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The Effectiveness of Vocabulary Apps in Enhancing the Vocabulary Skills of Pre-University Students: The Case of Memrise

Mohamed Essafi¹, Latifa Belfakir², Mohammed Moubtassime³

Abstract

The purpose of this research is to examine the effectiveness of app-based learning for curriculum vocabulary among pre-university students, with Memrise as a case study. The study adopts a quasi-experimental design, including stratified sampling and pre- and post-testing phases. The study participants (n=48) were first randomly sampled from four high schools in Sefrou. The sample was then divided into two groups: an experimental group (n=24) and a control group (n=24). In line with the research design, data was collected using vocabulary tests, both at the outset (pretest) and at the endpoint (posttest) of a semester-long intervention. The gathered data was analyzed using an independent samples t-test. The findings yielded divergent outcomes, with, on the one hand, research hypothesis one indicating a significant performance gap favoring users of Memrise in the vocabulary posttest, and on the other hand, research hypothesis two being rejected, as only four of six vocabulary aspects displayed a significant advantage for Memrise users over non-users of the app. In the end, the study highlights the need for guiding learners to access online resources and use them effectively in their self-mode vocabulary learning practices.

Keywords: App-Based Vocabulary Learning, Pre-University Students, Memrise.

Introduction

Technology developments have immensely improved the quality of language learning (Ayres, 2002; Green, 2005; Wang & Heffernan, 2010), with mobile-assisted language learning (MALL) apps being integrated into in-class and self-mode learning practices. The ubiquity and flexibility of MALL, along with students' current study habits, facilitated this trend, establishing MALL as an incredible venue for language acquisition (Aprizal & Wachyudi, 2024; Fadhilawati, Ulum, et al., 2022; Nurani et al., 2023; Zohoorian et al., 2022). Furthermore, students' increasing reliance on MALL applications like Memrise for language acquisition highlights the attractiveness and effectiveness of app-based learning as a mode of learning that is convenient, interactive, aligned with the daily use of technology, and highly valued by students (Fadhilawati, Rachmawati, et al., 2022; Karanfil & Özet, 2021; Nhu & Quyen, 2021; Quyen, 2022). Therefore, MALL apps are gradually perceived as important platforms, offering intriguing learning experiences that cater to the different learning styles and linguistic proficiency levels of 21st-century language learners. This learning trend through MALL apps aligns with the broader educational shifts in Morocco, where integrating digital tools is encouraged to enhance students' academic excellence and meet the urgent demands of the job market (Adoui, 2024).

Achieving high proficiency in English requires the development of a robust vocabulary, a key component that serves as a marker of overall linguistic competency. MALL apps are

¹ CRÉDIF Research Laboratory, Sidi Mohammed Ben Abdellah University, Fez, Morocco, Email: mohamed.essafi1@usmba.ac.ma

² CRÉDIF Research Laboratory, Sidi Mohammed Ben Abdellah University, Fez, Morocco

³ CRÉDIF Research Laboratory, Sidi Mohammed Ben Abdellah University, Fez, Morocco



continuously demonstrated in research to enhance students' vocabulary skills and to foster positive attitudes toward app-based learning (Fadhilawati, 2016; Luczak, 2017; Aminatun & Oktaviani, 2019b). However, concerns persist regarding reduced student interaction and potentially less effective learning outcomes (Arkorful & Abaidoo, 2015). With that in mind, this study contributes to this debate by offering insights into the integration of vocabulary apps, with Memrise as a case study, within the Moroccan curriculum.

In a similar vein, when pre-university students—specifically 12th graders—experiment with the Memrise app, they enhance their vocabulary skills and become better prepared for the ongoing pedagogical reforms in Moroccan universities. This emphasizes the value of initiatives aimed at integrating digital tools into high school curricula, especially during the pivotal second year of the baccalaureate program (Zambrano, 2023). By introducing students to remote learning initiatives, policymakers can ensure that students will effectively engage in large-scale university projects, such as the Rosetta Stone enterprise. This way, we will ensure that our educational system is adaptive, effective, and resilient (Slimani & Jabal, 2023).

Vocabulary learning in Moroccan high schools faces two main practical obstacles. First, the insufficient time frame allotted to vocabulary instruction—a 60-minute session every 2–3 weeks—in available high school timetables necessitates a different approach to dealing with this challenging component of English. This restricted exposure limits the ability of 12th-grade students to sufficiently practice new vocabulary, which is vital as they prepare for the end-of-year national exam that qualifies them for higher education. Second, the way vocabulary is taught often isn't very interactive or deep. It focuses on gap-filling exercises and does not leave room for incidental vocabulary learning. While the reductionist approach of drilling is sometimes acceptable, it can lead to students' disengagement if not supplemented with more interactive learning tools like vocabulary apps. Finally, by addressing these gaps, this study hopes to inform decision-makers of the pivotal role of vocabulary apps in the pedagogical landscape of Moroccan education, especially within the specific context of second-year baccalaureate students.

The general purpose of this research is to examine the effectiveness of app-based vocabulary learning for academic English among pre-university students, with Memrise as a case study. This overall goal can further be divided into two specific objectives: (i) investigate the influence of learning through Memrise on students' vocabulary knowledge by comparing the vocabulary test scores of Memrise users with non-users of the app in the posttest phase; and (ii) explore whether the experimental group significantly outperforms the control group on all six aspects of the vocabulary posttest. Based on that, the following questions and hypotheses can be developed:

RQ1: Do students in the experimental group (Memrise users) significantly outscore those in the control group (non-users of Memrise) on the vocabulary posttest?

→ RH1: Students in the experimental group (Memrise users) significantly outscore those in the control group (non-users of Memrise) on the vocabulary posttest.

RQ2: Do students in the experimental group significantly outperform those in the control group on all six aspects of the vocabulary posttest, including word formation, word definition, synonymy/antonymy, phrasal verbs, collocations, and idiomatic expressions?

→ RH2: Students in the experimental group significantly outperform those in the control group on all six aspects of the vocabulary posttest, including word formation, word definition, synonymy and antonymy, phrasal verbs, collocations, and idiomatic expressions.

Literature Review

2.1 Vocabulary Learning

Vocabulary refers to the entire collection of words that a certain person or group has at their disposal, whether for understanding or usage (Pikulski & Templeton, 2004). Nonetheless, this definition only reveals a part of the picture, as vocabulary includes more than just words. This observation was made by Aichaoui (2005, as cited in Gacem, 2016), who contended that when dealing with vocabulary, the focus is fundamentally on words; however, this approach does not capture the thorough meaning. Aichaoui (2005, as cited in Gacem, 2016) argued that a more accurate terminology would be "vocabulary items" rather than "words" because vocabulary includes more than just individual words.

2.1.1 Aspects of Vocabulary

Understanding a word, expressions included, requires much more than knowing how to define it. It encompasses various elements, such as correctly articulating a word despite knowing its spelling or identifying one interpretation of it while attempting to comprehend its alternative meanings in different contexts. As elegantly expressed by Nation (2001), mastering a word entails a three-step process: capturing its spelling/pronunciation (i.e., word form); understanding its signification (i.e., word meaning); and knowing how to apply it in the right context (i.e., word use).

Word form, also known as orthographical knowledge, is vital in vocabulary acquisition as well as overall language learning. Nation (2001) states that mastering word forms entails the acquisition of three skills. The first skill pertains to the mastery of the word's spoken representation, including being able to determine how a word sounds within continuous speech and to articulate words when speaking in connected discourse. The second skill concerns the written form of a word, meaning not only being able to identify the visual representation of a word but also correctly writing/spelling it. The last skill in word-form command is developing the awareness of word constituents, namely roots, affixes, and word families, and their influence on meaning (Nation, 2001; Schmitt, 2000).

However, to master a vocabulary item, it is crucial to acquire not only its form but also its meaning, including the form-meaning connection, the denotation-connotation dichotomy, and word associations. First, when learners come across a new vocabulary item, they tend to establish a connection between the word's meaning and its written form (Schmitt, 2010). In addition, learners should distinguish between denotation and connotation. Denotation is often defined as the "dictionary definition" of a word, while connotation is the "emotional suggestion" of that word, rather than its literal meaning. Moreover, full mastery of a word entails understanding word associations, specifically synonymy, antonymy, homonymy, collocation, and so on (Schmitt, 2000).

Finally, in addition to understanding word form and meaning, learners should also become familiar with word use (Nation, 2001). To start, learners should master both grammatical categories, such as verbs, nouns, and adjectives, and grammatical patterns, that is, the linguistic environment in which words commonly appear. Word use also includes distinguishing between syntactic collocations, which are made up of the main word and a preposition, and semantic collocations, involving multi-word units with nouns, adjectives, verbs, and adverbs (Harmer 2001; Schmitt, 2000). Further, full mastery of words is complete with understanding the various constraints associated with word use, including, on one side, register, which refers to the

appropriate application of vocabulary in a specific situation and for a particular purpose, and, on the other side, frequency of occurrence, meaning the number of times and the duration of exposure to a word (Nation, 2001; Schmitt, 2000).

2.1.2 Types of Vocabulary

With the aspects of vocabulary discussed, we will now explore types of vocabulary learning. These can be associated with four key adjectives: direct, indirect, accidental, and purposeful (Karami & Bowles, 2019; Naeimi & Foo, 2015). In this subsection, the four identified types of vocabulary will be divided into—and respectively dealt with by—two non-identical dichotomies: the direct-indirect division and the accidental-purposeful duality.

To begin, direct vocabulary learning involves a conscious effort to acquire new vocabulary items. This approach often entails learning vocabulary items in isolation, namely through using word lists or flashcards. According to Oxford (1990), structured reviewing is a valuable approach for retaining new vocabulary items (i.e., passive vocabulary) and actively using them (i.e., productive vocabulary) in the target language, as it involves reviewing materials at different intervals. In addition to that, the mechanical technique, a remarkable strategy, is applied using flashcards, with the vocabulary items written on one side and the corresponding definition on the other side, for the sake of enhancing memory retention.

Now, in addition to direct vocabulary learning, vocabulary can also be acquired indirectly. Indirect vocabulary learning refers to the acquisition of vocabulary items without a specific focus on them (Oxford, 1990). Indirect vocabulary learning is closely related to learning vocabulary in context, which is different from the typical out-of-context approach used in direct vocabulary learning. For instance, vocabulary can be acquired indirectly, that is, through language skills, while reading a text (reading skills), listening to a podcast (listening skills), or using diaries to keep track of one's thoughts and feelings (writing skills) for prospective subsequent sharing of these with peers, friends, or family (Naeimi & Foo, 2015).

Based on Karami and Bowles's (2019) findings, accidental vocabulary learning refers to the acquisition of vocabulary as an unintended consequence of engaging in activities that are not specifically focused on vocabulary acquisition. Accidental vocabulary learning focuses on the unintentional acquisition of words through meaningful contexts, suggesting that learners can actively use words if they learn them incidentally. Careful selection of meaningful contexts is crucial to avoid misinterpretation and enhance longer retention of words in the cognitive process (Webb, 2008). Huckin and Coady (1999) highlighted three advantages of accidental vocabulary learning: (i) words can be recognized through meaningful use and within context; (ii) learners can be involved in both reading and vocabulary acquisition at the same time; and (iii) they can select the learning materials based on their needs and interests.

Now let us turn our attention to purposeful vocabulary learning. Previous research has referred to purposeful vocabulary learning as designed or intended learning that takes place in classroom settings and follows a highly structured approach (Marsick & Watkins, 1990; Yali, 2010). Hulstijn (2003) described purposeful learning as a mode of learning where participants are informed in advance that they will be tested on their retention of specific information (testing phase) after engaging in a learning task (learning phase). Yali (2010) stated that purposeful learning places significant emphasis on the words themselves and utilizes various conscious

vocabulary learning strategies and memorization techniques. Furthermore, Schmitt (2008) argues that purposeful vocabulary learning often leads to quicker and more effective achievements, with a greater likelihood of retaining the acquired knowledge.

2.2 Mobile Vocabulary Learning

Beyond doubt, vocabulary learning can by far be better learned via mobile devices than any other means. Mobile technologies play a supportive role in the acquisition of new vocabulary by facilitating access to a wide range of interactive exercises, activities, and tasks. In this subsection, I will first introduce app-based vocabulary learning, and then I will present Memrise, the focus of this study.

2.2.1 App-Based Vocabulary Learning

In addition to text messaging, games, and websites, language-learning apps are a fantastic way to learn vocabulary for many reasons. Some of these advantages include that apps can be a lot of fun, enable users to acquire new words quickly, offer various methods to help users learn word meanings, and provide flexibility for use during spare time, work, or school (Kayra, 2024; Maenza et al., 2020; Nishioka, 2020).

A study conducted by Devitasari (2019) found a significant correlation between the use of vocabulary apps and improved English vocabulary. Using the quasi-experimental method, the study compared the test scores of high school students who used a vocabulary app to learn English vocabulary with those who relied solely on traditional methods. The study revealed that app users outperformed non-users in vocabulary test scores. The findings revealed that apps are an intriguing and effective medium for teaching/learning vocabulary.

Similarly, Nuralisah and Kareviati (2020) targeted enhancing students' understanding and achievement of vocabulary through the use of the Memrise app. The study used surveys and vocabulary tests as instruments for collecting data from a sample of 35 students. The findings showed not only an enhancement in students' vocabulary mastery but also increased levels of interest and motivation for app-based vocabulary learning. In the end, Memrise was recommended for teachers to use as an alternative approach to teaching vocabulary.

In the same way, Almansour (2019) investigated students' perceptions and use of Memrise as a supplement to vocabulary learning. Based on a mixed-method approach, the study used questionnaires (n= 205), vocabulary tests (n= 189), and interviews (n= 11) as instruments for data gathering. After a semester-long intervention, the findings indicated significance in the posttest vocabulary achievement for the app users. The results also suggested that Memrise be used as a supplemental tool to vocabulary teaching, that learner autonomy be taught, and that language teaching practices shift toward learner-centeredness.

2.2.2 The Memrise App

Memrise is a vocabulary-building tool popular for its attractive design and engaging content, as well as its promotion of learner autonomy (Karjo & Andreani, 2018; Zohoorian et al., 2022). Memrise relies on two main techniques for teaching vocabulary to its users: spaced repetition and digital flashcards (Aminatun & Oktaviani, 2019b). This versatile app extends beyond language learning, as it hosts a vast amount of user-generated content spanning various subjects.

Memrise is a free online learning tool that works as both a smartphone app and a web app (Nuralisah & Kareviati, 2020). Table 1 presents technical information about the Memrise app, as displayed by the app developers:

Table 1. Memrise App Info

App name :	Memrise
Version :	2024.09.04.0
Ratings and downloads :	4.5 (10,000,000+)
Released on :	May 20, 2013
Updated on :	September 4, 2024
Operating systems :	Android ; iOS
Supported languages :	18 languages
Price :	Free; \$14.99/month for the pro features

Note: This information was obtained on September 9, 2024

In Table 1, it is revealed that Memrise is a massively downloaded app that was released in 2013 and can be downloaded from either Google Play or the App Store. The table also shows that the app targets 18 different languages. Memrise's basic version is free; in fact, the app developers demonstrate 'generosity' by providing an abundance of free features, with most of the app's learning content accessible at no cost (Essafi et al., 2024). However, Memrise users can pay a monthly fee to upgrade to the pro version, which enables them to access more features and benefits. See our earlier publication (Essafi et al., 2024) for a detailed analysis of Memrise's features across the categories of app design, content, and pedagogy.

Methodology

3.1 Research Design

To assess the relative efficacy of the Memrise app in vocabulary enhancement, the study adopted the pre- and posttest control and experimental group design. Fraenkel et al. (2012) describe this method as involving two chosen groups: one that receives the treatment (i.e., app usage) and another that does not use the technology for comparison. Both groups were assessed at the beginning and end of the semester (Fraenkel & Wallen, 1993). This design facilitates a comparison of vocabulary test score improvements between Memrise and non-Memrise users (Schutze et al., 2013), enabling an evaluative examination of the Memrise app's utility. The non-Memrise group acts as a control group against which the Memrise app's effectiveness can be gauged. Both groups continued to benefit from conventional learning methods alongside the study's approach.

3.2 Sample and Sampling

I used stratified sampling to sample 48 participants from four public high schools in Sefrou City. This sample was divided into two groups—an experimental group and a control group—each consisting of 24 students. The objective was to make sure that both groups were representative of the broader student population and balanced in terms of the demographic variables. After selecting the 48 respondents for the experiment phase, the next step was to choose the vocabulary items for the pre- and posttests. To verify that the vocabulary knowledge and skills are

comprehensively assessed, stratified sampling was drawn upon once again. The objective was to select a representative sample of 60 vocabulary items for the pre- and posttests out of the nearly 500 academic words that Moroccan students are expected to master by the end of the first semester of the second-year baccalaureate.

3.3. Research Instruments

3.3.1 Author-Designed Course

This course, designed by the researcher, includes vocabulary items from the official textbook in all concerned schools, covering six vocabulary aspects. The author-designed course is organized into five units, each containing five lists of lexical terms for students to master. In each list, translations to Arabic were provided, and where necessary, audio was integrated to give the learner a holistic approach to this journey of autonomous vocabulary learning. This course was exclusively designed for the experimental group to use as an additional tool for intentional vocabulary learning. The Memrise group integrates the vocabulary app into their learning process, alongside their regular classroom attendance and institutional learning. On the other hand, the non-Memrise group continues with their usual methods of schooling.





Figure 1. Memrise Screenshots of the Author-Designed Course

3.3.2 Vocabulary Tests

Before initiating the quasi-experimental treatment, a vocabulary pretest was formulated to evaluate students' vocabulary skills. The pretest employs a multiple-choice format (QCM) and comprises six tasks, each containing 10 items, to assess the students' grasp and use of the 60 vocabulary items across the six tested vocabulary aspects. The second component of this research instrument was a vocabulary posttest. All aspects of the posttest were the same as those of the pretest in terms of the type and the number of tasks and items (QCM test; 6 tasks; 60 items). The only difference between this test and the pretest was that the order of questions and alternatives was changed to avoid the probable recall of the pretest answers. It was administered to help the researcher measure the effectiveness of the treatment.

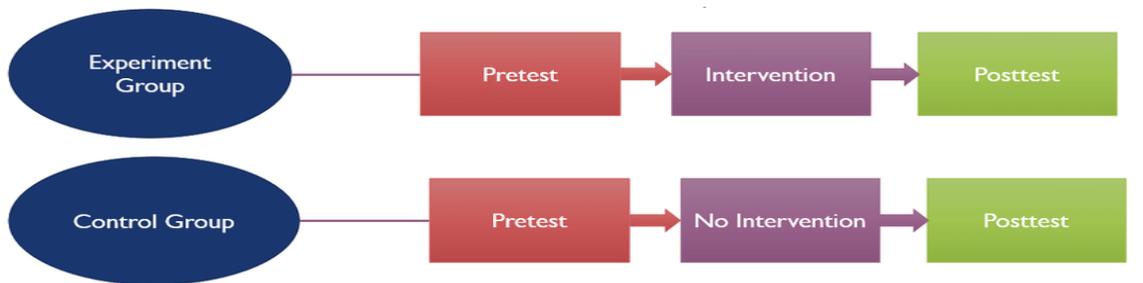


Figure 2. Design of the Quasi-Experimental Study

3.4 Data Collection

3.4.1 The Pilot Study

In this phase, the piloting process concerned two components: the author-designed Memrise course and the vocabulary pre- and posttests. To begin, the course designed by the researcher for the Memrise app underwent rigorous testing with two experienced colleagues, leading to adjustments in vocabulary list lengths based on their input. Moreover, a beneficial

recommendation led to the creation of a WhatsApp group to provide ongoing monitoring and technical assistance, thereby enhancing the overall learning journey for participants. Concerning vocabulary tests, the researcher developed a vocabulary test comprising 60 multiple-choice questions to evaluate students' understanding and use of vocabulary items from the standard textbook. Hence, 11 participants were given the chance to engage in a pilot vocabulary test one week ahead of the experiment. The untimed pilot test was meant to be done during class, although its duration exceeded the researcher's initial estimate for some students. Consequently, for the main study, incentives and a time limit were introduced to ensure fairness and equal opportunities and encourage active participation.

3.4.2 The Main Study

The main study consisted of three interrelated steps: (i) pretest delivery; (ii) intervention implementation; and (iii) posttest and scoring. First, the delivery of the pretests took place in the first week of the fall semester, after which the experimental group underwent an intervention, and the control group continued with their usual methods of learning. On the day of the pretest, a hard copy consent form was provided to the participants. Ten minutes were designated for a silent review of the "Information Sheet," with any questions for clarification addressed. A clear explanation was offered regarding the methodology to approach the vocabulary items, and 35 minutes were allotted for the test itself.

Having completed the pretest tasks, participants were assigned to either the Memrise or non-Memrise experiment groups. Those in the Memrise group were assisted (by the researcher) in downloading the Memrise app via a shared link. Both groups leveraged conventional teaching, with the only difference being the inclusion of Memrise as a supplemental tool within the learning process for the Memrise group. The experiment lasted an entire semester, offering the experimental group sufficient time to engage with it and assess the impact of leveraging the Memrise app for developing vocabulary skills over an extended period. Furthermore, a central element of technical support was introduced, creating a specific WhatsApp group.

Concluding the 14-week experiment, a posttest was administered to the participants of the two experiment groups, aiming to gauge the vocabulary progress in both groups and assess the effectiveness of the treatment within the experimental group. The posttest replicated the words from the pretest but introduced variations in question order and answer alternatives. Following the collection of posttests, the grading process unfolded in two stages: an initial assessment conducted by myself, followed by a second evaluation performed by two experienced EFL teachers. Employing multiple scorers for assessment, a practice advocated for its reliability by Kroll (1990) and Scott (1996), contributed to the comprehensive and accurate evaluation of the results.

3.5 Reliability and Validity

The vocabulary tests employed in this study were rigorously validated for reliability and validity. First, reliability was assessed using Cronbach's alpha, which revealed high internal consistency, with pretest coefficients ranging from 0.86 to 0.92 and posttest coefficients approaching 0.93. Second, validity was established through face and content validity checks, where expert feedback helped refine the tests to ensure they accurately measured the intended vocabulary constructs. Convergent validity was demonstrated by high correlations between pre-

and posttest scores ($r = 0.817$, $p < 0.01$), while discriminant validity was confirmed by low correlations between different vocabulary aspects, with off-diagonal correlation values typically below 0.85. Third and last, the data was analyzed for normality using skewness, kurtosis, and formal tests like Kolmogorov-Smirnov and Shapiro-Wilk, all indicating that the data adhered to normal distribution criteria. Boxplots further confirmed the absence of significant outliers and minimal skewness.

3.6 Data Analysis

To address the research questions of this study, the analysis of data was conducted employing the Statistical Package for the Social Sciences (SPSS). Initial scrutiny involved employing the Kolmogorov-Smirnov (KS) and Shapiro-Wilk (SW) tests to assess the data's normal distribution. Subsequently, descriptive statistics, including means and standard deviations, were computed. Lastly, to evaluate the effects of the intervention on the vocabulary proficiency of pre-university students, independent samples t-tests were employed, whether with the overall vocabulary tests or the vocabulary subtests.

3.7 Ethical Considerations

During the study, the guidelines about voluntary participation and informed consent were rigorously applied. To start, I did not force any participant to take part in this study, as only the students who wanted to pilot-test the vocabulary tests were permitted. Further, participants were throughout the study constantly reminded of the voluntary nature of their participation and were at all times given the right to opt out. Regarding informed consent, students' written permission was required and obtained throughout the study. Thereby, before the experiment, students were briefed on the intervention's scope and their rights as research participants.

Similarly, Creswell's (2014) guidelines about anonymity and confidentiality were strictly followed throughout the study. First, each participant has been assigned a unique code to replace their identities. All data, such as copies of vocabulary tests and answer sheets, has been safely stored with strict access control. Furthermore, pseudonyms have been used instead of real names, and potential identifiers have been excluded (Babbie, 2016). Second, confidentiality procedures were rigorously followed, ensuring participants understood and agreed to the measures in place. Accordingly, despite the absence of sensitive topics, a commitment to ensuring anonymity and confidentiality has been extended to all participants.

Results

In this section, I examine the two hypotheses of this study. Research hypothesis 1 contends that students in the experimental group (Memrise users) exhibit a significant advantage over their peers in the control group (non-users of the app) on the vocabulary posttest. In the same way, research hypothesis 2 posits that students in the experimental group outperform those in the control group across all aspects of the vocabulary posttest.

4.1 Research Hypothesis 1

RH1: Students in the experimental group (Memrise users) significantly outscore those in the control group (non-users of Memrise) on the vocabulary posttest. The tool I used to test this hypothesis was the independent samples t-test, as it is appropriate for comparing the means of two independent groups. By using this test, the analysis can adequately

determine if there are significant differences in performance between the users of Memrise and non-users of the app.

Table 2. Independent T-Test of Students' Performance on the Vocabulary Pre- and Posttests

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pre-test: All Items	Equal variances assumed	.302	.585	.088	46	.930	.125	1.416	-2.725	2.975
	Equal variances not assumed			.088	45.886	.930	.125	1.416	-2.725	2.975
Post-test: All Items	Equal variances assumed	5.737	.021	-3.827	46	.000	-5.375	1.404	-8.202	-2.548
	Equal variances not assumed			-3.827	40.790	.000	-5.375	1.404	-8.212	-2.538

Table 2 displays the t-test results for the vocabulary tests on the pre- and posttest phases of the study. In the pretest stage, the mean difference between the control and experimental group is 0.125, and the significance value is largely higher than the alpha value 0.05. Further, the t-value is reported as $t(46) = 0.088$, with a corresponding significance value of 0.93. Hence, the mean difference between the experiment's two groups on the pretest is not significant, which means that we can safely carry on to the posttest outcomes.

In the posttest phase, the mean difference between the two groups from the experiment is 5.37, in favor of the experimental group. The corresponding t-value is reported as $t(46) = -3.82$, with an associated significance value of 0.00. This number is less than the alpha value ($0.00 < 0.05$), which supports research hypothesis one. This outcome indicates a significant outperformance by students in the experimental group (i.e., users of Memrise) compared to their peers in the control group (i.e., non-users of the app) on the vocabulary posttest.

4.2 Research Hypothesis 2

RH2: Students in the experimental group significantly outperform those in the control group on all six aspects of the vocabulary posttest, including word formation (WF), word definition (WD), synonymy and antonymy (SA), phrasal verbs (PV), collocations (C), and idiomatic expressions (IX).

This hypothesis can be further divided into six subhypotheses:

RH2(a): Students in the experimental group significantly outperform those in the control group on the aspect of word formation (WF) of the vocabulary posttest.

RH2(b): Students in the experimental group significantly outperform those in the control group on the aspect of word definition (WD) of the vocabulary posttest.

RH2(c): Students in the experimental group significantly outperform those in the control group on the aspect of synonymy and antonymy (SA) of the vocabulary posttest.

RH2(d): Students in the experimental group significantly outperform those in the control group on the aspect of phrasal verbs (PV) of the vocabulary posttest.

RH2(e): Students in the experimental group significantly outperform those in the control group on the aspect of collocations (C) of the vocabulary posttest.

RH2(f): Students in the experimental group significantly outperform those in the control group on the aspect of idiomatic expressions (IX) of the vocabulary posttest.

In this section, the objective is to assess the above subhypotheses—which collectively constitute research hypothesis two—by examining the significance of the differences between students who enhance their vocabulary learning through using Memrise and those who do not.

To perform this analysis, I will, as with the first hypothesis, use the same tool, that is, the independent samples t-test, and the same process, namely the comparison of the mean scores of the experiment's two groups, both at the outset (pretest) and at the endpoint (posttest).

Table 3. T-Test of Students' Performance on the Vocabulary Subtests of the Posttest Phase

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post-test: WF	Equal variances assumed	4.091	.049	-2.789	46	.008	-.750	.269	-1.291	-.209
	Equal variances not assumed			-2.789	42.187	.008	-.750	.269	-1.293	-.207
Post-test: WD	Equal variances assumed	6.492	.014	-.874	46	.387	-.250	.286	-.826	.326
	Equal variances not assumed			-.874	42.228	.387	-.250	.286	-.827	.327
Post-test: SA	Equal variances assumed	4.774	.034	-2.158	46	.036	-.708	.328	-1.369	-.048
	Equal variances not assumed			-2.158	41.412	.037	-.708	.328	-1.371	-.046
Post-test: PV	Equal variances assumed	.562	.457	-8.728	46	.000	-1.958	.224	-2.410	-1.507
	Equal variances not assumed			-8.728	45.123	.000	-1.958	.224	-2.410	-1.506
Post-test: C	Equal variances assumed	6.264	.016	-1.689	46	.098	-.417	.247	-.913	.080
	Equal variances not assumed			-1.689	39.464	.099	-.417	.247	-.915	.082
Post-test: IX	Equal variances assumed	1.583	.215	-4.723	46	.000	-1.292	.274	-1.842	-.741
	Equal variances not assumed			-4.723	41.632	.000	-1.292	.274	-1.844	-.740

Table 3 presents the t-test findings for the vocabulary posttest, covering six vocabulary aspects, including word formation, word definition, synonymy/antonymy, phrasal verbs, collocations, and idioms. Initially, on word formation, the mean difference between the two groups of the experiment is 0.75, with the associated t-value recorded as $t(46) = -2.78$, and a correlated p-value less than the alpha level ($0.008 < 0.05$). This conclusion means that subhypothesis RH2(a) is supported, implying a noteworthy posttest outperformance of Memrise users over non-users of the app in the vocabulary aspect of word formation.

Concerning word definition, the mean difference between the two groups from the experiment is 0.25, and the corresponding t-value is reported as $t(46) = -0.87$, with an associated p-value of 0.38. The obtained significance value is higher than the theoretical value ($0.38 > 0.05$). As a result, subhypothesis RH2(b) is rejected, proposing no significant posttest outperformance of the experimental group over the control group in terms of word definition.

Regarding synonymy and antonymy, the mean difference between the two groups from the experiment is 0.7, and the corresponding t-value is reported as $t(46) = -2.15$, with an associated p-value of 0.03. The obtained significance value is less than the alpha value ($0.03 < 0.05$). Therefore, subhypothesis RH2(c) is supported, suggesting the effectiveness of Memrise in enhancing students' vocabulary aspect of synonymy/antonymy.

In reference to phrasal verbs, the mean difference between the experimental and the control group is 1.95, and the corresponding t-value is recorded as $t(46) = -8.72$, accompanied by a p-value of 0.00. This significance value falls below the conventional threshold ($0.00 < 0.05$), providing support for subhypothesis RH2(d). This outcome corroborates the significant outperformance of Memrise users over non-users of the app on phrasal verbs.

The mean difference in collocations between the two groups under examination is 0.41, with a t-value of $t(46) = -1.68$ and a corresponding p-value of 0.09. This obtained significance value exceeds the theoretical threshold ($0.09 > 0.05$). Consequently, subhypothesis RH2(e) is rejected, as the use of Memrise has not displayed any notable posttest advantage for the experimental group over the control group in terms of collocations.

Last, the mean difference between the experimental and control groups is 1.29, with the corresponding t-value reported as $t(46) = -4.72$, accompanied by a p-value of 0.00. This significance value falls below the customary threshold ($0.00 < 0.05$), lending support to subhypothesis RH2(f). This outcome proves the significant impact of Memrise in improving users' vocabulary skills in terms of idioms. All in all, the second research hypothesis is rejected, as the use of Memrise by students has shown a significant impact on just four of the six tested vocabulary aspects.

Discussion

The first research hypothesis of this study claimed a significant outperformance of students who supplement their traditional vocabulary learning with the use of Memrise over those who suffice with classroom learning. At the end of the semester-long experiment, the alternative hypothesis was confirmed, showing a significant impact of the Memrise app in enhancing users' overall vocabulary skills.

The findings of this study resonate with those of many researchers. For example, Luczak (2017) observed that Polish students who relied on Memrise for learning achieved higher test scores, a trend consistent with the results of this study, although students reported utilizing various other available learning resources. This observation aligns with the conclusions drawn by Almansour (2019) in Saudi Arabia, who emphasized the potential impact of Memrise, as a supplementary tool to traditional teaching, on enhancing students' vocabulary learning performance. In the same way, students perceived the Memrise app as effective in enhancing vocabulary skills, finding it useful, entertaining, and advantageous in speaking, pronunciation, listening, and writing, leading to increased satisfaction in learning (Biniara et al., 2024). Research also demonstrated that utilizing Memrise in conjunction with a participatory approach significantly enhanced students' vocabulary skills compared to traditional teaching methods (Wuisan & Simanjuntak, 2024). Additionally, Cahyono et al. (2023) found the app effective in enhancing students' English vocabulary skills.

The implications of these findings are multiple. To start, the confirmed outperformance of

Memrise users compared to non-users of the app suggests that integrating digital language learning tools like Memrise can yield tangible benefits in vocabulary acquisition among students (Fathi et al., 2018). Hence, it is crucial to provide targeted support and resources to students to effectively integrate technology into their self-study practices. Moreover, leveraging the Memrise app as an online curriculum component or requirement aligns with the current reforms in Moroccan tertiary education, which increasingly relies on digital platforms to develop the linguistic skills of English language students (Hafa & Moubtassime, 2021; Laadem, 2017). One of these digital platforms is Rosetta Stone, through which English and French are taught and certified remotely. In the same context, it is time apps like Memrise are integrated as a remote teaching resource into the curriculum of second-year baccalaureate students, capitalizing on the affordances of app-based learning to provide students with flexible and accessible opportunities to reinforce their language skills.

The second research hypothesis, being an in-depth focus on vocabulary learning, asserted a significant performance gap favoring the experimental group in each of the six aspects of vocabulary, namely word formation, word definition, synonymy/antonymy, phrasal verbs, collocations, and idioms. This hypothesis was rejected, as only four of these vocabulary aspects—word formation, synonymy/antonymy, phrasal verbs, and idioms—displayed a significant advantage for Memrise users over non-users of the app.

To start, the effect of Memrise on word definition (WD) was minimal in this study. This outcome conflicts with the findings of a study by Vu and Bui (2023), in which Quizlet users outperformed non-users of the app in recalling word definitions. Nonetheless, it matches studies suggesting that correctly grasping and defining words requires a subtle connection between form, meaning, and use, which may not be entirely captured by apps alone (Laufer & Goldstein, 2004). As with word definition, Memrise's impact on collocations (C) seems minor in this research. The result points to a gap in digital vocabulary learning, which may not provide the contextual and syntactic depth needed for mastering collocational use (Nesselhauf, 2003; O'Dell & McCarthy, 2009). That said, Amer (2014) indicated that a mobile app designed to teach idioms and collocations positively impacted learners' usage and test scores, promoting effective collocation acquisition through mobile technology. Hence, teachers should opt for contextual learning and hands-on activities to boost students' understanding of word definitions and collocations (Norman et al., 2023; Utami et al., 2023).

With the non-significant vocabulary areas addressed, the discussion now shifts to the significant aspects. Initially, Memrise was proven to be notably effective in enhancing students' word-formation (WF) skills, as digital tools designed for cognitive tasks on word formation, according to Bolotina and Vlavatskaya (2022), enable students to independently derive the meanings of unfamiliar words with familiar word-formation parts. Memrise's use of adaptive learning and spaced repetition reinforces the mastery of word-formation techniques by ensuring repeated practice at ideal intervals. Concerning synonymy/antonymy (SA), another statistically significant aspect, research states that mastering this vocabulary area is shown to be strongly positively associated with better performance in both receptive and productive language skills (Pamungkas et al., 2022). The potency of Memrise in improving students' mastery of synonyms and antonyms can be attributed to its blend of visual, gamified, and customized features, suggesting the need for the use of technology to support diverse learning needs and active learning strategies (Kukulaska-Hulme & Traxler, 2019).

As pertains to phrasal verbs (PV), in line with the current study, Yamini and Malarvizhi (2017) noted that online learning approaches are successful in meeting learning goals connected to phrasal verbs. That said, conventional methods of teaching commonly find it challenging to handle the idiomatic and contextual intricacies of phrasal verbs, depending instead on isolated examples and recall practice (Thornbury, 2002). Regarding idiomatic expressions (IX), many studies revealed, as is the case in our study, the supremacy of app-based learning over traditional methods of idiomatic instruction, with learners exhibiting enhanced learning outcomes (Basal et al., 2016; Wu et al., 2021). Mastering idioms is not an easy task, as it involves navigating cultural context and figurative language, a challenge efficiently addressed through the interactivity and contextuality of app-based learning (Gibbs, 2017). Hence, teachers can leverage vocabulary apps to generate in-app activities that feature figurative language like phrasal verbs and idioms, enabling learners to use these activities as a pre-class initiation—as in the flipped classroom model—and/or a post-class practice.

Conclusion

The current study aimed to examine the effectiveness of app-based vocabulary learning in academic English among pre-university students. In this study, I was required to execute a semester-long experiment employing a quasi-experimental design to evaluate two research hypotheses. The analysis of data revealed mixed outcomes. The initial research hypothesis was validated, indicating a substantial performance disparity favoring the experimental group (Memrise users) compared to the control group (individuals relying solely on classroom instruction) in the vocabulary posttest. However, the second research hypothesis was only partially accepted, in that while Memrise users showed notable improvement in four of six vocabulary aspects—word formation, synonymy and antonymy, phrasal verbs, and idiomatic expressions—the remaining two aspects, word definition and collocations, exhibited only a slight advantage.

We must consider two main limitations of this study when interpreting its results. First, while stratified sampling was applied to cover diverse schools, academic streams, and genders, the study was limited to 12th-grade students in a single city. That said, future studies should involve participants from multiple regions and educational levels and backgrounds to verify whether the results are consistent across different contexts. Another limitation is the extent of the quasi-experimental intervention, which was restricted. Hence, the emphasis on one app and only 60 lexical items (from a pool of around 500) might reduce the generalizability of the results to other apps or the broader vocabulary students need to master. To make the results more widely applicable, future research should consider expanding the number of apps and the sample size of vocabulary items.

The findings of this study offer several implications for the adoption of vocabulary apps in educational settings. Initially, the study points out the need for ongoing research, namely longitudinal studies, to offer observations about the long-term impact of integrating digital tools into students' self-study routines (Izah, 2019; Mashru & Upadhyay, 2015). Further, institutions should facilitate access to these online resources and integrate them into structured learning plans, aligning with previous research, which highlights the benefits of these tools in improving vocabulary skills (Cahyono et al., 2023; Fathi et al., 2018). Moreover, educators should advocate for a blend of online and on-site vocabulary learning modalities to foster a more holistic and inclusive learning environment for their students. Last, students should be guided to include

digital tools like apps in their self-study practices to enhance their language learning and achieve their learning goals (Abarghoui & Taki, 2018; Fadhilawati, 2016).

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Authors' contributions

Dr. Mohammed Moubtassime, Dr. Latifa Belfakir and Mr. Mohamed Essafi contributed equally to this study. All authors read and approved the final manuscript.

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The authors declare no conflict of interest.

Informed consent

Obtained.

Data availability statement

The data that support the findings of this study are available upon request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Ethics Statement

Ethical review and approval were not required for this study on human participants in accordance with local legislation and institutional requirements. Participants provided written informed consent to take part in the study.

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