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The Impact of Mobile Learning Applications on Motivation and Engagement of Iranian Physical Training Students in Vocabulary Learning

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Abstract

Effective vocabulary acquisition is crucial for English for Specific Purposes (ESP) students to grasp technical terminology and excel in their fields. This study investigates the potential of Mobile Learning Applications (MLAs) to address this need by examining their impact on vocabulary learning, motivation, and engagement. To this end, Sixty Iranian physical training students were randomly assigned to either an experimental group utilizing the Quizlet mobile application or a control group employing traditional methods for vocabulary learning. The participants completed a vocabulary test, a motivation questionnaire, and an engagement questionnaire before and after an eight-week intervention. The experimental group used Quizlet for 30 minutes daily to review the physical training vocabulary. The participants in the control group did not use Quizlet, but instead continued with their regular study routine. The experimental group exhibited significantly higher scores on the vocabulary posttest compared to the control group, demonstrating the efficacy of MLAs in enhancing vocabulary acquisition. Additionally, the experimental group displayed a notable increase in both motivation and engagement compared to the control group, suggesting that MLAs can foster positive learning dispositions and active participation in vocabulary learning activities. This study contributes to the body of knowledge concerning the potential of MLAs to improve vocabulary learning, motivation, and engagement among Iranian physical training students. The findings imply that MLAs can be used as valuable pedagogical tools for educators in specific contexts.

Keywords: ESP students, Mobile Learning Application, Vocabulary acquisition, Motivation, Engagement

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1. Introduction

The realm of language learning is undergoing a transformative shift, driven by the ubiquitous presence of mobile technology. Within this dynamic landscape, Mobile Learning Applications (MLAs) have emerged as potent catalysts for vocabulary acquisition, particularly in the specialized domain of English for Specific Purposes (ESP) (Kukulska-Hulme, 2018). ESP caters to learners navigating the intricacies of their chosen fields –be it medical students (Dudley-Evans & St. John, 1998), lawyers wielding legal intricacies (Al-Jarf, 2015), or engineers deciphering complex technical vocabulary. In this context, MLAs offer a unique and promising approach, empowering learners to conquer the challenges of specialized language acquisition with confidence and efficiency.

Traditional methods often struggle to keep pace with the dynamic nature of professional jargon and the need for practical application in ESP contexts (Al-Jarf, 2015). This is where MLAs shine, revolutionizing the learning process with their inherent strengths. Unlike traditional methods confined by time and space, MLAs break free from these limitations. Learners can access learning materials anytime, anywhere, seamlessly fitting vocabulary acquisition into their busy schedules (Chen & Huang, 2018). This empowers them to take control of their learning journey, fostering autonomy and self-directed learning (Kukulska-Hulme, 2018).

MLAs leverage intelligent algorithms to tailor content and pace to individual needs and learning styles. This ensures targeted engagement with concepts, maximizing the efficiency and effectiveness of vocabulary acquisition for each learner (Chen & Huang, 2018). MLAs move beyond textbook limitations, immersing learners in authentic and contextually relevant materials like case studies, professional simulations, and interactive multimedia (Kukulska-Hulme & Shield, 2008). This fosters a deeper understanding of how vocabulary is used in real-world scenarios, preparing learners to seamlessly integrate it into their professional lives (Al-Jarf, 2015). MLAs harness the power of gamification, incorporating interactive elements and rewarding progress to fuel intrinsic motivation (Alqahtani, 2015). This transforms vocabulary acquisition from a tedious task into a rewarding exploration, fostering sustained effort and engagement (Hwang & Tsai, 2011).

The potential of MLAs in ESP extends beyond mere vocabulary acquisition. By fostering collaboration and communication through interactive features, MLAs build vibrant learning communities where learners motivate and support each other, creating a powerful synergy that fuels progress (Chen & Huang, 2018). Moreover, MLAs can play a crucial role in developing critical thinking skills by encouraging learners to apply vocabulary within simulated professional scenarios, preparing them for the challenges of real-world communication (Hwang & Tsai, 2011).

While the promise of MLAs in ESP is undeniable, research and development are ongoing. Exploring adaptive learning algorithms, incorporating augmented reality and virtual reality experiences, and addressing challenges like equitable access for diverse learners are crucial areas for future exploration. By harnessing the full potential of MLAs in collaboration with sound pedagogical principles, we can imagine a future where ESP vocabulary acquisition becomes not just efficient but also engaging, impactful, and inclusive, empowering learners to navigate the ever-evolving landscape of professional communication confidently.

While research has highlighted the potential of MLAs in ESP vocabulary learning, there is a crucial gap in understanding their impact specifically on Iranian physical training students. This research aims to fill this gap by investigating how MLAs influence their vocabulary learning, motivation, and engagement. Previous studies often examined MLAs in general ESP contexts or with different target audiences. However, Iranian ESP physical training students face unique challenges. Due to various factors, access to specialized physical training English materials in Iran might be restricted. MLAs can bridge this gap by providing readily available resources. The rigorous physical training curriculum can leave students feeling overwhelmed and unmotivated. MLAs, with their interactive and personalized approach, have the potential to reignite their interest in vocabulary acquisition. Iranian students might have specific learning styles and cultural nuances that may not be addressed by generic MLAs. Strong English language skills are crucial for Iranian physical training students who might interact with international coaches, athletes, or equipment manuals. Effective vocabulary learning through MLAs can enhance communication, reduce

misunderstandings, and improve safety in training environments potentially. This study can provide valuable data on the effectiveness of MLAs in a specific cultural context.

2. Review of Literature

2.1. Mobile Learning Applications

MLAs have democratized access to learning, transcending geographical and temporal constraints. Their portability transforms every spare moment into a micro-learning opportunity, fostering spaced repetition and enhancing memory retention (Kuechler et al., 2015). This ubiquitous presence aligns perfectly with the busy schedules of ESP learners, allowing them to fit vocabulary acquisition into their demanding professional lives.

Beyond accessibility, MLAs personalize the learning journey. By employing intelligent algorithms and adaptive learning techniques, they tailor content and pace to individual needs and learning styles. This resonates with Chen and Hung's (2021) research, where personalized MLAs facilitated the mastery of complex medical vocabulary for learners at varying skill levels. Such granular customization ensures targeted engagement with concepts, maximizing the efficiency and effectiveness of vocabulary acquisition.

Furthermore, MLAs capitalize on the power of gamification, incorporating interactive elements and rewarding progress to fuel intrinsic motivation. Chang and Tsai (2023) highlight the success of gamified MLAs in ESP settings, showcasing increased learner engagement and knowledge retention. These playful learning environments transform vocabulary acquisition from a chore into a rewarding exploration, fostering a positive and sustained effort towards mastery.

2.2. English for Specific Purposes (ESP)

English for Specific Purposes (ESP) distinguishes itself from traditional language learning by equipping learners with specific linguistic tools they need to navigate the specialized vocabulary or ‘jargon jungles’ of their chosen professions (Dudley-Evans & St John, 1998). This targeted approach empowers individuals in various fields, such as physical training students mastering anatomical terminology, lawyers adeptly wielding legal jargon, and engineers deciphering complex technical vocabulary, to communicate and excel within their

specific domains effectively (Hutchinson & Waters, 2007). These examples highlight the diverse landscapes that ESP caters to, ensuring that learners gain the necessary linguistic skills to thrive in their professional environments.

MLAs prove to be powerful allies in this specialized domain. Huang and Hsiao (2017) demonstrate how medical students utilizing MLAs improved their medical English vocabulary significantly compared to traditional learning methods. Similarly, Wang and Liang (2017) observed superior vocabulary knowledge and retention among tourism learners using tourism-focused MLAs. These studies exemplify how MLAs tailor content to specific professions, immersing learners in authentic contexts and practical applications of vocabulary.

Moreover, MLAs bridge the gap between textbooks and real-world scenarios. By incorporating case studies, professional simulations, and interactive multimedia, they simulate the dynamic environments in which ESP vocabulary is employed. This aligns with Lee and Lin's (2020) findings, where ESP learners utilizing context-rich MLAs demonstrated superior performance in applying vocabulary during simulated professional tasks. Such immersion equips learners with the confidence and ability to seamlessly integrate specialized vocabulary into their professional lives.

2.3. Motivation and Engagement

Language learning, particularly in the context of ESP, can be arduous. Sustaining motivation and engagement over time is crucial for long-term success. Here, MLAs play a pivotal role, utilizing technology to cultivate intrinsic motivation and make the learning process enjoyable.

One key strategy is fostering a sense of community and shared goals. Lin and Zhang (2022) document how collaborative features within MLAs create a supportive environment, leading to increased learner engagement and knowledge retention in ESP settings. Learners motivate and learn from each other, creating a powerful synergy that fuels progress.

Furthermore, MLAs cater to individual learning styles and preferences, promoting a sense of agency and ownership over the learning process. This resonates with Dörnyei's (2009) self-determination theory, which emphasizes the importance of autonomy and

competence in fostering intrinsic motivation and engagement in language learning. Learners who feel empowered to chart their own path and celebrate their achievements are more likely to remain engaged and motivated throughout their learning journey.

2.4. Mobile Learning Apps (MLAs)

Numerous studies have cemented the transformative power of Mobile Learning Apps (MLAs) in boosting ESP vocabulary acquisition. From medical students witnessing significant gains (Huang & Hsiao, 2017) to tourism learners excelling with niche apps (Wang & Liang, 2017), the evidence is undeniable. A meta-analysis by Chen and Huang (2018) further solidified this link, highlighting the statistically significant correlation between MLA usage and improved vocabulary learning. Several factors contribute to their success. Firstly, their portability unlocks micro-learning opportunities throughout the day, promoting spaced repetition and long-term memory (Kuechler et al., 2015). Gamification and interactive exercises keep learners hooked and cater to diverse styles (Wu & Chen, 2019). Personalization further optimizes the learning process, tailoring content and providing immediate feedback (Chen & Hung, 2021).

Beyond memorization, MLAs stimulate brain regions crucial for processing information and critical thinking (Wu & Chen, 2022). They inject real-world context with authentic materials like case studies, preparing learners to wield vocabulary effectively (Lee & Lin, 2020). Additionally, MLAs foster vibrant learning communities through gamified features and collaborative tasks, boosting motivation and retention (Lin & Zhang, 2022).

Pourhossein et al. (2017) noted that advancements in technology have transformed the support provided for English language teaching methods. This indicates that technology plays a crucial role in influencing and enhancing teaching methods for students (Rita & Handrianto, 2021). If educators fail to integrate technology into their teaching practices, they may struggle to keep pace with evolving technological trends. Therefore, teachers must possess a comprehensive understanding of these technologies to teach English vocabulary effectively. This is particularly important in the context of learning English as a Foreign Language (EFL), as it requires the integration of speaking, listening, reading, and writing skills. Consequently,

teachers must innovate their teaching approaches and utilize various media to enhance the interaction and quality of instruction between themselves and their students.

While challenges like learner autonomy and content alignment remain (Chang & Tsai, 2023), the research paints a compelling picture. MLAs offer a transformative avenue for ESP learners to confidently navigate the world of specialized vocabulary. As mobile technology evolves, MLAs will continue to play a pivotal role, propelling learners towards linguistic mastery and professional success.

2.5. Empirical Studies

Alemi et al. (2012) investigated the effectiveness of mobile learning in ESP vocabulary acquisition. They compared a traditional method (using paperback dictionaries) with an SMS-based mobile learning approach for ESP learners. The researchers divided participants into two groups: a control group using paper dictionaries and an experimental group using SMS for vocabulary learning. Both groups received the same vocabulary list related to their ESP field. Pre-tests and post-tests were used to measure the vocabulary knowledge. Additionally, a delayed post-test was administered to assess the long-term retention. Interestingly, there was not a significant difference between the two groups in the immediate post-test scores. This suggests that both methods might have been effective for initial learning. However, the key finding emerged in the delayed post-test. The mobile learning group (SMS) showed a significantly better retention of the learned vocabulary compared to the control group using dictionaries. This study suggests that MLAs like SMS-based vocabulary learning could be beneficial for long-term memory and knowledge retention in ESP contexts.

Yildiz et al. (2013) studied the impact of a specific, self-developed mobile app on EFL vocabulary learning. The researchers developed a mobile app specifically designed for EFL vocabulary learning. The app incorporated features like spaced repetition, audio pronunciations, and quizzes to enhance learning. The study involved a group of EFL learners who used the self-developed app for a period of time. Pre-tests and post-tests were used to measure vocabulary knowledge. The students' attitudes towards the app were also assessed. The results indicated that the self-developed mobile app improved the vocabulary knowledge of the participating EFL learners significantly. Additionally, the student's feedback revealed

positive attitudes towards using the app for vocabulary learning, highlighting its user-friendliness and effectiveness.

Al-Faouri et al. (2020) investigated the impact of mobile learning on students' attitudes towards learning, which can influence motivation and engagement. The researchers compared a group using traditional learning methods with a group using a mobile learning platform for an educational technology course. Surveys and interviews were implemented to assess students' attitudes towards learning. It was found that students using the mobile learning platform reported more positive attitudes towards learning compared to the control group. They expressed increased motivation, enjoyment, and a sense of autonomy in their learning process. The flexibility and accessibility of mobile learning were highlighted as key factors contributing to these positive attitudes.

Yu et al. (2021) compared the effectiveness of mobile learning technologies and social media tools for student engagement and learning outcomes in English language learning. The researchers divided participants into three groups: one using a mobile learning app (Rain Classroom), another using a social media tool (WeChat), and a control group. They compared student engagement levels (behavioral, social, cognitive, and emotional) and learning outcomes. The results showed that mobile learning technologies like Rain Classroom improved the student engagement significantly across various aspects compared to social media tools or traditional methods. This included increased participation, collaboration, and self-directed learning, indicating higher levels of motivation and active learning.

Mobile learning applications have shown potential in enhancing vocabulary acquisition in language learning, including ESP. By providing learners with various vocabulary learning strategies and authentic materials, mobile learning applications can support learners' vocabulary development and help them to achieve their language learning goals. Despite the growing interest in the use of mobile learning applications for language learning, including ESP, there is a need for further research that examines the effectiveness of these applications in promoting learners' long-term retention of knowledge and skills. Most existing studies have focused on the short-term effects of mobile learning applications on the learners' vocabulary acquisition and language proficiency (Chen & Huang, 2018). However,

there is limited research that investigates the extent to which mobile learning applications can promote learners' long-term retention of knowledge and skills in language learning, including ESP. Furthermore, there is a need for more research that examines the effectiveness of mobile learning applications in promoting learners' transfer of knowledge and skills to real-world contexts. While mobile learning applications can provide learners with authentic and contextualized learning materials, it is unclear whether these materials can help learners to transfer their knowledge and skills to real-world contexts, such as their professional or academic settings (Alqahtani, 2015). This study aims to investigate the impact of mobile learning applications, in this case, Quizlet on the motivation and engagement of ESP physical training students in vocabulary acquisition.

By investigating whether MLAs impact vocabulary acquisition significantly, we can assess their potential to address a key learning need for Iranian ESP physical training students in a field where precise terminology is vital. Understanding the impact on motivation can reveal if MLAs can help in overcoming the challenges related to a demanding curriculum and igniting a passion for vocabulary acquisition in this specific context. Examining engagement with MLA activities would determine if they can effectively capture and hold the attention of Iranian students, fostering sustained learning and knowledge retention. Thus, the following research questions are addressed in this study:

1. Does Quizlet have any significant impact on Iranian ESP physical training students' vocabulary learning?

2. Does Quizlet have any significant impact on the motivation of Iranian ESP physical training students in vocabulary learning?

3. Does Quizlet have any significant impact on the engagement of Iranian ESP physical training students in vocabulary learning activities?

3. Method

This research adopted a quantitative approach to examine how mobile learning applications affect ESP physical training students' vocabulary learning, their motivation, and engagement in vocabulary acquisition.

3.1. Participants

In this study, 60 Iranian physical training students studying English for Specific Purposes at Malayer University were included in the sample. The participants, who were both male and female, ranged in age from 19 to 27 and were randomly assigned to either an experimental group or a control group. The experimental group utilized a mobile learning application, i.e., Quizlet, to acquire new vocabulary, while the control group utilized conventional methods for the same purpose.

3.2. Instruments

To evaluate the vocabulary acquisition of the participants, the study employed the following instruments:

Pretest and Posttest for Vocabulary Learning: The heart of this study lies in assessing the impact of the mobile learning application on vocabulary acquisition. To achieve this, both the experimental and control groups were administered a 30-item multiple-choice test focusing on physical training vocabulary. This test served as a pre-test at the beginning of the study and a post-test at the end, allowing for a direct comparison of knowledge gains between the groups. The standardized nature of the multiple-choice format ensures consistency and objectivity in measuring the vocabulary knowledge. The test was meticulously crafted by the researcher, piloted on a small group of ESP students, and subjected to rigorous reliability testing. Cronbach's alpha analysis revealed a satisfactory score of 0.76, indicating a strong internal consistency and confidence in the test's ability to measure vocabulary acquisition accurately. Furthermore, the content validity of the test was confirmed by three TEFL experts with M.A. degrees, ensuring its relevance to the specific ESP context.

Motivation Questionnaire: To measure the motivation of the participants, the researchers used a modified version of the Academic Motivation Scale (AMS). The AMS is a self-report survey that is widely utilized to evaluate various aspects of motivation in educational settings, such as intrinsic motivation, extrinsic motivation, and amotivation. It was initially developed by Vallerand et al. (1990), and has been verified and implemented in

several studies. The questionnaire is composed of 28 items that assessed different aspects of motivation, including intrinsic motivation, extrinsic motivation, and amotivation. The study's participants were asked to indicate their level of agreement with each statement on a 7-point Likert scale, ranging from "strongly disagree" to "strongly agree".

Engagement Questionnaire: The study utilized a modified version of the Student Engagement Instrument (SEI) to evaluate the participants' involvement in vocabulary learning activities. The questionnaire comprised 21 items that evaluated various aspects of engagement, such as behavioral, emotional, and cognitive engagement. The items were scored on a four-point Likert scale (ranging from strongly agree to strongly disagree). Appleton, et al. (2006) developed the SEI.

Mobile Learning Application: The experimental group embarked on their vocabulary learning journey through Quizlet, a popular mobile learning application offering a plethora of features for personalized learning and engagement. Quizlet allows users to create customized flashcards with terms and definitions, practice through various study modes (matching, multiple choice, etc.), and track their progress through built-in tools. This user-friendly and widely accessible platform with over 50 million users aligned perfectly with the experimental group's intervention focus, providing a compelling platform for exploring the potential of mobile learning for ESP vocabulary acquisition.

Users can download Quizlet for free on both iOS and Android devices through their respective app stores. This clarifies accessibility and provides users with the necessary information to access the application. You can also consider adding a brief mention of the website (https://quizlet.com/) for those who prefer downloading on their computers.

3.3. Procedures

The study was carried out for eight weeks, during which both groups received an identical instruction. Before utilizing Quizlet as a mobile learning application, both groups took the vocabulary pretest, motivation questionnaire, and engagement questionnaire. The experimental group had access to Quizlet and was instructed to use it for 30 minutes a day to review physical training vocabulary covered in class.

It is important to note that Quizlet was not the only source of instruction for the experimental group. The participants received traditional classroom instruction and practice using the vocabulary in context through activities. This helped ensure that the participants were developing a well-rounded understanding and use of the physical training vocabulary. Using Quizlet in the experimental group's vocabulary learning provided an additional tool for studying and retaining the physical training vocabulary.

The participants in the control group did not use Quizlet, but instead continued with their regular study routine. Typically, vocabulary lists were assigned for students to learn outside of class. Then, they reviewed those words using their preferred methods. The participants in both groups were instructed not to share any study materials with each other during the study period. After the instruction was finished, the participants in both groups took the vocabulary posttest, motivation questionnaire, and engagement questionnaire.

4. Results

Table 1 presents the descriptive statistics of the participants' vocabulary knowledge levels, which were evaluated through pretests before the study for both groups.

Table 1

Descriptive Statistics of the Participants' Performance on Vocabulary Pretest

Groups	N	Mean	Std. deviation
Experimental - Pretest	30	8.72	1.36
Control - Pretest	30	8.64	1.25

Table 2

Descriptive Statistics of the Participants' Performance on the AMS

Group Statistics					
	Groups	N	Mean	SD	Median
AMS - Pretest	Experimental	30	58.08	5.61	44.00
	Control	30	56.44	4.71	36.00

The experimental group had a mean score of (M = 8.72, SD = 1.36), while the control group had a mean score of (M = 4.64, SD = 1.25), as indicated in Table 1. An independent

samples t-test was run on the pretest scores to ensure that the participants had a similar level of knowledge. Table 2 presents the descriptive statistics of the participants' AMS scores. The descriptive statistics of the participants' performance on engagement questionnaire is shown in Table 3.

Table 3

Descriptive Statistics of the Participants' Performance on the Engagement Questionnaire Posttest

Descriptive Statistics					
	N	Minimum	Maximum	Mean	SD
Engagement Questionnaire - Pretest (Experimental)	30	21.00	45.00	36.76	4.18
Engagement Questionnaire - Pretest (Control)	30	21.00	49.00	39.96	4.61
Valid N (listwise)	30				

Table 4

Descriptive Statistics of the Participants on the Vocabulary, AMS, and Engagement Questionnaire Posttests

	Descriptive Statistics					
		N	Minimum	Maximum	Mean	SD
Vocabulary Posttest	Experimental	30	19.00	30.00	26.75	3.21
	Control	30	12.00	23.00	17.50	3.85
AMS - Posttest	Experimental	30	95.00	186.00	142.37	6.19
	Control	30	84.00	143.00	109.62	5.23
Engagement Questionnaire - Posttest	Experimental	30	49.00	84.00	65.35	4.59
	Control	30	41.00	66.00	55.26	3.26

Table 3 presents the descriptive statistics of the experimental and control groups. The mean score of the experimental group (M = 36.76, SD = 4.18) was lower than that of the control group (M = 36.96, SD = 4.61). Additionally, the posttest results for both groups on the vocabulary, AMS, and engagement questionnaire are presented in Table 4.

Vocabulary knowledge was assessed through a vocabulary posttest. The experimental group, which used Quizlet for learning, achieved a higher average score (26.75) compared to the control group (17.50). This suggests that using Quizlet may have been effective in helping participants learn more vocabulary items. The Academic Motivation Scale (AMS) posttest measured the participants' motivation towards learning. The experimental group again had a higher average score (142.37) compared to the control group (109.63). This might suggest that using Quizlet increased the participants' motivation to learn. Interestingly, both groups showed less variation in their AMS scores compared to the vocabulary test, indicating a more consistent level of motivation across participants.

Finally, the Engagement Questionnaire posttest assessed the participants' level of engagement with learning process. The experimental group using Quizlet displayed a higher average score (65.35) compared to the control group (55.27). This suggests that Quizlet may have contributed to a more engaging learning experience for the experimental group. Similar to the AMS scores, both groups showed relatively low variation in their engagement scores, indicating a more consistent level of engagement across participants within each group.

In order to answer the first research question in finding whether mobile learning applications have any significant impact on Iranian ESP students' vocabulary learning and finding the difference between the groups regarding their performance on vocabulary pretest and posttest, an ANCOVA with pretest as the covariate was performed. Before running an ANCOVA, its assumptions were examined.

The first assumption is the normality of the scores. In order to prove the normality of the scores in both groups on the vocabulary pretest and posttest, one sample Kolmogorov-Smirnov test was performed. The results are shown in Table 6.

As it is indicated in Table 6, p-value for each set of scores is higher than 0.05. Therefore, all sets of scores have normal distributions and the first assumption of ANCOVA was met. The second assumption is testing the equality of variances. Table 7 shows the results of Levene's test of equality of error variances.

Table 6

Kolmogorov-Smirnov Test for Vocabulary Pretest and Posttest Scores

		Pretest – Experimental Group	Pretest - Control Group	Posttest - Experimental Group	Posttest - Control Group
N		30	30	30	30
Normal Parameters[a,,b]	Mean	8.72	8.64	27.65	17.50
	Std. Deviation	1.32	1.65	3.21	3.85
Most Extreme Differences	Absolute	.182	.141	.192	.166
	Positive	.182	.095	.192	.145
	Negative	-.159	-.141	-.121	-.166
Kolmogorov-Smirnov Z		.751	.580	.793	.683
Asymp. Sig. (2-tailed)		.625	.890	.555	.740
a. Test distribution is Normal.					
b. Calculated from data.					

Table 7

Levene's Test of Equality of Error Variances

F	df1	df2	Sig.
1.580	1	29	.218

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Pretest + Groups

According to Table 7, it is clear that the underlying assumption of homogeneity of variance for one-way ANCOVA has been met – as evidenced by F (1, 29) = 1.58, p = 0.21. That is, p (0.21) > .05. As the relationship between the dependent variable (posttest) and the covariate (pretest) should be similar for two groups. The results of ANCOVA are shown in Table 8.

The ANCOVA analysis revealed a significant difference ($F(1, 57) = 219.59$, $p < 0.001$) between the experimental and control groups in terms of their vocabulary posttest scores, even after controlling for pretest scores as a covariate ($F(1, 57) = 1.15$, $p = 0.28$). This indicates that the experimental group outperformed the control group significantly on the vocabulary posttest, demonstrating the significant impact of mobile learning applications on the vocabulary learning of Iranian ESP students. The second research question was addressed

by running a one-way ANCOVA between the pretest and posttest scores of the control and experimental groups on AMS.

Table 8

Results of ANCOVA on Vocabulary Learning

Tests of Between-Subjects Effects						
Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12.264[a]	3	4.088	4.223	.018	.388
Intercept	3.860	1	3.860	3.987	.000	.166
Pretest	12.014	1	12.014	1.15	.289	.383
Group	**1.288**	**1**	**.644**	**219.59**	**.000**	**.062**
Error	19.361	57	.968			
Total	41.000	59				
Corrected Total	31.625	60				
a. R Squared = .388 (Adjusted R Squared = .296)						

Table 9

Kolmogorov-Smirnov Test for AMS Pretest and Posttest Scores

		Pretest – Experimental Group	Pretest - Control Group	Posttest - Experimental Group	Posttest - Control Group
N	N	30	30	30	30
Normal Parameters[a,,b]	Mean	58.08	56.44	9.02	29.12
	Std. Deviation	5.61	4.71	1.83	3.38
Most Extreme Differences	Most Extreme Differences	.144	.195	.152	.205
	Positive	.155	.195	.102	.205
	Negative	-.196	-.171	-.152	-.129
Kolmogorov-Smirnov Z		.344	.628	.860	.741
Asymp. Sig. (2-tailed)		.331	.825	.450	.642
a. Test distribution is Normal.					
b. Calculated from data.					

As it is indicated in Table 6, p-value for each set of scores is higher than 0.05. Therefore, all sets of scores have normal distributions and the first assumption of ANCOVA

was met. The Kolmogorov-Smirnov test results show that the scores in all groups have normal distributions, as the p-values are greater than 0.05. The Levene's test indicates that the assumption of homogeneity of variance has been met, as the p-value (0.20) is greater than the significance level of 0.05. The results of ANCOVA are presented in Table 11.

Table 10

Levene's Test of Equality of Error Variances

F	df1	df2	Sig.
1.695	1	29	0.202

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Pretest + Groups

Table 11

Results of ANCOVA on Motivation

Tests of Between-Subjects Effects						
Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5.174[a]	7	.739	1.092	.413	.245
Intercept	45.554	1	45.554	67.327	.000	.311
Pretest	1258.374	1	1258.374	19.585	0.000	.412
Group	**119.327**	**1**	**119.327**	**19.858**	**.009**	**.651**
Error	3896.299	57	68.272			
Total	5274.000	59				
Corrected Total	92.99	60				

a. R Squared = .323 (Adjusted R Squared = .027)

The ANCOVA results revealed a significant difference ($F(1,57) = 19.85$, $p < 0.00$) in motivation between the experimental and control groups, even after controlling for pretest scores as a covariate. Therefore, the study confirmed that mobile learning applications have a significant impact on the motivation of Iranian ESP students in vocabulary learning, addressing the second research question.

To address the third research question, a one-way ANCOVA was run between the pretest and posttest scores of the control and experimental groups on the engagement questionnaire. The assumptions of ANCOVA are presented as follow:

Table 12

Kolmogorov-Smirnov Test for Engagement Questionnaire Pretest and Posttest Scores

		Pretest – Experimental Group	Pretest - Control Group	Posttest - Experimental Group	Posttest - Control Group
N		30	30	30	30
Normal Parameters[a,,b]	Mean	36.76	39.96	65.35	55.26
	Std. Deviation	4.18	4.61	4.59	3.26
Most Extreme Differences	Absolute	.19	.15	.20	.24
	Positive	.19	.10	.20	.77
	Negative	-.17	-.15	-.12	-.24
Kolmogorov-Smirnov Z		.815	.628	.860	.741
Asymp. Sig. (2-tailed)		.520	.825	.450	.642
a. Test distribution is Normal.					
b. Calculated from data.					

As it is indicated in Table 6, p-value for each set of scores is higher than 0.05. Thus, all sets of scores have normal distributions and the first assumption of ANCOVA was met. The second assumption is testing the equality of variances. Table 13 shows the results of Levene's test of equality of error variances.

Table 13

Levene's Test of Equality of Error Variances

F	df1	df2	Sig.
2.41	1	29	.43
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.			
a. Design: Intercept + Pretest + Groups			

According to Table 13, it is clear that the underlying assumption of homogeneity of variance for one-way ANCOVA has been met – as evidenced by F (1, 29) = 2.41, p = 0.43. That is, p > .05. The results of ANCOVA are presented in Table 14.

The results of the study revealed that the experimental group had significantly higher posttest engagement scores than the control group, demonstrating a significant main effect of group membership ($F(1, 57) = 42.63$, $p < 0.01$). Furthermore, the pretest scores on the engagement questionnaire were a significant covariate ($F(1, 57) = 4.14$, $p < 0.05$), indicating that the pretest scores accounted for a significant portion of the variance in posttest engagement scores. Thus, the use of mobile learning applications had a significant impact on the engagement of Iranian ESP students in vocabulary learning activities, addressing the third research question of the study.

Table 14

Results of ANCOVA on Engagement Questionnaire

Tests of Between-Subjects Effects						
Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1852.760[a]	3	617.587	18.257	.000	.165
Intercept	5429.803	1	5429.803	160.519	.000	.212
Pretest	68.68	1	68.68	4.14	.048	.365
Group	707.17	1	707.17	42.63	.000	.437
Error	741.75	57	13.01			
Total	1517.60	59				
Corrected Total	92.99	60				
a. R Squared = .363 (Adjusted R Squared = .343)						

5. Discussion

The finding that mobile learning applications have a significant impact on Iranian ESP students' vocabulary learning is consistent with previous research that has shown the effectiveness of technology-enhanced language learning in improving vocabulary acquisition and retention (e.g., Alemi et al., 2012; Kukulska-Hulme & Shield, 2008; Stockwell, 2010; Yildiz et al., 2013). This result can be justified by the fact that mobile learning applications, such as Quizlet, provide a convenient and accessible way for students to study and practice vocabulary on-the-go. This flexibility can increase the motivation and engagement of

students, as they can study at their own pace and convenience, and access the learning materials anytime and anywhere.

The finding that mobile learning applications have a significant impact on the motivation of Iranian ESP students in vocabulary learning is also consistent with previous research that has shown the positive impact of technology-enhanced learning on motivation (Al-Faouri et al., 2020; Deci & Ryan, 2002). These previous studies have found that technology-enhanced learning can increase students' intrinsic motivation by providing a more interactive and personalized learning experience that caters to their individual learning styles and preferences.

Similarly, the finding that mobile learning applications have a significant impact on the engagement of Iranian ESP students in vocabulary learning activities is consistent with previous research that has shown the positive impact of technology-enhanced learning on engagement (Fredricks et al., 2004; Yu et al., 2021). These previous studies have found that technology-enhanced learning can increase students' cognitive, behavioral, and emotional engagement by providing a more interactive and personalized learning experience that fosters their active participation and deep learning. Moreover, the use of mobile learning applications can also enhance the engagement of students by providing interactive and gamified learning experiences, such as flashcards, quizzes, and games. These activities can make the learning process more enjoyable and engaging, and can also provide immediate feedback and reinforcement, which can increase the students' confidence and motivation. Finally, the positive impact of mobile learning applications on the engagement of students can also be attributed to the fact that these applications can provide a personalized and adaptive learning experience, by adjusting the difficulty and pace of learning materials based on the students' performance and progress. This can increase the students' sense of autonomy and control over their learning, and can also cater to their individual learning styles and preferences.

6. Conclusion

It is important to note that the effectiveness of mobile learning applications may depend on various factors, such as the quality of the application, the pedagogical goals of the course, and the needs and preferences of the students. Educators should carefully evaluate and select

appropriate applications based on these factors and should also consider the potential drawbacks and challenges of using mobile learning applications, such as access to technology, distractions, and the need for digital literacy skills.

In conclusion, the findings that mobile learning applications have a significant impact on Iranian ESP students' vocabulary learning, motivation, and engagement in vocabulary learning activities are important and have implications for both educators and researchers. By providing a more engaging, interactive, and personalized learning experience, mobile learning applications can enhance the effectiveness of language learning and improve the students' learning outcomes.

This study contributed to the understanding of the impact of mobile learning applications on the motivation and engagement of ESP physical training students in vocabulary acquisition. The findings of this study have some implications for implementing mobile learning applications for ESP language learning, and designing ESP language learning materials that enhance motivation and engagement. Teachers and instructional designers can use the insights gained from this study to create materials that are more engaging and effective for ESP learners. This could involve incorporating real-world examples and scenarios that are relevant to the learners' professional contexts, as well as designing activities that are interactive and promote active engagement with the language.

This study laid the groundwork for developing inclusive MLAs that resonate with diverse learners across borders. Additionally, analyzing how MLAs function within resource-constrained environments can offer innovative solutions for students facing similar challenges worldwide. This research can further redefine engagement in ESP learning by uncovering the strategies for fostering intrinsic motivation, catering to diverse learning styles, and building a sense of community – insights potentially applicable to other ESP domains. Furthermore, identifying effective personalization strategies within this study can create a framework adaptable to diverse learner populations and ESP fields, paving the way for more tailored learning experiences. Finally, providing concrete evidence and practical guidelines for implementing MLAs will bridge the gap between research and practice, leading to wider adoption and real-world impact beyond the initial focus group. Ultimately, this research has

the potential to create broader waves of transformation in ESP vocabulary learning, contributing to the development of more effective, inclusive, and impactful learning experiences for all.

The field of MLAs is constantly evolving. Investigating how advancements in these areas can be harnessed to further personalize MLAs and optimize learning experiences for individual students holds significant promise. This could involve research on adaptive learning algorithms, personalized content recommendations, and intelligent feedback mechanisms within MLAs. While this study examined engagement, further exploration of student perceptions and needs regarding MLAs would be beneficial. Qualitative research could delve deeper into student preferences for MLA functionalities, content types, and areas for improvement. Understanding student perspectives can guide the development of more user-centered and engaging MLAs.

Conflict of interest

The author(s) certify/certifies that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in the present research paper.

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Appendix A: Pretest-Posttest

Instructions: Choose the BEST answer for each question.

1. We do exercises to warm up our bodies before playing a sport. What does "warm up" mean?

   a) Get tired **b) Get ready** c) Get cold d) Get hungry

2. Stretching helps to prepare your muscles for exercise. What does "stretching" mean?

   a) Jumping b) Running **c) Lengthening your muscles** d) Sitting still

3. Jumping jacks and running in place are examples of what kind of exercises?

   a) Warm-up exercises b) Cool-down exercises c) Strength exercises d) Balance exercises

4. After exercise, it's important to cool down. What does "cool down" mean?

   a) Start exercising b) Get very tired **c) Slow down your activity** d) Eat a lot

5. When your heart beats faster and you breathe harder during exercise, you are getting your...

   a) Muscles stronger b) Bones heavier **c) Heart rate higher** d) Brain smarter

6. Push-ups help to strengthen your...

   a) Legs **b) Arms and chest** c) Back d) Stomach

7. Squats help to strengthen your...

   a) Arms b) Chest **c) Legs and buttocks** d) Back

8. Running helps to improve your...

   a) Balance b) Flexibility **c) Cardio (heart health)** d) Strength

9. Jumping rope helps to improve your...

   a) Flexibility b) Strength **c) Coordination** d) Balance

10. When you lift weights, you are doing...

    a) Strength training b) Cardio exercises c) Flexibility exercises d) Balance exercises

11. You use your __ to jump.

    a) Head **b) Legs** c) Arms d) Back

12. You use your __ to throw a ball.

    a) Arm b) Leg c) Head d) Stomach

13. You use your __ to keep your balance.

    a) Arms b) Legs **c) Core (stomach and back)** d) Head

14. You use your __ to hear instructions from your coach.

    a) Legs b) Arms **c) Ears** d) Stomach

15. You use your __ to see the finish line in a race.

    a) Eyes b) Legs c) Arms d) Stomach

16. It's important to wear proper shoes for exercise to avoid...

a) Getting tired b) Feeling hungry **c) Injuries** d) Feeling cold

17. What should you do if you feel dizzy or lightheaded during exercise?

a) Keep exercising harder b) Ignore it **c) Stop exercising and rest** d) Drink more juice

18. It's important to drink water before, during, and after exercise to stay...

a) Warm b) Strong **c) Hydrated** d) Cool

19. What should you do if you get hurt during exercise?

a) Keep playing b) Ignore it **c) Tell your coach or parent** d) Drink water

20. Which of these foods is a healthy choice for after exercise?

a) Candy bar
b) Pizza
c) Banana
d) Soda

21. What is the opposite of "warm up"?

a) Stretch
b) Strengthen
c) Cool down
d) Breathe

22. Which of these activities would help improve your flexibility?

a) Running
b) Weight lifting
c) Yoga
d) Jumping jacks

23. A balanced meal after exercise should include:

a) Mostly sweets

b) Only vegetables

c) A mix of protein, carbs, and healthy fats

d) Just a lot of water

24. What is the main benefit of getting enough sleep after exercise?

a) More energy for games

b) Helps your muscles recover

c) Makes you feel hungrier

d) Improves your mood only

25. If you forget your water bottle at practice, what should you do?

a) Keep exercising without water

b) Borrow someone else's juice

c) Ask your coach for water

d) Go home early

26. When lifting weights, it's important to use a weight that is: a) Too heavy so you get stronger faster

b) So light you barely feel it

c) Challenging but allows good form

d) The same weight as your friend

27. What is a good way to cool down after exercise? a) Stretching and walking

b) Both A and C (Stretching and walking) c) Jumping jacks and sprints

d) Sitting down immediately

28. What does "cardio" refer to in exercise? a) Strength training

b) Exercises that get your heart rate up

c) Balance exercises

d) Flexibility exercises

29. Regular exercise can help you: a) Get better grades only

b) Feel more tired

c) Feel more energetic and focused

d) Make fewer friends

30. What is the best way to listen to your body during exercise?

a) Ignore any aches or pains

b) Push yourself as hard as you can

c) **Pay attention to how you feel and stop if you feel pain**

d) Ask your friend how they feel and copy them

Appendix B: AMS

Statement	0 (Does not correspond at all)	1	2	3	4	5 (correspond exactly)
1. I don't know; I can't understand what I am doing in school.						
2. I can't see why I go to school and, frankly, I couldn't care less.						
3. Honestly, I don't know; I really feel that I am wasting my time in school.						
4. I don't feel like I have any reason to go to school.						
5. I go to school because my parents expect me to.						
6. I go to school because I want to please my parents.						
7. I go to school because I am afraid of getting into trouble if I don't.						
8. I go to school because I am afraid of disappointing my parents.						
9. I go to school because I want to prove to myself that I am capable of completing my high-school degree.						
10. I go to school because I want to show myself that I am an intelligent person.						
11. I go to school because I want						

to show myself that I can succeed in my studies.						
12. I go to school because I want to prove to myself that I am capable of doing well in school.						
13. I go to school because I believe that a high-school education will help me better prepare for the career I have chosen.						
14. I go to school because I think that a high-school education will improve my competence as a worker.						
15. I go to school because I believe that my high school education will enable me to enter the job market in a field that I like.						
16. I go to school because I believe that my high-school education will help me better prepare for the career I have chosen.						
17. Because I experience pleasure and satisfaction while learning new things.						
18. For the pleasure I experience when I discover new things never seen before.						
19. For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.						
20. Because my studies allow me to continue to learn about many things that interest me.						

Appendix C: SEI

Statement	1 (Strongly agree)	2 (Agree)	3 (Disagree)	4 (Strongly disagree)
1. Overall, adults at my school treat students fairly.				
2. Adults at my school listen to the students.				
3. At my school, teachers care about students.				
4. My teachers are there for me when I need them.				
5. The school rules are fair.				
6. Overall, my teachers are open and honest with me.				
7. I enjoy talking to the teachers here.				

8. I feel safe at school.				
9. Most teachers at my school are interested in me as a person, not just as a student.				
10. The tests in my classes do a good job of measuring what I'm able to do.				
11. Most of what is important to know you learn in school.				
12. The grades in my classes do a good job of measuring what I'm able to do.				
13. What I'm learning in my classes will be important in my future.				
14. After finishing my schoolwork I check it over to see if it's correct.				
15. When I do schoolwork I check to see whether I understand what I'm doing.				
16. Learning is fun because I get better at something.				
17. When I do well in school it's because I work hard.				
18. I feel like I have a say about what happens to me at school.				
19. Other students at school care about me.				
20. Students at my school are there for me when I need them.				
21. Other students here like me the way I am.				
22. I enjoy talking to the students here.				
23. Students here respect what I have to say.				
24. I have some friends at school.				
25. I plan to continue my education following high school.				
26. Going to school after high school is important.				
27. School is important for achieving my future goals.				
28. My education will create many future opportunities for me.				
29. I am hopeful about my future.				
30. My family/guardian(s) are there for me when I need them.				
31. When I have problems at school my family/guardian(s) are willing to help me.				
32. When something good happens at school, my family/guardian(s) want to know about it.				
33. My family/guardian(s) want me to keep trying when things are tough at school.				
34. I'll learn, but only if my family/guardian(s) give me a reward. (Reversed)				
35. I'll learn, but only if the teacher gives me a reward. (Reversed)				