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The Effect of Teaching Vocabulary through Artificial Intelligence (AI) on ESP Students' Vocabulary Learning and Retention with Focusing on Accounting Students

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Abstract

The aim of this study is to examine the possible effects of teaching vocabulary through Artificial Intelligence (AI) on accounting ESP students' vocabulary learning and retention. For the aim of this study, the researcher selected 80 accounting ESP students. For the aim of homogenizing, the researcher administered Oxford Placement Test (OPT) (2018) and based on the results of the test 50 pre-intermediate ESP students were selected as the research sample. The participants were members of two different classes in university. The researcher assigned the participants randomly into two groups of the experimental (n=25) and the control (n=25). The intended vocabulary (n=50) was selected from accounting book of students. Prior to intervention, the researcher-made vocabulary test was administered as the pretest. The treatment lasted for ten sessions and each session five vocabularies were taught to students of both group. The researcher used Memrise as the AI-based application for teaching vocabulary to participants of the experimental group. The researcher taught the same vocabulary conventionally by providing synonym to participants of the control group. After covering the treatment, the researcher-vocabulary test was administered as the posttest. Independent Samples T-test (t = 2.34, p = 0.000) indicated that AI-based application boost ESP students' vocabulary learning. Moreover, delayed posttest was conducted two weeks after the posttest. Independent Samples T-test (t = 1.78, p = 0.003) indicated that AI-based application enhances ESP students' vocabulary retention. Finally, the study provides useful implications for ESP instructors, syllabus designers, and material developers.

Keywords: accounting, artificial intelligence (AI), ESP students, vocabulary learning, vocabulary retention

1. Introduction

Recent advances in technology have led to major transformation in education and the field of language learning is not exceptional (Xia, 2022). One of the most impactful developments is the integration of Artificial Intelligence (AI) into language learning. In fact, AI can be considered as the simulation of human intelligence in computer models that are designed to think and learn such as

humans. These models even can do some cognitive-based tasks such as data analysis, problem-solving and interpretation (Hassani et al., 2020, as cited in Alharbi & Khalil, 2023). Particularly, AI is employed in different functional programs such as intelligent tutoring systems and adaptive learning systems. The aim of using these technologies is to support L2 learners in boosting their different language skills and components (De La Vall & Araya, 2023).

In context of ESP, students need to master English since they need to know the technical words and phrases of their own field. For exampling, accounting students need to know enough technical vocabulary in order to have better job offer and being able to work with different accounting software. It can be said that effective vocabulary acquisition plays a critical role in mastering subject-specific language and making sure professional competence (Hiebert et al., 2019). Moreover, traditional methods of teaching vocabulary often struggle to present the level of personalization and engagement necessary for students to retain and employ new words usefully. Undoubtedly, vocabulary is considered as a central component in any language system. In other word, for mastering any foreign or second language, the first step is to master its vocabulary. Given the importance of vocabulary, this area has been remained as a challenging one for many L2 learners (Abu Qbeita, 2024).

Concerning vocabulary, Schmitt (2000) stated that comprehending word needs knowledge of both forms and meaning. Moreover, learners should understand how to employ words in particular context. This broad perspective on vocabulary acquisition highlights the complexity of the learning process, where learners need to comprehend pronunciation, spelling, grammatical structures, and the subtle differences in meaning (Abu Qbeita, 2024). Similarly, Hiebert et al. (2019) noted that the challenges of learning vocabulary often arise from the inherent difficulty of the words themselves, which adds an additional layer of complexity to the acquisition process for learners. Without adequate chances to interact with new vocabulary in meaningful contexts, learners might struggle to reach the level of mastery required for fluent communication (Crossley et al., 2013, as cited in Abu Qbeita, 2024). In vocabulary learning, AI can serve various roles, consisting of personal assistant, instructor, and evaluator for second language learners, transforming traditional teaching methods into more innovative and efficient learning solutions (Kessler, 2018).

The vocabulary on accounting like other fields includes technical terms, legal expression and industry jargon that are different from everyday English. Terms like "assets," "liabilities," "equity," "amortization," and "accrual" are fundamental to accounting practice and require not only memorization but also a deep understanding of their contextual use. In other words, accounting ESP students should know enough technical accounting words in order to be able to work with different accounting applications as well (Nugroho, 2019, as cited in Nartiningrum & Nugroho, 2020). Moreover, accounting ESP students must become familiar with financial statements, taxation policies, and international accounting standards, all of which introduce specialized terminologies that may be challenging to acquire through conventional language learning methods (Nartiningrum & Nugroho, 2020).

Accounting field like many other academic field include many difficult vocabulary and students of this field need to master them. Given the complexity of accounting vocabulary, conventional rote memorization techniques may not be sufficient for long-term retention (Nugroho, 2019). Instead, modern educational approaches, such as AI-based learning platforms, recommend interactive and personalized methods for vocabulary acquisition. AI-powered instruments can assist accounting ESP students engage with terminology in realistic contexts, such as case studies, financial simulations, and

interactive exercises, making vocabulary learning more meaningful and useful. By combining AI-driven vocabulary instruction into ESP courses, accounting students can boost their language proficiency, reinforce their comprehension of financial concepts, and expand the communication skills necessary for professional success. This approach not only makes easy learning but also makes sure better retention and application of accounting-specific terminology in real-world scenarios (Abu Qbeita, 2024).

In the current study, the focus of the study was on Memrise application. Memrise is an online educational platform concentrated on vocabulary enhancement. It was created by Ed Cooke, a Grand Master of Memory, and Greg Detre, a neuroscientist from Princeton who specializes in the study of memory and forgetfulness (Nuralisah & Kareviati, 2020). According to Amminatun and Oktaviani (2019), this AI-based application is designed for a particular audience interested in boosting their vocabulary knowledge. As such, it caters to both educators who wish to assist their learners explore their vocabulary data and learners who aim to boost their vocabulary in an enjoyable and straightforward way. Memrise is user-friendly and leverages flashcard repetition to accelerate learning and retention (Aminatun & Oktaviani, 2019, as cited in Nuralisah & Kareviati, 2020). The researcher used this application as the treatment tool for the students of the experimental group.

2. Literature Review

2.1. Theoretical Framework

In this section, the researcher explains the main theory of the study along with some explanations concerning the variables of the study.

2.1.1. The Theory of the Study

The main theory behind this study is Sociocultural Theory (SCT) by Vygotsky (1978). This theory has been used in different pedagogical settings to make easy the process of learning and expansion Based on SCT, learning is viewed as a kind of social activity that can take place in a cultural context and is mediated by the employment of instruments and language (Kilag et al., 2024). Based on SCT, having interactions is emphasized and the role of cultural context has been stressed. SCT also emphasize on the role of learners as active agents who take part in the construction of knowledge as well (Wertsch, 1991). The main theory behind using social media, social networks and AI-based application is SCT.

2.1.2. AI and Language Learning

With development of technology in recent years, many transformations have been happened in the world and one of the important ones is in the domain of education. These days, there are different types of AI-based applications that are designed for the aim of teaching. In fact, it can be said that AI is significantly combined into our fast-moving, tech-driven world, affecting nearly every dimensions of our lives, encompassing education (Følstad & Brandtzaeg, 2020, as cited in Kutsyk & Nykyporets, 2024). The field of language education is one of the educational fields is under influence of AI. The rise of AI-powered instruments has brought an important transformation in language education, and it suggests learners' innovative resources and methods to boost their language abilities. However, these tools can provide efficient and tailored learning experiences, they still differ from human instructors in terms of presenting personalized feedback and the depth of human interaction (Kutsyk & Nykyporets, 2024).

Additionally, some studies have reflected that learners employing AI-based language learning instruments tend to obtain higher proficiency in their target language in comparison to those relying on

traditional methods. This is due to the interactive features of AI platforms, which consists of real-time feedback and assessments, making information retention more useful. Moreover, AI-based language learning instruments can particularly support language acquisition, but their effectiveness varies relying on both the individual and the particular instrument. According to Dodigovic (2007), some of these tools can be just as useful as in-person classes or tutors, especially for beginners. According to Kutsyk and Nykyporets (2024), one of the advantages of using AI-based tools for language learning is that geographic and socioeconomic barriers are no longer significant obstacles to accessing high-quality language education. In fact, this enhanced accessibility opens up new chances for learners worldwide to pursue their language learning objectives, potentially leading to advancements in both personal growth and career expansion (Kutsyk & Nykyporets, 2024).

As it was mentioned earlier, AI-powered instruments and technologies boost students' learning experiences, recommend personalized learning paths, and present instant feedback across all grade levels (Sahem Khalil, 2024). As noted by Rusmiyanto et al. (2023), AI technologies such as speech recognition and virtual instructors can be especially beneficial in assisting learners to improve their language skills. The feedback expanded by AI has manifested to lead to important improvements when compared to conventional, non-AI feedback methods. There is a need for a more detailed understanding of how AI technologies can usefully support both instructors and learners in pedagogical setting (Sahem Khalil, 2024). In the current study, the researcher focused on Memrise as one of the AI-based applications that is personalized based on needs of learners.

2.1.3. Memrise Application

Memrise is considered as AI-based ongoing online educational platform that concentrated on vocabulary enhancement by providing interactive and engaging learning techniques. It was founded by Ed Cooke, a Grand Master of Memory, and Greg Detre, a Princeton neuroscientist specializing in memory and forgetfulness, the platform is rooted in cognitive science principles to enhance learning efficiency (Nuralisah & Kareviati, 2020). According to Amminatun and Oktaviani (2019), Memrise is an AI-powered application that is designed for particular audiences who interested in expanding their vocabulary knowledge. It serves both educators and learners—educators can utilize it as a supplementary instrument to help students explore and reinforce vocabulary, while learners can benefit from its structured yet enjoyable approach to language acquisition.

Furthermore, Memrise is known for its user-friendly interface and its effective employment of spaced repetition, which uses flashcards and mnemonic techniques to improve learning retention. This application employs gamification elements like points, leaderboards, and interactive challenges, to keep users engaged and motivated. In addition, it combines multimedia features, encompassing audio from native speakers and video clips, to boost comprehension and pronunciation skills. Beyond traditional vocabulary drills, Memrise supports multiple languages and adapts to users' learning progress through AI-driven personalization. This ensures that learners receive tailored exercises suited to their proficiency level, boosting their ability to retain new words efficiently. With its science-backed methodology and engaging format, Memrise keeps on to be a popular choice for language learners seeking an effective and enjoyable way to construct their vocabulary (Aminatun & Oktaviani, 2019, as cited in Nuralisah & Kareviati, 2020).

2.2. Vocabulary

Vocabulary is viewed as the central component that one needs to mater it to learning any languages. In other word, the first step in the process of learning any languages is to learn its words. It can be said that vocabulary learning as a central component of language learning has many on the central

focus of many studies in recent years. According to Schmitt (2019) “the chief characteristic of English vocabulary is that it is very large” (p. 48). Thus, it can be said that vocabulary knowledge is viewed as an important instrument for many L2 learners. Moreover, lack of vocabulary knowledge cause failure in boosting different language main skills and failure in communication (Farrokhi & Gholami, 2024). Additionally, vocabulary learning is naturally a never ending task (Gu, 2018). In this regard, it can be said that even learners with higher proficiency never stop learning new words, thus it is considered as a never stop process (Farrokhi & Gholami, 2024).

Additionally, Wibowo and Syarifah (2018) noted that a vocabulary is considered as the set of dialect. When there is no word, there is no dialect. Vocabulary is seen as the building block of any language. For L2 learners, mastering vocabulary is considered as the crucial step for mastering the intended language. For many EFL learners, mastering English is considered as the fundamental instrument for having communication at international level. Besides, words can act like a bridge and it can connect different language skills. For example, when learners do not know enough vocabulary, they will have problems with different language skills (Chotimah & Astiyandha, 2022).

Furthermore, Oxford (1990) stated that knowledge of vocabulary is viewed as the most unmanageable dimension in L2 learning process that is why mastering vocabulary is considered as the important source of failures in L2 communication. In the same vein, Nation (2001) noted that there is a direct relationship between language use and vocabulary knowledge and they are in somewhat complementary. In fact, vocabulary knowledge leads learners towards language use and language use leads learners towards enhancing vocabulary knowledge. Concerning the importance of vocabulary, Siregar (2013) stated that vocabulary refers to group of words that one needs to master them for having effective communication. In fact, vocabulary refers to whole number of words that one needs for having communication in a given context. Vocabulary learning is also important for ESP learners in order to be successful in their technical subject and their profession. For example, accounting ESP students need to master enough technical English vocabulary in order to satisfy the needs of their field.

2.3. Related Studies

In their study, Abu Qbeita (2024) examined the possible effects of employing AI on Jordanian EFL university students’ vocabulary learning. She selected 40 EFL students. She assigned them randomly into two groups of the experimental and control. She used Duolingo application to teach vocabulary to participants of the experimental group. The results indicated that the participants of the experimental group who received teaching vocabulary through Duolingo as AI-based application performed significantly better than the participants of the control group.

In the same line, Aldowsari and Aljebreen (2024) explored the effect of employing Chat GPT-based application on Saudi EFL students’ vocabulary learning. They collected the required data from 57 high school students. They concluded that the participants of the experimental group who received Chat GPT as the treatment received higher scores in comparison to participants of the control group.

In another study, Algraini (2024) examined the perceptions of Saudi female EFL learners concerning the effect of ChatGPT on developing vocabulary. The required data was collected from 101 female EFL learners in questionnaire phase and 13 EFL students took part in interview phase. The researcher concluded that ChatGPT can have positive effect on enhancing EFL learners’ vocabulary development and EFL learners had positive attitude towards using it.

Similarly, in their study, Jomaa et al. (2024) investigated the possible effects of AI on Omani EFL students' vocabulary learning. For conducting this study, they employed mix-method. Data was collected both quantitative and qualitatively. They came to this conclusion that AI is effective in teaching vocabulary and many of students had positive attitudes towards using different AI-based applications.

In the same line, Sapan and Uzun (2024) conducted a study and they investigated the possible effects of ChatGPT integrated English teaching on EFL students' writing and vocabulary skill. They used both quantitative and qualitative in order to collect the required data. For this aim they selected 66 students who were members of two classes. They used some tasks and activities through ChatGPT for the participants of the experimental group and they continued conventional way in the control group. Their results indicated that the participants of the control group outperformed significantly in comparison to participants of the control group. Moreover, concerning qualitative phase, the results showed that students had positive attitudes toward ChatGPT.

In another study, Wang et al. (2024) explored the effects of learning vocabulary through ChatGPT on ESP students' vocabulary learning. They came to this conclusion that using ChatGPT can lead to new and engaging learning experience. They also stated that learning experience is partly under influence of learners' characteristics. They concluded that employing ChatGPT for teaching vocabulary to ESP students can enhance their vocabulary knowledge.

In the same vein, Alharbi and Khalil (2023) conducted a study to examine the effect of AI on ESL students' vocabulary learning. The researchers also focused on perspectives of both teachers and learners concerning AI. For this aim, they collected 77 college students and 22 English teachers. An exploratory thematic analysis was done for their study. They concluded that students have positive attitudes concerning using AI. They also came to this conclusion that the attitudes of teachers vary based on their age. But in general, teachers also had positive attitudes.

In another study, Ali et al. (2023) examined the possible effects of ChatGPT on L2 learners' motivation for language learning. They used quantitative method to collect the required data and 80 students and teachers were selected for this aim. They concluded ChatGPt has positive effect on enhancing motivation of L2 learners towards language learning.

In one study, Ouis (2023) examined the possible effects of ChatGPT on ESP students' writing proficiency. She concluded that using technology such as ChatGPT can be effective on enhancing ESP students' writing skill. Moreover, by using questionnaire, she came to this conclusion that most of ESP students had positive attitudes towards using technology for learning.

Similarly, in another study, Taj et al. (2017) examined the possible effect of technology enhanced language learning on EFL learners' vocabulary acquisition. They selected 122 male and female EFL learners and divided them into two groups of the experimental and control. Computer and mobile were the tools that used in the experimental group and the vocabulary was taught to participants of this group through these tools. The results indicated that the participants of the experimental group outperformed control group.

In sum, review of the related literature showed that however different studies were conducted on the effect of different AI-based applications on developing different skills particularly vocabulary on language learners, only a few studies were conducted in ESP context especially for accounting students. This study aimed to fill this gap in the literature. In fact, the aim of this study was to examined the

possible effects of teaching vocabulary through AI (here Memrise application) on accounting ESP students' vocabulary learning and retention.

3. Research Questions

Concerning the aim of this study, the following research questions re addressed:

1. Does teaching vocabulary through AI have any significant effect on accounting ESP students' vocabulary learning?

2. Does teaching vocabulary through AI have any significant effect on accounting ESP students' vocabulary retention?

4. Method

4.1. Research Design

This study was employed a quantitative quasi-experimental design. In this study, the researcher selected the participants after homogenizing them through OPT (2018) and they were assigned randomly into two groups of the experimental and control. In fact, we had random assignment. In this study, teaching vocabulary through AI was independent variable and ESP students' vocabulary learning and retention were dependent variables.

4.2. Participants

For the aim of this study, as the target population, the researcher selected 80 accounting ESP students. For the aim of homogenizing and getting reliable results for this study, the researcher administered OPT (2018). Based on the results of this study, 50 ESP students were selected. These participants were considered to be pre-intermediate and they include both male and female. Besides, they were at the age of 20 to 25 and at the time of doing this study they were doing B.A in accounting field. The researchers selected them from Islamic Azad University.

4.3. Instruments

To fulfill the aim of this study, the researcher used (a) Oxford Placement Test (OPT) (2018), (b) researcher-made vocabulary test as the pretest, posttest and delayed posttest. In the following the researchers explain each of them in detail.

4.3.1. OPT (2018)

In order to homogenize the participants and determine the language proficiency of ESP students, the researcher administered OPT (2018). This test includes 60 items and it took 45 minutes to run this test. It is worth to mention here, writing and speaking sections of this test were not conducted due to time limitation. Based on the results of this test, 50 pre-intermediate ESP students were selected as the research sample. Besides, the Kr-21 reliability of the test turned out to be 0.911.

4.3.2. Researcher-Made Vocabulary Test (As Pretest, Posttest and Delayed Posttest)

The researchers selected 50 technical words from English accounting books of students from upcoming lessons. Then, they made a multiple and fill in the blank 50 items test. In fact, this test included 30 multiple choices items and 20 fill in the blank. Prior the intervention this test was conducted to ensure participants of both groups did not know these words before and they were at the same level based on

vocabulary knowledge. After covering the treatment, this test was conducted the posttest to see which group perform better. Finally, after two weeks, this test was conducted to measure vocabulary retention of ESP students. In the delayed posttest only the face of the items had been changed. The reliability of this test was calculated through Kr-21 and it reached to 0.872. Additionally, expert opinion method was used to examine the face and content validity of this test. In fact, three subject-matter university instructors approved the face and content validity of the test.

4.3.3. The Semi-Structured Interview on Shyness

The participants were asked to respond to one open question seeking their attitudes on the sources that could lead to their shyness. The question asked: "What could be the most important sources that would lead to your shame in the language class? Explain. You can refer to any source and problem that you have faced to make you feel shy.

4.4. Data Collection Procedure

For the aim of this study, the researcher selected 80 accounting ESP students from Islamic Azad University. The participants include both male and female and at the time of conducting this study, they were doing B.A at accounting field. Before the intervention, the researcher administered OPT (2018) and based on the results of this test, 50 pre-intermediate ESP students were selected as the research sample. The participants were members of two intact classes. The researcher assigned them randomly into two groups of the experimental and control with equal number of the participants.

Prior to intervention, the researcher administered researcher-made vocabulary test to ensure both groups were at the same level based on technical vocabulary knowledge. After this phase the treatment was started. The researchers used Memrise as AI-based application to teach vocabulary to participants of the experimental group. This application could provide interactive and engaging learning environment for learning. In each session five new words were taught to participants of the experimental group through Memrise. The same words were taught to participants of the control group in the conventional way. For example, in each session, teacher wrote words in the board and she provided definitions or synonym for each one. Sometimes, she asked students to make sentences with each word.

The treatment lasted for ten sessions and 50 words were taught to participants of both groups. After covering the treatment, the researchers administered researcher-made vocabulary test as the posttest to see which group could perform better. Finally, after two weeks and without receiving any instruction concerning the intended vocabulary (n=50), the researchers administered delayed posttest to measure long-term vocabulary learning of both groups and to see which group perform better.

4.5. Statistical Analysis

For calculating the reliability of the researcher-made vocabulary test, the researcher used KR-21. The raw data gained from pretest, posttest and delayed posttest was sent to SPSS (version .29). Moreover, the researcher used three independent sample t-tests in this study. The first one was conducted to compare the mean score of the two groups on the pretest, the second one on the posttest (1st research question), and the third one on the delayed posttest (2nd research question).

5. Results

For the aim of this study, the target population included 80 male and female accounting ESP students. In order to homogenize there, the researcher selected OPT (2018). Table 1 shows that the mean, median and mode of the OPT scores were 35.56, 36, and 35 respectively. These central parameters are close to one another denoting that the OPT scores are normally distributed around the mean. Based on the results of this test, 50 pre-intermediate ESP students were selected. The statistical results are provided here in Table 1.

Table 1

Descriptive Statistics for OPT

N	Mean	Median	Mode	SD	Skewness Ratio	Kurtosis Ratio
80	35.56	36	35	5.53	-0.317	-1.129

According the results of this test, 50 pre-intermediate ESP students were selected as the research sample. These students scored fell between 30 and 39 and they were regarded as pre-intermediate ESP students (Table 2).

Table 2

Criteria for Scoring OPT

Level	OPT Score	Range	Group
0 beginner	0-17	0-30	1
1 elementary	18-29		
2 lower intermediate	30-39	31-45	2
3 upper intermediate	40-47		
4 advanced	48-54	46-60	3
5 very advanced	54-60		

The aim of the first research question is to see if teaching vocabulary through AI has any significant effect on accounting ESP students' vocabulary learning. Prior to intervention, the researcher administered researcher-made vocabulary test as the pretest and after the treatment, this test was conducted as the posttest. The statistical results are provided in the following tables. Table 3 shows descriptive statistic for researcher-made vocabulary pretest. Table 3 shows that the mean of vocabulary in the experimental group (M = 14.67, SD = 3.57) and control group (M = 12.25, SD = 2.10) are close to each other on the pretest

Table 3

Descriptive Statistics for Experimental and Control Groups' ESP Vocabulary Scores on the Pretest

Group	N	Mean	SD	Std. Error Mean
Experimental	25	14.67	3.57	0.743
Control	25	15.25	2.10	0.862

For comparing the results of the students of both groups in the experimental, the independent sample t-test was employed. Table 4 manifests that the mean difference between the scores of the vocabulary of both groups is .58 and it shows that the participants of the both groups were at the same level before starting the treatment, t = .47, p = .64, p > 0.05.

Table 4

Independent Samples T-Test for Comparing Two Groups' Scores of Vocabulary Learning (Pretest)

	Levene's Test for Variances		T-test for Means			
Factor	F	Sig.	T	DF	Sig. (2-tailed)	Mean Diff.
Equal variances assumed	1.092	0.283	0.466	48	0.643	-0.580
Equal variances not assumed			0.466	48	0.643	-0.580

The statistical results for the posttest are provided in Table 5. Table 5 indicates that the students in the experimental group (M = 37.65, SD = 3.53) achieved a higher mean score than those in the control group (M = 31.67, SD = 2.45) on the posttest

Table 5

Descriptive Statistics for Experimental and Control Groups' ESP Vocabulary Scores on the Posttest

Group	N	Mean	SD	SEM
Experimental	25	37.65	3.53	1.322
Control	25	31.67	2.45	1.424

A line chart (Figure 1) was prepared to depict the results of pretest and posttest more onviously. As Figure 1 shows, the vocabulary mean score of both groups has progressed noticeably from pretest to the posttest, though, the experimental group's mean rise is more severe than that of the counterpart.

Figure 1

Line Chart for Experimental and Control Groups' ESP Vocabulary Means on the Pretest and Posttest

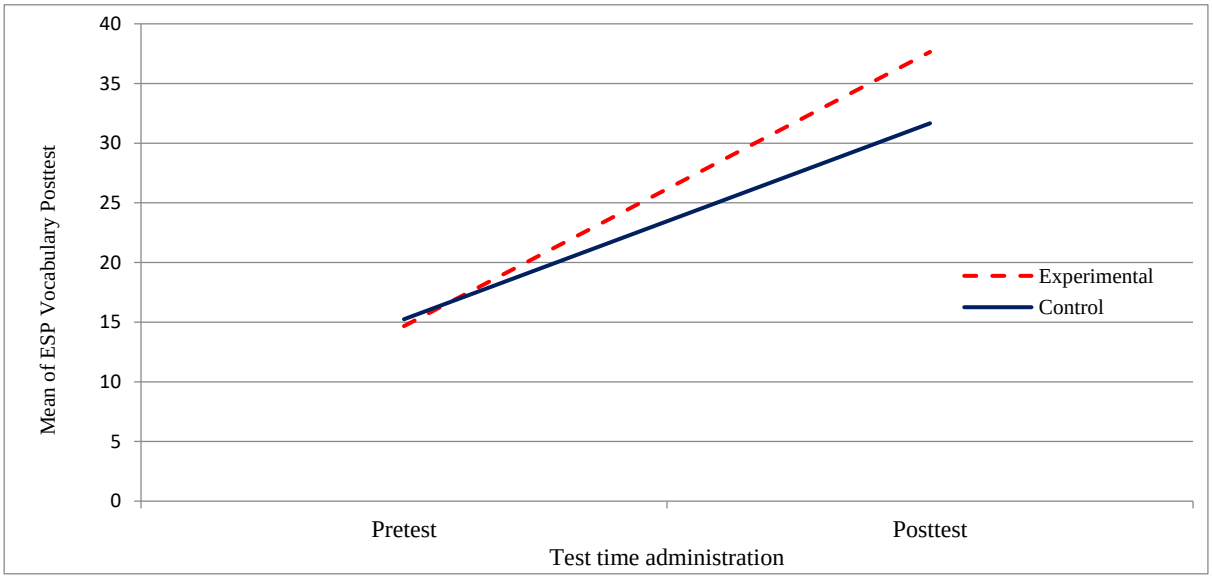

Table 6 manifests the results of independent sample t-test and in this table, the scores of the students in both groups were compared. The independent samples t-test (Table 6) indicated that there is a statistically significant difference in vocabulary learning means, t = 2.34, p = 0.000, p < 0.01, for the experimental group who experienced Memrise as AI-based application, and the control group who

received no AI. In other words, the results revealed that AI-based application influences ESP students' vocabulary learning.

Table 6

Independent Samples T-Test for Comparing Two Groups' ESP Vocabulary Means on the Posttest

	Levene's Test for Variances		T-test for Means			
Factor	F	Sig.	T	DF	Sig. (2-tailed)	Mean Diff.
Equal variances assumed	1.452	0.232	2.341	48	0.000	6.980
Equal variances not assumed			2.341	48	0.000	6.980

The objective of the second research question was to examine the possible effects of teaching vocabulary through AI on ESP students' vocabulary retention. To aim, the researcher administered delayed posttest after two weeks. The results of delayed posttest are provided in Table 7. According to the results represented in Table 7, again, the students in the experimental group (M = 34.65, SD = 3.74) outperformed those in the control group (M = 29.53, SD = 2.31) on the delayed posttest.

Table 7

Descriptive Statistics of Experimental and Control Groups' ESP Vocabulary Scores on the Delayed Posttest

Group	N	Mean	SD	SEM
Experimental	25	34.65	3.74	1.312
Control	25	29.53	2.31	1.461

To demonstrate the results of pretest and delayed posttest more clearly, another line chart (Figure 2) was drawn. Figure 2 displays that the vocabulary mean score of both groups has improved remarkably from pretest to the delayed posttest, still, the experimental group's mean rise is again harsher than that of the counterpart.

Figure 2

Line Chart for Experimental and Control Groups' ESP Vocabulary Means on the Pretest and Delayed Posttest

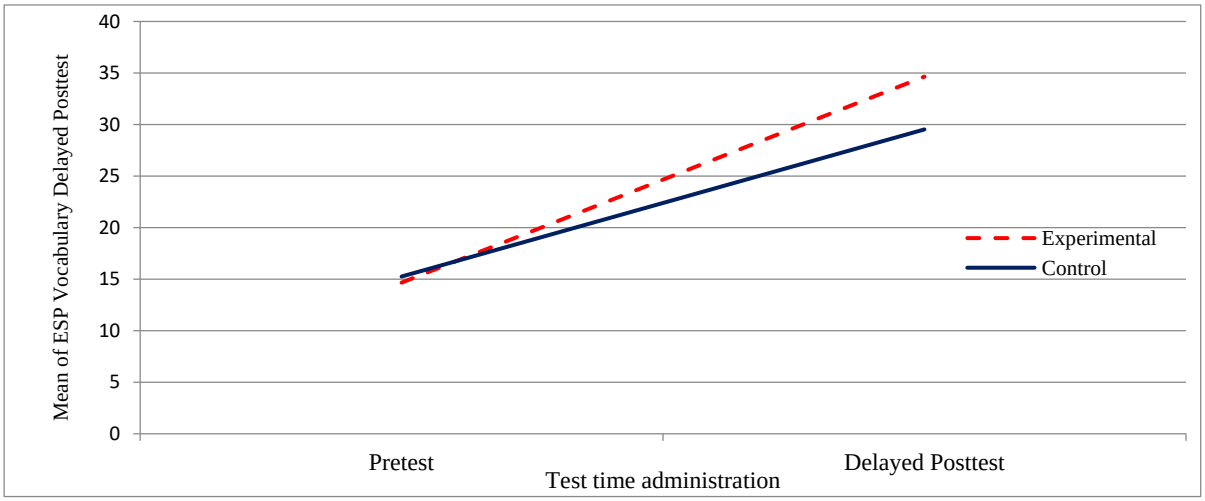

Table 8 shows the results of comparison between the scores of the experimental and control group. This table shows the results of independent samples t-test concerning vocabulary retention of students. The independent samples t-test (Table 8) reflects that there is a statistically significant difference in vocabulary retention measures, $t = 1.78$, $p = 0.003$, $p < 0.01$, for the experimental group who experienced Memrise as AI-based application, and the control group who received no AI. Thus, it was shown that AI-based application boosts ESP students' vocabulary retention.

Table 8

Independent Samples T-Test for Comparing Two Groups' ESP Vocabulary Means on the Delayed Posttest

	Levene's Test for Variances		T-test for Means			
Factor	F	Sig.	T	DF	Sig. (2-tailed)	Mean Diff.
Equal variances assumed	1.156	0.187	1.785	48	0.003	5.120
Equal variances not assumed			1.785	48	0.003	5.120

6. Discussion

This study aimed to examine the possible effects of teaching vocabulary through AI-based application (here Memrise application) on ESP students' vocabulary learning and retention. The results indicated that AI-based application has positive effects on accounting ESP students' vocabulary learning. In the delayed posttest, however both groups received less scores in comparison to posttest, participants of the experimental group received a high mean score in comparison the participants of the control group. Therefore, the effectiveness of teaching vocabulary through AI was proved.

The outcomes of this study align with previous studies on the efficacy of AI-driven language learning applications. As an example, our results are in line with Abu Qbeita's (2024) findings in which he investigated the impact of AI on Jordanian EFL university students' vocabulary learning employing the Duolingo application. The study proved that the experimental group, which utilized Duolingo, significantly outperformed the control group, highlighting the effectiveness of AI in vocabulary acquisition. In the same line, Aldowsari and Aljebreen (2024) found that ChatGPT brings effects into Saudi EFL students' vocabulary learning and the experimental group obtained higher scores compared to the control group, further validating the benefits of AI-based instruction.

Also, Algraini' (2024) study support our outcomes. He concluded that learners have a positive attitude toward using ChatGPT to learn vocabulary, reinforcing the idea that AI can be a valuable tool in language learning. Likewise, Jomaa et al. (2024) examined the effects of AI on Omani EFL students' vocabulary learning employing both quantitative and qualitative methods. Their outcomes supported the conclusion that AI is effective for vocabulary instruction and that students generally had favorable attitudes toward AI applications in learning. Similarly, Wang et al. (2024) explored the effects of learning vocabulary through ChatGPT on ESP students, concluding that AI applications create engaging learning experiences, though learner characteristics also play a role in outcomes.

Moreover, our results correlate with those of Alharbi and Khalil (2023) in which they uncovered that students generally have positive attitudes toward AI-based vocabulary learning, while teachers' perspectives varied based on age but were largely positive. Ali et al. (2023) also examined the influence

of ChatGPT on L2 learners' motivation for language learning, finding that AI had a significant positive effect on learner motivation. In addition, these findings are compatible with that of Ouis (2023) who AI-based technology enhances writing skills and that students generally had favorable attitudes toward AI tools. Similarly, Taj et al. (2017) examined the effects of technology-enhanced language learning on EFL learners' vocabulary acquisition. Their study, which used computers and mobile devices for vocabulary instruction in the experimental group, demonstrated that these learners outperformed those in the control group.

In contrast to results of this study, Sapan and Uzun (2024) investigated the impact of ChatGPT-integrated English teaching on EFL students' writing and vocabulary skills. Their study, which included both quantitative and qualitative data collection, manifested that however participants of the experimental group had positive attitudes towards using technology-based tools and AI-based application, but participants of the control group gained higher score in both vocabulary and writing.

In sum, the findings of this study align with existing research, reinforcing the effectiveness of AI-based vocabulary learning applications. The results show that AI instruments can significantly boos vocabulary acquisition and retention among accounting ESP students.

7. Conclusions and Implications

The main conclusion of this study was that teaching vocabulary through AI bring effects into ESP students' vocabulary learning and retention. In this study, the researcher used Memrise as AI-based application. In conclusion, the employment of Memrise as an AI-based application for accounting ESP students' vocabulary learning and retention has proven to be highly beneficial. Memrise's personalized, adaptive learning system effectively supports ESP students by tailoring content to their individual needs, allowing them to concentrate on areas where they may struggle with specific accounting terminology. The platform's spaced repetition feature makes sure that students are exposed to vocabulary at optimal intervals, which aids in long-term retention.

Additionally, Memrise's interactive and engaging characteristics, such as gamified elements and real-world context, make learning more enjoyable and motivating for ESP students. The AI-driven feedback and progress tracking assist to distinguish gaps in knowledge, permitting for targeted practice. As a result, ESP students are better equipped to master accounting-specific language and retain it for practical utilize in their professional careers. Combining Memrise with traditional learning methods boosts the overall learning experience, giving a comprehensive approach to vocabulary acquisition in the context of accounting ESP.

The implications of this study on the use of Memrise as an AI-based application for accounting ESP students' vocabulary learning and retention are significant both for educational practices and the development of future language learning instruments. The positive effect of Memrise on vocabulary learning and retention recommends that AI-powered platforms can be highly useful in improving learning outcomes for ESP students. Educators could consider integrating such instruments into their curricula to assist their students acquire and retain specialized language more efficiently, giving a more personalized and engaging learning experience.

The current study also highlights the potential for combining AI-based instruments such as Memrise into accounting and other ESP curricula. This combination could lead to a more dynamic learning setting, where technology complements traditional teaching methods. It can also allow for

continuous, real-time assessment and adjustment to student learning needs, making sure a tailored educational experience. The employment of Memrise's gamified features and adaptive learning paths implies that learners may find learning more enjoyable and motivating. This recommends that AI-based applications could assist to maintain learners' interest and engagement, which is necessary for long-term retention of specialized vocabulary, especially in fields like accounting, where the terminology can be complicated and dense.

Finally, the current researchers provided some suggestions for further research in this area as follows: a) The treatment lasted for ten 30-minutes sessions. Other study can be conducted with more sessions in order to get more reliable results. b) This study focused on accounting ESP students. Other study can be conducted on different fields such as medicine, chemistry and…. c) The participants of the current study were selected from Tehran, Iran, Islamic Azad University. Other study can be replicated to choose participants from other cities, countries and other universities.

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Authors' Contributions

All authors have conducted the study, collected data, analyzed and interpreted the data, and written up the manuscript.

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Competing Interests

The authors declare that there is no conflict of interest.

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