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RESEARCH ARTICLE

Self-Regulated Mobile Learning Impact on Students' Technology Acceptance in Saudi Arabia: Quizlet as a Tool

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ARTICLE INFO	ABSTRACT
  *Corresponding Author: Husam.m.alwahoub@gmail.com	Vocabulary learning is crucial in the realm of English as a Foreign Language (EFL) as it forms the foundation of language and enhances effective communication. The emergence of mobile devices as powerful educational tools has led to increased research on the academic benefits of mobile learning and gamification, mainly through apps like Quizlet, to teach and enhance vocabulary. Prior studies have highlighted the transformative potential of these tools, making the learning experience more enjoyable and engaging. However, existing research has predominantly focused on utilizing pre-existing or teacher-created materials on Quizlet, leaving a gap in understanding the impact of student-generated Quizlet flashcard sets on second language (L2) or foreign language (FL) vocabulary learning motivation. Consequently, this study aims to evaluate the influence of student-generated materials using Quizlet on the vocabulary learning motivation of K-12 students in an international school in Saudi Arabia. This study employs a quasi-experimental design and convenience sampling and includes 83 EFL 6th-grade students, with data collected through pre- and post-study surveys. Statistical analysis using SPSS 23 was conducted on all numerical data to draw meaningful insights. The study revealed that the participants exhibited high acceptance levels across all items and variables, with a mean score increase in most post-study items compared to the pre-study phase. Specifically, participants demonstrated higher acceptance of 16 items in the post-study survey, emphasizing positive attitudes towards Quizlet. Moreover, it was found that the participants maintained a neutral attitude in two items related to intention in the pre-study phase, and no negative attitudes were observed in either the pre-study or post-study surveys, reinforcing the overall positive outlook on Quizlet's technology implementation. These results could help educators and teachers develop policies and strategies to control the use of mobile devices and decide on the best practices to apply self-regulated m-learning and gamification in education.

INTRODUCTION

Computer-Assisted Language Learning (CALL) and Electronic Learning (e-learning) have gained widespread adoption in K-12 and higher education, proving effective in enhancing students' productive skills (Alwahoub et al., 2022; Alwahoub et al., 2020; Alwahoub, 2020). The prevalence of advanced mobile devices, such as smartphones, tablets, and phablets, has shifted from desktops to

portable devices for various educational tasks. Educators, curriculum designers, and students increasingly embrace modern digital devices, transforming learning experiences and yielding tremendous success (Khan et al., 2021). Language learning has become integral for students pursuing career objectives, and the flexibility and accessibility of mobile devices have popularized Mobile-Assisted Language Learning (MALL) as an alternative to traditional e-learning methods (Khan, 2021).

The history of integrating mobile devices into foreign language teaching dates back to 1994, with research and publications showcasing its evolution (Burston, 2013). Created by Chinnery (2006), the term "Mobile-Assisted Language Learning" underscores the pedagogical potential of mobile devices for language learning. The increasing use of technologies and portable wireless devices, including laptops, tablets, PCs, mobile phones, phablets, and satellite systems, empowers users to access educational materials anytime, anywhere. Over the past two decades, the cost and size of mobile devices have decreased while processing power, memory, and speed have increased. These features make mobile devices particularly conducive to student-centered learning.

In the context of English as a Foreign Language (EFL), vocabulary learning is crucial as it forms the foundation of language and enables effective communication with listeners (Pan & Xu, 2011; Okkan & Aydın, 2020). While grammar knowledge provides the overall structure of a language, a lack of vocabulary knowledge can hinder foreign language learners' ability to communicate or express themselves (Sanosi, 2018) and can also impact other language skills such as listening, speaking, reading, and writing (Cahyono & Widiati, 2008; Alqahtani, 2015). However, unlike phonology or syntax, vocabulary acquisition does not follow specific rules, making it a challenging aspect of language learning (Alqahtani, 2015). Therefore, learning vocabulary is essential in the EFL context, but it is often considered one of the main areas of difficulty in the learning process. Thus, aiming to emulate such challenges and problems in vocabulary learning, researchers probed the possibility of using MALL to make learning English more accessible and attainable through Web 2.0 platforms and applications, such as Google and Microsoft applications, Quizlet, Quizzes, and WhatsApp. Accordingly, after two decades of research in CALL, former research concluded that technology implementation and acceptance (Davis, 1989) are vital to improving language learning (Alwahoub et al., 2022; Alwahoub et at, 2020).

The Technology Acceptance Model (TAM) is a widely used framework that explains users' acceptance and usage behavior towards Information Technology (IT). Researchers have frequently employed TAM to investigate users' acceptance and utilization of IT, as confirmed by Surendran (2012). TAM is designed to predict technology acceptance and usage based on several key constructs. These constructs include Perceived Usefulness (PU), which refers to the extent to which an individual believes that using a particular system would enhance their job performance, and Perceived Ease of Use (PEU), which refers to the extent to which an individual believes that using a specific system would be effortless (Davis, 1989). The model also incorporates Attitudes (A) and Behavioral Intention (BI). Attitudes represent the overall positive or negative feelings towards using the technology, while Behavioral Intention reflects the individual's intention to use the technology in the future. TAM is based on the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen (1975) and offers a framework for understanding users' acceptance and adoption of technology. According to Davis (1989), TAM suggests that users' behavioral intention and acceptance of a given program can be determined by their perceived usefulness and perceived ease of use. This means that users are more likely to accept and use technology if they perceive it as valuable and easy to use (see Figure 2).

Quizlet, available at https://quizlet.com (see Figure 1), is an online platform designed explicitly for vocabulary management. Geared towards both teachers and students, it facilitates monitoring vocabulary learning progress. The platform encompasses diverse tools for crafting various

vocabulary activities, including flashcards, learning exercises, spelling practice, tests, matching games, and gravity games under two main categories: Quizlet Study and Play features.

A key strength of Quizlet lies in its user-friendly interface and array of features that enhance the learning experience. Accessible on various devices such as computers, mobile devices, and tablets, users can sign up using their Google, Microsoft, Facebook, or other accounts and effortlessly search for educational materials. The Quizlet app is free and provides access to millions of sets created within the platform. To discourage rote memorization, Quizlet automatically shuffles items within a set and offers several interactive features for users to engage with (Barr, 2016). The principal features of Quizlet encompass Quizlet Study, comprising Flashcards, Learn and Test, and Quizlet Play, which includes the Match game. Quizlet, available at https://quizlet.com (refer to Figure 1), is an online platform designed explicitly for vocabulary management. Geared towards both teachers and students, it facilitates monitoring vocabulary learning progress. The platform encompasses diverse tools for crafting various vocabulary activities, including flashcards, learning exercises, spelling practice, tests, matching games, and gravity games.

In 2023, Quizlet underwent a comprehensive update, maintaining its core features. Notable changes included merging the "Write" and "Spell" components into the "Learn" tab and eliminating the "Gravity" game mode while retaining the "Match" game mode. Consequently, the "Study" mode now integrates Flashcards, Learn, and Test, while the "Play" mode offers Match. Quizlet boasts impressive statistics, boasting a monthly user base exceeding 60 million learners and a remarkable number of study sessions surpassing 3 billion. Additionally, the platform houses an extensive collection of over 350 million study sets, attesting to its credibility and popularity among both learners and educators. As the largest online learning community for students and teachers, Quizlet has solidified its position as one of the most widely utilized language-learning technology tools on the internet (Andarab, 2019; Shehane, 2015).
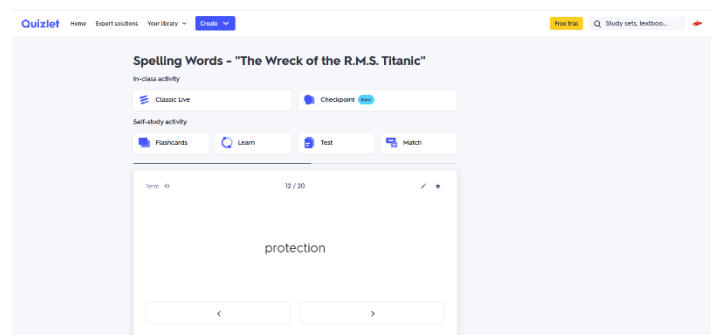

Figure 1: Quizlet Study and Play Features Interface

In the context of Quizlet, most existing research has primarily focused on learners' acceptance and perceptions of teacher-generated or ready-made Quizlet materials. However, there is a dearth of study informer research regarding learners' acceptance of Quizlet after they get involved in producing their own learning materials and study sets individually. Previous research has shown that students' involvement in creating their own learning material can be beneficial for their learning (Farangi et al., 2015; Gholami & Mohammadi, 2015; Haraldseid, Friberg, & Aase, 2016; Könings et al., 2021) and may accordingly produce different perceptions after the self-regulated involvement. Therefore, further investigation is needed to understand learners' technology acceptance and perceptions of Quizlet when they actively participate in creating their own materials and study sets. Hence, the current study investigates how student-generated Quizlet study and play features impact learners' technology acceptance and attitudes, especially in the non-tertiary K-12 setting. Accordingly, this study aims to answer the following research questions:

1. How do EFL learners perceive m-learning and gamification through Quizlet as a tool that may impact their acceptance of technology in the learning process?

LITERATURE REVIEW

From a historical perspective, the advancement of information and communication technology (ICT) has led to the emergence of new language teaching methods, such as Computer-Assisted Language Learning (CALL), Mobile-Assisted Language Learning (MALL), and Blended Learning. CALL originated in the 1960s as a practice program and has evolved into various forms, including virtual learning environments, web-based distance learning, and MALL (Šimonová, 2014). MALL refers to the formal or informal learning of a foreign language with the assistance of mobile devices (Chen, 2013). Mobile devices in education have made learning portable, real-time, and collaborative, expanding the horizons of language learning (Wong & Looi, 2011). Research on MALL has highlighted several benefits for language improvement (Cho et al., 2018). The evolution of web tools, from read-only information systems (Web 1.0) to artificial intelligence-powered systems (Web 4.0), has facilitated interconnectivity and fast human-machine collaboration (Aghaei, Nematbakhsh & Farsani, 2012). Web 2.0 tools, the second generation of web tools, have significantly impacted education by allowing learners to generate content easily (Albion, 2008). They also promote collaboration and collective intelligence, providing learners with effective learning opportunities (Alwahoub et al., 2022).

Incorporating technology into language classes is vital, especially in vocabulary teaching, as helping learners develop their lexical competence has been an important issue for language teachers for a long time (Nushi & Jenabzadeh, 2016). Thus, most former research concluded that learners had positive attitudes toward vocabulary learning through technology. A comprehensive examination of multiple studies reveals a consistent pattern of positive perceptions and efficacy in technology-assisted language learning (TALL) across diverse educational contexts. In the study conducted by Azli et al. (2018), vocational college students demonstrated unanimous agreement on the perceived usefulness (PU) and ease of use (PEoU) of mobile-assisted language learning (MALL). This affirmative stance indicates a general receptivity among students towards integrating technology into language learning experiences, showcasing the potential of MALL to enhance the educational journey.

The exploration by Anjaniputra and Salsabila (2018) into gamified vocabulary learning, particularly utilizing the Quizlet platform, among Indonesian EFL learners further supports the positive impact of digital games on language acquisition. The findings underscore the role of such gamification in fostering increased engagement, autonomy, and overall positive learning development among tertiary-level students. Similarly, Shi and Tsai's (2022) investigation into the effectiveness of a mind-mapping MALL app for Taiwanese EFL students offers valuable insights. The app facilitated a transition from receptive to productive learning and encouraged word perception and retention, resulting in demonstrable benefits for learners in delayed posttests. This suggests incorporating innovative MALL tools can contribute to a more dynamic and effective language learning experience.

The cluster of studies focusing on Quizlet further accentuates the positive reception of technology in language education. Rejeki et al. (2020) emphasized the utility of Duolingo and Quizlet in improving word banks and enhancing overall English learning, showcasing the multifaceted benefits of such platforms. Apriliani's (2021) recognition of Quizlet as remarkably effective and engaging for students reinforces the notion that well-designed digital tools can serve as catalysts for heightened student involvement. Additional studies (Prayogi & Wulandari, 2021; Aksel, 2021; Alhadiah, 2020) underscore Quizlet's practicality and user-friendly nature, highlighting its seamless integration into classroom activities.

Furthermore, Sudrajat's (2022) investigation into Quizlet as a learning medium for young learners reveals positive responses, attributing the platform's success to its exciting features, including pictures, sounds, and games. Collectively, these findings not only affirm students' positive attitudes towards various TALL tools but also highlight the potential for technology to facilitate enhanced language learning engagement, autonomy, and overall educational outcomes in diverse learning environments. Also, in a Chinese context, Christian and Fortunata (2023) investigated how teachers and students used Quizlet and their views on the use of Quizlet as a teaching and learning tool. The study revealed that the participants found Quizlet an easy-to-use and very useful tool. Also, it was found that students believed that their vocabulary had improved after using Quizlet, and they could memorize vocabulary faster as their test results improved.

From a theoretical standpoint, the Technology Acceptance Model (TAM) was applied to analyze participants' technology acceptance levels after implementing Quizlet. Derived from the Theory of Reasoned Action, TAM focuses on users' acceptance and usage behavior of Information Technology (IT). It considers constructs like Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitudes (A), and Behavioral Intention (BI) to predict technology acceptance. Perceived usefulness is defined as the belief that using a system enhances productivity, while Perceived Ease of Use is the belief that using a system is effortless. These constructs, attitudes, and intentions were used to analyze students' perceptions of MALL usage in an EFL setting (see Figure 2).
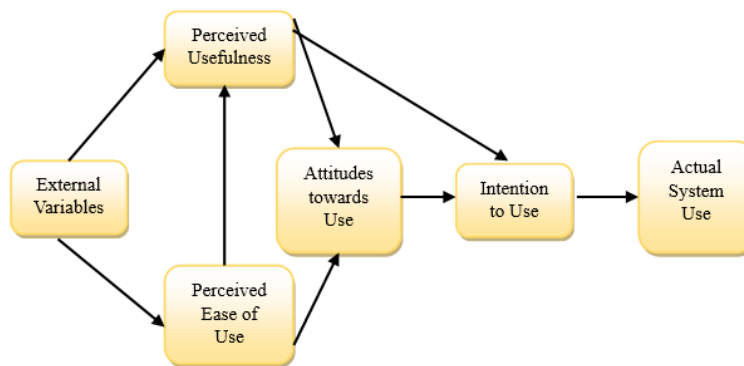

Figure 2: Technology Acceptance Model (TAM)

METHODOLOGY

In this study, the researcher employed a Quantitative Quasi-Experimental design. Experimental research stands out as the only type capable of establishing cause-and-effect relationships between variables. True-experimental designs usually incorporate a pretest and posttest randomized experiment, where participants are randomly assigned to different groups. However, logistical constraints may hinder random selection in quasi-experimental research, leading to the use of alternative methods (Trochim, 2020). Given that the school administration had already assigned students to classes, random group assignment wasn't feasible in this study. Therefore, the researcher opted for a quasi-experimental design based on availability and convenience.

Participants

The study comprises a total of 42 participants, all of whom are 6th-grade students (n=42). These students are Arabic speakers and learn English as a Foreign Language (FL), predominantly using

Arabic as their native language at home. English is exclusively learned and practiced within the school environment. The participants originate from various Arab countries, including Saudi Arabia, Syria, Jordan, Egypt, Palestine, and Yemen. In terms of proficiency levels, it is crucial to highlight that all participants share similar proficiency levels. This uniformity arises from their common placement in the same grade, 6th grade. Additionally, as part of the school's admission process, a standardized test evaluates students' proficiency across the four language skills: listening, reading, writing, and speaking. Students gain admission only if they pass this assessment, achieving a minimum score of 60%. Consequently, all students attending this private school are considered proficient in English, exhibiting relatively comparable literacy abilities.

Sampling Technique

The researchers opted for nonprobability convenience sampling to select participants for this study. In nonprobability sampling, individuals are chosen based on availability and convenience rather than through random selection (Creswell, 2012). The researchers focused on primary school students who met specific criteria, such as proficiency in English and technological knowledge. Nonprobability sampling is commonly employed when random selection is impractical or unfeasible (Frankfort-Nachmias & Nachmias, 2008). While random selection is considered ideal in experimental research, nonprobability sampling can still offer valuable insights and information for addressing research questions (Creswell, 2012). In this study, a total of 4 primary school students participated. However, it's crucial to acknowledge that convenience sampling may introduce limitations, such as potential bias and a reduced ability to generalize findings to the broader population.

Validity and Reliability

Questionnaire validation is crucial to ensure that an instrument effectively measures its intended constructs (Field, 2013). It is essential to mention that all 16 items in this questionnaire were adapted from Rabu and Talib (2017), which also originated from Davis's (1989) technology acceptance model (TAM). The reliability coefficient, calculated using Cronbach's Alpha within the confidence interval, demonstrated high-reliability values for both the pretest ($\alpha = 0.93$) and posttest ($\alpha = 0.96$). This finding reinforces the reliability and suitability of this instrument for the research (see Table 1).

Table 1: Cronbach's Alpha Reliability Statistics of TAM

	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items	N of Participants
Pretest	.933	.934	16	42
Posttest	.964	.965	16	42

Data Collection and Analysis

Data collection is a systematic process of gathering information relevant to the research purpose (Blaikie, 2009), and this study addresses how EFL learners perceive m-learning and gamification through Quizlet as a tool that may impact their acceptance of technology in the learning process. The TAM questionnaires were administered before Quizlet implementation and immediately at the end of the experiment to assess the experimental group's technology acceptance levels of m-learning and gamification via Quizlet. The questionnaire items, adapted from Rabu & Talib (2017) and derived from Davis's (1989) technology acceptance model (TAM), comprised five Likert-type items with response options ranging from "strongly disagree" to "strongly agree." The questionnaire's language style was adjusted to suit the participant's age, and the classroom teacher ensured that each student understood the items before responding. The questionnaire encompassed 16 items across five sections: (1) Student background, (2) Perceived ease of use, (3) Perceived usefulness, (4) Attitude

towards technology, and (5) Desire to use the technology (see Appendix A2). As for data analysis, the questionnaire responses were converted into numerical data and analyzed quantitatively using SPSS version 23. The primary analytical approach involves descriptive statistical analysis, which presents results through figures and charts, summarizing the collected data's key elements, including means and standard deviations. This quantitative analysis aims to provide insights into technology acceptance levels after the implementation of Quizlet.

FINDINGS

The emerging findings from both the pretest and the posttest revealed insightful results. The adapted questionnaire from Rabu & Talib (2017), originating from Davis's (1989) technology acceptance model (TAM), served as a valuable tool to gauge students' levels of acceptance toward technology implementation using Quizlet. In terms of Ease of Use, all mean scores increased in the post-study survey. Respondents expressed that learning through Quizlet Study and Play features became easier, emphasizing that it was more straightforward compared to direct instruction from teachers. They also highlighted that their interaction with Quizlet was clear and easy to understand, and they felt confident in using Quizlet without the assistance of a teacher (see Table 2).

Table 2: Ease of Use Descriptive Findings

No.		Item (Pre: N=42, Post: N=42)	Test	Mean	Std. Dev.
1		Learning using Quizlet Learn and Play features is easy for me.	Pre	3.83	0.986
			Post	3.93	1.113
2		It is easier for me to learn English vocabulary through Quizlet rather than direct instruction from teachers.	Pre	3.52	1.194
	Ease of Use		Post	3.76	1.226
3		My interaction with Quizlet is clear and easy to understand.	Pre	3.71	0.970
			Post	3.88	1.041
4		I can use Quizlet without the help of a teacher.	Pre	3.74	1.127

Usefulness

Concerning usefulness, there were mean gains in three items, with respondents indicating that Quizlet Study and Play features could improve their effectiveness in learning activities, increase their productivity in English vocabulary, and were found to be very useful. While no increase in mean was observed for the statement related to Quizlet's ability to develop their English proficiency, the overall trend indicated a positive perception of Quizlet's usefulness (see Table 3).

Table 3: Ease of Use Descriptive Findings

No.		Item (Pre: N=42, Post: N=42)	Test	Mean	Std. Dev.
5		Using Quizlet Learn and Play features can improve my effectiveness in learning activities.	Pre	3.64	1.032
			Post	3.86	1.072
6		Using Quizlet Learn and Play features can develop my English proficiency.	Pre	3.81	0.969
			Post	3.81	1.174
7	Usefulness	Using Quizlet Learn and Play features can increase my productivity in English vocabulary.	Pre	3.81	1.110
			Post	3.95	1.081
8		I find that Quizlet Learn and Play features is very useful.	Pre	3.76	1.008
			Post	3.90	1.031

Attitude

Respondents demonstrated high acceptance levels in pre- and post-study surveys in the Attitude variable. Mean gains were observed in three items, indicating a positive shift in attitude after Quizlet implementation. Students expressed a liking for Quizlet Study and Play features, believed these features should be used both inside and outside the classroom, and considered it a good idea to incorporate Quizlet into English vocabulary learning. However, there was a slight decrease in the mean score for the item related to liking it when a teacher used Quizlet, suggesting a preference for self-regulated learning using Quizlet (see Table 4).

Table 4: Ease of Use Descriptive Findings

No.		Item (Pre: N=42, Post: N=42)	Test	Mean	Std. Dev.
9		I like to use Quizlet Learn and Play features.	Pre	3.38	1.168
			Post	3.76	1.284
10		Quizlet Learn and Play features should always be used inside and outside the classroom (at home, at the access point, and anywhere).	Pre	3.45	1.131
			Post	3.67	1.203
11	Attitudes	I believe it is a good idea to use Quizlet Learn and Play features in English vocabulary learning.	Pre	3.76	1.100
			Post	3.90	1.100
12		I like when a teacher uses Quizlet in teaching English vocabulary.	Pre	3.76	1.100
			Post	3.74	1.231

Intention

The Intention variable also showed high acceptance levels in both pre- and post-study surveys, with mean gains in all items during the post-study survey. Respondents expressed an intention to continue using Quizlet Study and Play features in grade 7, use Quizlet consistently outside class time, use Quizlet in the future, and recommend Quizlet Study and Play features to their friends (see Table 5).

Table 5: Ease of Use Descriptive Findings

No.		Item (Pre: N=42, Post: N=42)	Test	Mean	Std. Dev.
13		I intend to continue using Quizlet Learn and Play features in grade 7.	Pre	3.50	0.969
			Post	3.62	1.324
14		I will always use Quizlet to learn new English vocabulary out of the class time.	Pre	3.29	1.215
			Post	3.52	1.194
15	Intention	I intend to use Quizlet in the future.	Pre	3.21	1.048
			Post	3.69	1.259
16		I would recommend my friends to use Quizlet Learn and Play features.	Pre	3.69	0.897
			Post	3.83	1.167

DISCUSSION

Overall, the results suggest that EFL learners exhibited positive perceptions and high levels of acceptance toward Quizlet's self-regulated m-learning and gamification features. The findings indicate that Quizlet is perceived as easy to use, useful for vocabulary learning, and positively influences learners' attitudes and intentions to continue using it in the future. This study used TAM to assess participants' acceptance of Quizlet's technology implementation. TAM predicts acceptance based on Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitudes (A), and Behavioral Intention (BI). Perceived usefulness reflects a belief that a system enhances productivity, while

perceived ease of use influences both usefulness and technology usage. Results showed high acceptance levels in all variables, aligning with numerous studies emphasizing positive perceptions of Quizlet's technology implementation (Azli et al., 2018; Salsabila, 2018; Rejeki et al., 2020; Alhadiah, 2020).

Ease of Use displayed high acceptance in the pre-study survey, with all items increasing post-study, indicating the experimental group found Quizlet accessible and user-friendly. This aligns with studies confirming Quizlet's practicality and ease of use (Prayogi & Wulandari, 2021; Aksel, 2021; Alhadiah, 2020; Sudrajat, 2022; Jannah, 2022; Christian & Fortunata, 2023). Usefulness exhibited high acceptance in the pre-study survey, with most items increasing post-study, indicating participants found Quizlet useful for vocabulary learning. This aligns with findings from studies emphasizing Quizlet's accessibility and effectiveness (Pham, 2022; Christian & Fortunata, 2023). Participants reported that Quizlet could enhance their English proficiency, although the mean score for this item did not increase post-study. This deviates from Rejeki et al. (2020), who found Quizlet helpful for English learning.

Positive attitudes towards Quizlet increased post-study, reflecting its positive impact on participants. This aligns with studies showing improved attitudes and self-regulatory capacity during technology-assisted language learning programs (Lei et al., 2022; Novitasari & Prijambodo, 2022). While participants liked it when a teacher used Quizlet, the mean score for this item decreased post-study, indicating a preference for self-study. This resonates with the nature of self-regulated study, emphasizing autonomy (Chen et al., 2019). Intentions for future Quizlet use were positive, significantly increasing mean scores post-study. This aligns with Alhadiah's (2020) findings and contradicts Lam et al.'s (2018) study, possibly due to age-related differences. In conclusion, participants found Quizlet helpful and easy to use. They expressed positive attitudes and intended to use it in the future. This aligns with the positive impact of self-regulated m-learning and gamification on vocabulary learning performance.

CONCLUSION

The Technology Acceptance Model (TAM) revealed two key outcomes in this study. Firstly, the experimental group participants exhibited high acceptance levels across all items and variables, with a mean score increase in most post-study items compared to the pre-study phase. Specifically, participants demonstrated higher acceptance in 16 items post-implementation, emphasizing positive attitudes towards Quizlet. Secondly, participants maintained a neutral attitude in two items related to intention in the pre-study phase, and no negative attitudes were observed in either pre-study or post-study surveys, reinforcing the overall positive outlook on Quizlet's technology implementation. This study contributes to addressing the gap in exploring self-regulated Quizlet Study and Play feature implementation, distinct from teacher-based or out-of-school practices (Bueno-Alastuey & Nemeth, 2022). The utilization of web-based technologies, particularly Quizlet and social tools, significantly expands the potential for learning vocabulary in foreign languages (FL). These tools provide opportunities for meaningful interactions and foster individual and self-regulated linguistic growth. However, the implementation of technology-based activities in FL settings requires careful consideration of task selection and instructions, especially given the screen-centric nature of students in today's digital age. Depending on the linguistic gains observed in this study, prolonged engagement in self-regulated vocabulary learning sessions throughout the academic year may prove more beneficial. In conclusion, educators and researchers should tailor their focus to specific linguistic variables of interest, providing opportunities for meaningful practice and research aligned with their objectives. For example, synchronous, in-class collaborative writing activities with time constraints could enhance qualitative development in FL writing. Thus, these findings enhance our understanding of integrating collaborative digital literacy in K-12 settings, leveraging synchronous technology to equip students with essential writing skills for the 21st century.

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