

PAPER

The Impact of Mobile-Assisted Language Learning on Developing EFL Learners' Vocabulary Knowledge

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ABSTRACT

Currently, a great variety of educational apps have been developed and extensively used by learners and instructors, making, as a result, mobile-assisted language learning one of the most prominent learning methods in enhancing the quality of language learning. However, despite the growing popularity of commonly used apps supporting second language acquisition, such as Kahoot and Quizlet, empirical research on the pedagogical role of other more recent applications in boosting L2 vocabulary is still scarce. Given this, this experimental study examines the effectiveness of a mobile application in enhancing Moroccan EFL secondary school students' vocabulary knowledge. The study consisted of the control group (n = 30) and the experimental group (n = 30). While participants in the first group received traditional methods of teaching vocabulary, the experimental group integrated a mobile application (Flashcards World) during one semester. Data collection comprised vocabulary pre- and post-tests to compare the vocabulary learning of participants in both groups. To determine if there was a difference in the scores of the groups before and after the intervention, the findings were analysed using Independent-Samples T Tests (SPSS-26). The results revealed that the experimental group outscored the control group. Therefore, it was concluded that using Flashcard World application effectively improved vocabulary learning of secondary school students more than conventional teaching.

KEYWORDS

experimental study, Flashcard World application, mobile apps, MALL, pedagogical role, Moroccan secondary school students, vocabulary knowledge improvement

1 INTRODUCTION

Acquiring any foreign language can only take place by learning its lexis. Vocabulary is the basis for attaining proficiency in any language. Lexical knowledge is crucial to enhancing communicative competence [1], and with this knowledge, learners will be motivated to learn or use the language [2]. Despite its vital position in

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attaining language proficiency, EFL learners find learning and developing their linguistic repertoire challenging. EFL students face issues with accurate word spelling and pronunciation, identifying and predicting the meanings of unfamiliar words, learning new terms, and appropriately using new words [3].

To address the above difficulties, generating innovative strategies using modern technologies to enhance vocabulary learning is crucial. Accordingly, it is believed that implementing mobile technologies has the potential to change conventional teaching methods, bridge the gap between in-class and out-of-class learning, and help produce innovative and more flexible learning environments [4]–[5]. These new technologies have numerous characteristics, including, but not limited to, mobility, connectivity, security, familiarity, multimodality, supporting different learning styles, and providing individual scaffolding [6].

Recent research on mobile-assisted language learning has shown that mobile applications effectively boost EFL learners' linguistic competence, which significantly adds to better language practice [7]–[8]. Flashcard World application is one of the most common apps currently under research in enhancing vocabulary learning and solving students' vocabulary knowledge difficulties. It is a free app released in 2019, and thus it is a relatively recent software application. It helps learners build up, organise, and memorise vocabulary items by creating endless cards based on their needs [9].

In a nutshell, improving learners' vocabulary remains among the essential insights of MALL to foreign language learning. It has been previously proven that mobile-assisted language learning applications, namely Quizlet and Kahoot!, boosted EFL students' vocabulary acquisition. Nevertheless, more research is needed into implementing other recent applications, such as Flashcard World, especially in high school settings. This study, therefore, seeks to expand our grasp of MALL research in vocabulary by investigating the pedagogical role of Flashcard World application in improving Moroccan secondary school students' vocabulary learning. More specifically, the primary objective of this study is to compare the vocabulary pre- and post-test scores of the control and experimental groups and thus determine whether or not MALL implementation via Flashcard World app is more effective than traditional instruction. Therefore, the current study aims to contribute to the growing area of mobile-assisted language learning research by exploring the role of more recent applications in enhancing students' vocabulary learning.

2 LITERATURE REVIEW

MALL refers to supporting language learning through mobile devices such as mobile phones in various locations and contexts [10]. However, the analysis of previous research has manifested the potential role of MALL implementation in boosting students' motivation [11], enhancing collaboration [12]–[13], and developing the learner's language learning autonomy [14]–[15]. Latest investigations have also proved the potency of MALL implementation in enhancing English language skills [16, 17, 18, 19].

Regarding vocabulary learning, the literature review confirmed the effectiveness of MALL implementation in supporting and enhancing vocabulary learning [7, 8, 20, 21, 22, 23, 24]. Chaikovska & Zbaravska [20] studied the feasibility of using the Quizlet application in EFL vocabulary development in higher education. Both groups' post-test scores increased (+0.76 for the control group; +3.16 for the experimental group), but the experimental group outperformed the control group.

Okumus et al. [21] identified the usefulness of the created CollocatApp in vocabulary knowledge improvement of EFL learners. The findings revealed a significant difference in receptive vocabulary knowledge between the two groups. Nevertheless, the results of the retention tests showed no significant difference between the two groups. Reynolds [22] found that the experimental group's mean score improved thanks to the utilisation of Kahoot!, while the control group's scores decreased. In addition, the online survey and focus group discussions displayed positive attitudes of both instructors and students toward the implementation of Kahoot! in vocabulary classes.

Lei et al. [23] used a longitudinal research design to collect quantitative data on the impact of a MALL program on the vocabulary development of 139 EFL learners. For a one-year implementation, the authors employed mobile applications such as Merriam-Webster and Longman e-Dictionaries, English songs, and social network applications, mainly Telegram and WhatsApp. Within-person differences exhibited an improvement in vocabulary acquisition and self-regulatory ability in vocabulary learning. In addition, the findings revealed a beneficial relationship between vocabulary learning attitudes and self-regulatory ability in vocabulary improvement.

Therefore, the latest research on mobile-assisted language learning highlights that the implementation dramatically boosts vocabulary learning in EFL learners. However, the literature review analysis shows that most studies [7, 20, 22, 24] investigated the two common apps: Kahoot! and Quizlet. In contrast, very little is known about the role of other recent apps, such as Flashcard World, in supporting EFL learners' vocabulary knowledge. Therefore, this research aims to fill this knowledge gap from previous research and contributes to this growing area of research by examining the pedagogical role of implementing Flashcard World app in supporting and enhancing Moroccan EFL secondary school students' vocabulary knowledge. The key research question of this study was:

1. Is the implementation of Flashcard World application more effective in improving EFL learners' vocabulary knowledge than conventional teaching?

Accordingly, the hypotheses were formulated as follows:

H0: Participants who were taught vocabulary via Flashcard World app performed no better on the vocabulary tests than those in the control group.

H1: Participants who were taught vocabulary via Flashcard World app performed significantly better on the vocabulary tests than those in the control group.

3 METHODOLOGY

3.1 Research design

This experimental study used a pre-test/post-test design to detect the effectiveness of integrating the mobile app: Flashcard World, in improving vocabulary knowledge of EFL secondary school students. The experimental and control groups were randomly assigned, and the data were quantitatively compared. This study had two variables: one independent and one dependent. The independent variable is the vocabulary mobile app: Flashcard World app (X1) for the experimental group and conventional teaching for the control group, while the dependent variable is students' vocabulary scores (Y1). The research design is illustrated as follows (see Figure 1):

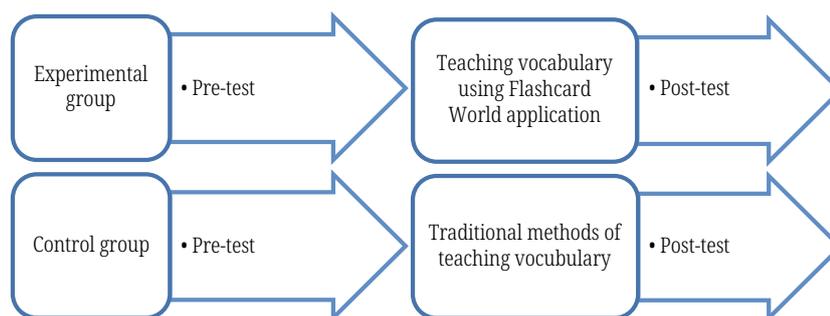


Fig. 1. The research design of the study

3.2 Participants

Sixty 2nd year Baccalaureate students (22 males and 38 females, aged 16–19) from a secondary school in Morocco were the study sample. The participants were equally and randomly assigned to the control group ($n = 30$) and the experimental group ($n = 30$). The study occurred during the first semester of the 2022/2023 academic year.

3.3 Data collection instruments

To collect quantitative data, a vocabulary pre- and post-test, designed by the research based on students' textbooks, was used to measure students' performance in both groups before and after the intervention. Before the treatment, the two groups took the vocabulary pre-test, which consisted of three sections: a multiple-choice section, an odd-one-out section, and a vocabulary pyramid game section. The three sections targeted twenty lexical items from students' textbooks. The researcher then scored the traditional paper-based pre-test on a scale of one to twenty, with one for correct and zero for incorrect answers. The post-test was administered and graded in the same manner as the pre-test to participants in both groups.

Even though the vocabulary test was based on students' textbooks, the test was given to five experts for validity reasons: two university professors in applied linguistics, two English language supervisors, and one experienced English language teacher. Based on the reviewers' comments and feedback, the order of the three sections was changed, a filling-the-gap section was removed and replaced with the vocabulary pyramid game section, and the number of lexical items was reduced to twenty instead of thirty.

To guarantee the test's reliability, test re-test reliability was tested. Fifteen students in the same school and level but not participating in the study took the test twice (two weeks between each session). As displayed in Table 1, Cronbach's Alpha value was .911, indicating a high positive correlation between the two tests' scores. Thus, the vocabulary test was reliable for the study.

Table 1. Test Re-test reliability of the vocabulary test

Cronbach's Alpha	N of Items
.911	2

3.4 Procedure and Implementation

The study aimed to investigate the pedagogical role of Flashcard World application in developing secondary school vocabulary knowledge. As a result, the study participants were split into the control group ($n = 30$), which received traditional vocabulary instruction, and the experimental group ($n = 30$), which received mobile-based learning.

The experiment started by administering the vocabulary pre-test to both groups to determine if there were any differences between the two groups before the experiment. The experimentation phase took place for a whole semester, from September 26th, 2022, to January 14th, 2023. During that period, the experimental group participants were first introduced to Flashcard World application, got an overview, and installed it on their mobile phones (see Figure 2).



Fig. 2. Flashcard world logo

Students started with creating a set based on the unit's theme; then, they were asked to add cards of lexical items related to the unit (see Figures 3 and 4 below).

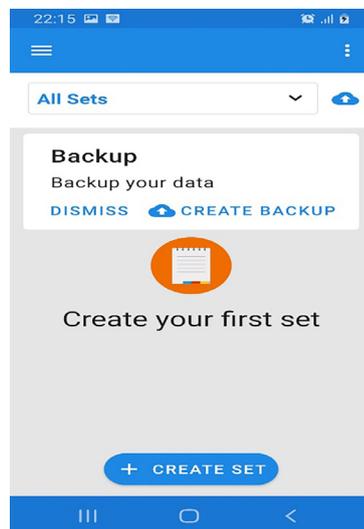


Fig. 3. Creating a set

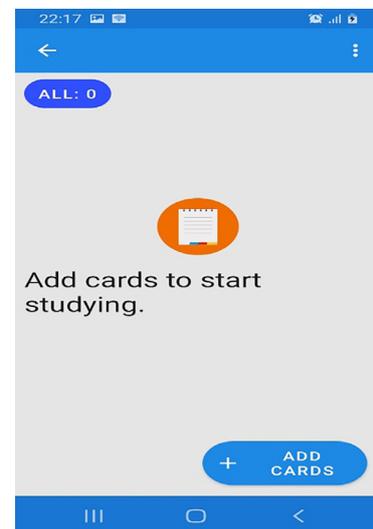


Fig. 4. Adding cards

Students can practice all the lexical items of the unit in different ways, including listening to the words for pronunciation. They can have a basic flashcards review, select the correct answer from multiple answers, match cards between two lists, review items by writing, or review items by listening to their records (See Figures 5 and 6).

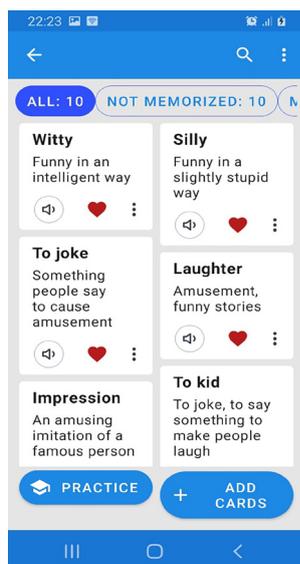


Fig. 5. Cards memorised

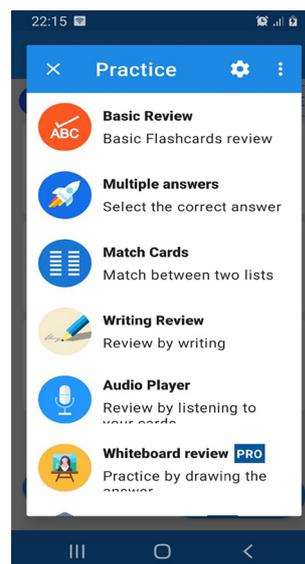


Fig. 6. Ways to practise vocabulary

During the semester, students were introduced to five units based on their textbooks (The Gifts of Youth, Humour, Education, Sustainable Development, and Women and Power). In each unit, they were provided with ten lexical items (see Table 2):

Table 2. Units and lexical items targeted

Units	Lexical Items
The Gifts of Youth	Adventure
	Ambition
	Audacity
	Creativity
	Enthusiasm
	Gifted
	Responsibility
	Talents
	Vigour
	Vitality
Humour	Boredom
	Caricatures
	Gaiety
	Humorous
	Impression
	To kid
	Laughter
	To joke
	Silly
	Witty

(Continued)

Table 2. Units and lexical items targeted (*Continued*)

Units	Lexical Items
Education	Absenteeism
	Compulsory
	Dropouts
	E-learning
	To improve
	Knowledge
	Literacy
	Performance
	Portfolio
	Success
Sustainable Development	Ecology
	Elimination
	Infrastructure
	Justice
	Micro-credits
	NGOs
	Preservation
	Rural
	Urbanisation
	Voting
Women and Power	Dominance
	Empowerment
	Equality
	Feminism
	Emancipation
	Gender
	Patriarchy
	Polygamy
	Stereotypes
	Violence

In the last phase of the study, a vocabulary paper-based post-test was administered to both groups to compare the differences in scores and thus determine the impact of the integrated mobile application on students' vocabulary knowledge improvement. It is worth noting that the students took the test without prior notice. Also, the examination focused mainly on lexical items targeted during the treatment. The instructional and data collection procedures are summarised in Table 3:

Table 3. Instructional and data collection procedures

Weeks	The Experimental Group	The Control Group
Week 1	took the paper-based pre-test	
Week 2	Introduced to Flashcard World application	Introduced to conventional vocabulary teaching methods
Weeks 3 and 4	Set 1: The Gifts of Youth	Taught vocabulary conventionally using students' textbooks and worksheets
Weeks 5 and 6	Set 2: Humour	
Weeks 7 and 8	Set 3: Education	
Week 9 and 10	Set 4: Sustainable Development	
Weeks 11 and 12	Set 5: Women and Power	
Week 13	took the paper-based post-test	

4 FINDINGS

4.1 The research question: Is the implementation of Flashcard World application more effective in improving EFL learners' vocabulary knowledge than conventional teaching?

The distribution of the two groups' scores was first examined before conducting an independent-sample t-test using the SPSS program (version 26) to compare these scores in the pre-test. The results are presented in Table 4:

Table 4. Normality test of the control and experimental groups' pre-test

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.154	30	.066	.932	30	.055
Control	.142	30	.124	.933	30	.057

As indicated in Table 4, in the Kolmogorov-Smirnov test, the experimental group had a p-value of .066, and the control group had a p-value of .124. In the Shapiro-Wilk test, the experimental group's p-value was .055, while the control group's p-value was .057. Thus, the scores within each group were normally distributed ($p > .05$). Accordingly, an independent-sample t-test was run to compare the vocabulary pre-test scores of the two groups. The descriptive data of the two groups are illustrated in Table 5:

Table 5. Pre-test descriptive data for the control and experimental groups

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	30	2.73	1.946	.355
Control	30	2.93	2.212	.404

Table 5 shows that the mean score of the experimental group ($n = 30$) was 2.73, with a standard deviation of 1.946 compared to 2.93 and a standard deviation of

2.212 for the control group ($n = 30$). These values, however, did not show any statistical difference between the two groups, as the p-value (see Table 6) was smaller than 0.05 (sig. 0.711). In fact, these values are not surprising since both groups did not study the given lexical items yet. Thus, all the items were unfamiliar when taking the pre-test.

Table 6. Independent samples T-test on pre-test of the control and experimental groups

	Levene's Test		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
Equal variances assumed	.263	.610	-.372	58	.711	-.200	.538	-1.277	.877
Equal variances not assumed			-.372	57.07	.711	-.200	.538	-1.277	.877

During a whole semester of instruction, the control group was conventionally taught vocabulary using the textbook and worksheets. In contrast, the experimental group used Flashcard World app. In the 13th week of the semester, the two groups took a post-test in the same testing and grading procedures. The results of normality test are illustrated in Table 7:

Table 7. Normality test of the control and experimental groups' post-test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experimental	.126	30	.200*	.968	30	.496
Control	.117	30	.200*	.942	30	.103

As can be analysed from Table 7, the p-value in the Kolmogorov-Smirnov test was 0.200* for both groups. In the Shapiro-Wilk test, the experimental group's p-value was .496, and the control group's p-value was .103. Thus, scores were normal in each group ($p > .05$) in the post-test. Accordingly, another independent-sample t-test was applied to compare the vocabulary post-test scores of the groups. The results of the post-test are described in Tables 8 and 9:

Table 8. Post-test descriptive data for the control and experimental groups

Groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental	30	13.47	2.515	.459
Control	30	10.20	4.656	.850

Table 8 shows that the experimental group got a mean score of 13.47 (SD = 2.515) compared to 10.20 (SD = 4.656) for the control group. Although the experimental group got higher scores than the control group, further analysis using independent samples t-test, as indicated in Table 9, was required to determine whether the difference was significant or not.

Table 9. Independent samples T-test on post-test of the control and experimental groups

	Levene's Test		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
Equal variances assumed	12.43	.001	3.381	58	.001	3.267	.966	1.333	5.201
Equal variances not assumed			3.381	44.59	.002	3.267	.966	1.320	5.213

Table 9 highlights a significant difference (Mean Difference = 3.267) in the t-test between the mean scores of the experimental group ($M = 13.47$) and the control group ($M = 10.20$) with a p-value (2-tailed) of .001 that was less than 0.05 ($T = 3.381$; $df = 58$; $p > .05$). This illustrates that the two groups showed an improvement in vocabulary learning. Nevertheless, the experimental group of students who taught vocabulary using mobile-assisted language learning outperformed the control group who taught vocabulary traditionally. These results confirmed the pedagogical role of utilising Flashcard World application in vocabulary performance of the experimental group after the treatment. Therefore, the implementation of Flashcard World application was more effective in improving EFL learners' vocabulary knowledge than conventional teaching.

Based on these findings and in relation to the research hypotheses, the null hypothesis was that participants taught vocabulary through Flashcard World app showed no difference in the vocabulary tests from participants taught vocabulary conventionally. Meanwhile, the alternative hypothesis was that participants who were taught vocabulary through Flashcard World app scored significantly higher than those who were taught vocabulary conventionally. Regarding the study findings, the experimental group showed much more improvement than the control group, and thus the null hypothesis was rejected, and the alternative hypothesis was accepted.

Therefore, Flashcard World app allowed participants in the experimental group to effectively manage their vocabulary learning more than traditional instruction did. Learners created countless cards based on their needs. In the study, the focus was on 50 lexical items. In each unit, students were required to create a set consisting of 10 items. Each card contained the term and its definition. This enabled students to build up and organise the learning of the items and access these terms whenever and wherever they desired.

Additionally, when reviewing the items, Flashcard World app offered several practice modes, including multiple-choice, matching cards, and reviewing by writing, listening, or drawing. These review features allowed learners with different learning styles to review and practise the way they liked. These unique functionalities provided an excellent opportunity for the learners of the current study to learn, review, memorise, and practise the 50 targeted lexical items.

5 DISCUSSION

The quantitative analysis using independent samples t-tests revealed that the experimental group who used Flashcard World application scored significantly higher than students in the control group. This illustrates that implementing Flashcard World app was more effective than traditional methods of teaching

vocabulary. This finding, however, aligns with previous studies on the pedagogical potential of MALL applications as effective learning tools in vocabulary [7, 8, 20, 21, 22, 23, 24].

There are a multitude of possible explanations for the success of the implementation. Admittedly, this improvement in vocabulary learning results from mobile-assisted language learning features that allow students to learn on the move using a mobile device that they are familiar with. Beutner et al. [25] identify that mobile learning has made learning more flexible and adaptable by offering the opportunity to learn anywhere and anytime. It also extends the classroom to outdoor learning, allows for resource exchange, and makes learners more autonomous and self-confident. Moreover, thanks to teachers' guidance, learners become more creative and critical thinkers.

Another explanation is that Flashcard World features allow learners to create and study unlimited cards, to focus on words that students are about to forget, and to use different review modes such as multiple answers, matching cards, writing reviews, reviewing by listening via the audio player, and reviewing by drawing via whiteboard. These features help learners build up, organise, memorise, practice, and use the targeted vocabulary items. These features make learning enjoyable while creating sets, adding cards to start studying, and practising. In this context, several studies through interviewing students reported that students who used MALL applications got better scores because MALL apps brought a fun and enjoyable learning atmosphere [24, 26, 27]. One more explanation could be the game-like activities of Flashcard World application. Recent evidence on gamification confirmed its effectiveness in increasing learners' motivation, collaboration, communication, engagement, and active learning [28, 29, 30, 31, 32].

6 CONCLUSION AND PEDAGOGICAL IMPLICATIONS

This present experiment examines the pedagogical potential of implementing mobile applications via Flashcard World app on the vocabulary knowledge improvement of Moroccan EFL secondary school students for one semester. Based on pre- and post-tests, the findings pointed out that participants in the experimental group got higher scores than participants in the control group because they were taught vocabulary using Flashcard World application.

With regard to the positive results obtained from the present study, implications for EFL students, instructors, and educators are suggested. First, it is highly recommended that MALL applications such as Flashcard World app be integrated into English vocabulary classes to spur learners' vocabulary learning. In addition, learners can also utilise these mobile apps to learn and regulate their vocabulary knowledge independently. Language educators should also benefit from the unlimited features offered by these mobile apps for the enhancement of not only vocabulary but also other language skills in their teaching practices both inside and outside the classroom.

The findings of this study also encourage EFL teachers to perceive mobile phones as a facilitator tool for learning vocabulary rather than seeing them as interruptive tools. Undoubtedly, using mobile technologies instead of conventional teaching makes learning more enjoyable, improves students' motivation, confidence, and performance, and enhances learning quality [33, 34, 35]. Thus, using mobile apps for language learning unlocks many opportunities for students.

Though the current investigation reached significant conclusions within MALL research, some limitations are recognised. First, the study is quantitative, examining one vocabulary aspect: word learning. Second, the study population was limited to 60 participants, with 30 in each group. Further, the study was restricted to one secondary school. Therefore, it is recommended that future researchers should include large sample populations in different settings. Moreover, future research should use other qualitative methods, such as conducting interviews with students to bring more in-depth analysis coupled with learners' attitudes toward the effectiveness of these technological tools on students' English learning in general and vocabulary in particular. Furthermore, future researchers should include other variables such as age or gender to determine if these variables could affect vocabulary learning via mobile-assisted language learning. Lastly, future research could investigate different aspects of vocabulary learning, such as collocations.

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