of use ($M = 4.15$) and enjoyment ($M = 4.06$), indicating that students viewed AR as useful, easy to use, and enjoyable for supporting vocabulary learning.
2. Willingness recorded the lowest mean score among the four dimensions. However, it remained high ($M = 4.01$), indicating that students were willing to continue using AR in the future but may still value a balance between traditional and technology-based learning methods.
3. The findings of the second research question revealed significant positive correlations among the TAM dimensions, and the correlation analysis confirmed the research hypothesis.
4. The correlation analysis revealed that enjoyment played an important role in students' acceptance of AR, suggesting that emotional engagement may influence AR adoption beyond the original TAM constructs.

4.8 Limitations

1. This research was conducted at a single private university in Medina, Saudi Arabia. Therefore, the findings may not generalize to other educational contexts.
2. The sample included only female learners, limiting the generalizability of the findings to male students and teachers.
3. The research focused solely on students' attitudes without measuring vocabulary achievement.
4. The implementation of the AR activities was brief, which may not reflect the long-term effects of AR on vocabulary learning.
5. Financial constraints limited the development and implementation of a greater number of AR activities.

4.9 Recommendations

1. Teachers are recommended to integrate AR into vocabulary instruction to create more engaging and interactive learning environments, while ensuring that the technology supports learning outcomes rather than distracts students.
2. Educational institutions should provide the necessary technical and financial support, including devices, stable internet access, and collaboration with AR developers to create ready-made AR experiences for classroom use.
3. Training programs should be offered to help teachers develop the skills needed to implement AR-based vocabulary activities effectively.
4. A balanced approach should be adopted when integrating AR into language learning, so that AR complements rather than replaces traditional instruction.

4.10. Suggestions for Future Research

1. Future research could investigate the long-term effects of AR on vocabulary learning, as the novelty of the technology might influence the current findings.
2. Researchers could examine the impact of AR on vocabulary retention and performance by using pre- and post-tests.
3. Future research could include diverse samples, such as male students or learners from different educational levels and institutions, to enhance the generalizability of the findings.
4. Further studies could extend the use of TAM by incorporating other affective variables, such as enjoyment and motivation.
5. Future research could examine how AR implementation in EFL classrooms affects other language skills, such as reading, writing, listening, and speaking.

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Appendix A Panel of Experts

No.	Name	Academic Rank/Specialisation	Affiliation	Years of Experience
1.	Prof. Ken Beatty	Professor + Author of TESOL, CALL, Language Education	Anaheim University	30+
2.	Dr. Iman AlZobiani	Assistant Professor of TESOL	Taibah Univeristy	10+
3.	Dr. Amal Mechraoui	Assistant Professor of Applied Linguistics	University of Prince Muqrin	10+
4.	Dr. Samar Mari	Assistant Professor of TESOL	University of Prince Muqrin	6
5.	Dr. Riham Alahmadi	Assistant Professor of TASOL	University of Prince Muqrin	10+