The Role of Autonomous Motivation in Shaping Mobile-Assisted Language Learning Adoption and Engagement for English Vocabulary Learning

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***Abstract*—This study explores how Perceived Ease of Use (PEU), Perceived (PU), and Autonomous Motivation (AM) shape Behavioral Intention (BI) and Actual usage Behaviors (AB) of Mobile-Assisted Language Learning (MALL) for English vocabulary learning. Drawing upon the Technology Acceptance Model (TAM) and Self-Directed Learning (SDL) theory, a quantitative design was employed with 201 English as a Foreign Language (EFL) learners completing an online questionnaire. The measurement model exhibited high reliability and validity, and subsequent structural equation modeling revealed that AM exerted the strongest influence on BI (β = 0.446, p = 0.001), followed by PU (β = 0.338, p = 0.000) and PEU (β = 0.193, p = 0.000). Additionally, BI significantly predicted the frequency (F) (β = 0.564, p = 0.009) and duration (D) (β = 0.557, p = 0.004) of MALL usage, underscoring the critical role of intention in bridging AM and cognitive factors with concrete learning behaviors. AB were measured solely via self-reported F and D of use, and did not include actual vocabulary learning outcomes. These findings highlight both the pedagogical importance of user-friendly application design and the need to foster AM among learners. These insights generally highlight MALL's significant potential as a learner-centred method for supporting vocabulary learning, by promoting consistent interaction and self-directed practice.**

***Keywords*—Mobile-Assisted Language Learning (MALL), vocabulary acquisition, autonomous motivation, actual usage behaviors**

I. Introduction

Vocabulary acquisition remains a cornerstone of language proficiency, yet the challenge of retaining new words persists for many English as a Foreign Language (EFL) learners [1]. Conventional classroom methodologies often struggle to sustain long-term engagement, resulting in plateaued learning outcomes [2, 3]. In recent years, the rapid expansion of mobile technology has presented new possibilities for language instruction, with Mobile-Assisted Language Learning (MALL) emerging as a dynamic approach to enriching vocabulary learning [4, 5]. By allowing learners to practice and review content in flexible, personalized environments, MALL applications can reshape the language learning experience by offering interactive exercises, gamified tasks, and real-time feedback that engage learners beyond the constraints of traditional settings [6, 7].

Notwithstanding these possible advantages, the effective acceptance of MALL depends on knowledge of how several, such as simplicity of use, perceived utility, and Autonomous Motivation (AM), collectively influence students' behavioural intentions and actual use patterns. Although earlier studies show the importance of these elements separately [8, 9], little empirical research has examined their interaction or followed how intention develops into consistent involvement over time. Examining the psychological aspect of AM is equally important, as it usually affects whether students keep strong in their practice and include fresh terminology into their developing repertoire [10, 11]. Gorjian *et al.* [12] and Fišer and Pongračić [13], this study builds on the intersection of Computer-Assisted Language Learning (CALL), Technology Acceptance Model (TAM), and learner AM to better understand MALL usage behaviour.

Against this background, the present work examines how perceived simplicity of use, perceived utility, and incentives could support both behavioural intention and actual use of MALL tools for English language learning. With an eye towards how these ideas interact and support one another, the study aims to provide useful analysis for legislators, teachers, and technology developers. The ultimate aim is to highlight techniques that let students not only start using MALL but also sustain and increase their participation for long-term vocabulary development.

II. Literature Review

A. Mobile-Assisted Language Learning

MALL particularly stands out for its great adaptability and simplicity of access, which allows students to interact with linguistic materials without temporal or geographical constraints. Learners may actively participate in learning activities at their own pace, therefore thereby enhancing their autonomy and promoting sustained engagement [7]. They are not limited to classroom bounds. Moreover, customised adaptive material available via mobile apps improves student AM and involvement, therefore offering a customised educational experience lacking in many conventional approaches [14, 15].

The user interface and general user experience of MALL apps are very vital for their acceptance and ongoing usage. Studies have repeatedly demonstrated that students' preparedness and drive to interact much rises when they find an application to be simple, user-friendly, and easily accessible [4, 16]. MALL tool creation should therefore give aesthetic simplicity and practical clarity first priority, hence reducing psychological obstacles and enabling a smooth teaching path. Emphasising simplicity of use within interface design fosters continuous learner involvement and helps to build good attitudes about technology [4].

In MALL environments, interactive components like gamification, multimedia annotations, and energetic exercises are very essential in grabbing and keeping students' interest. These interactive elements change the learning process and make it fun and interesting, therefore encouraging greater cognitive participation and more successful vocabulary acquisition [17, 18]. Including adaptive technology, voice commands, and interactive multimedia also offers different stimuli that fit different learning styles and improve memorability [19].

MALL still presents significant limitations that warrant critical discussion. Foremost among these is the risk of digital distraction, where the multifunctionality of mobile devices allows non-learning factors to reduce learners' concentration and retention [20]. Moreover, many popular MALL tools, relying heavily on flashcards or simple gamification, primarily support surface-level rote memorization [21]. They often fail to sufficiently facilitate deep learning required for contextual understanding, semantic nuances, or the ability to apply vocabulary productively in real communication. Finally, technical barriers remain a critical challenge; issues such as unstable internet connections, limited storage capacity, application errors, or low digital literacy can severely hinder the learning process, particularly in areas with weak infrastructure, potentially decreasing motivation and engagement [2, 22–24].

B. Autonomous Motivation

Motivation, particularly the distinction between intrinsic and extrinsic motivation, adds another dimension to this framework. Students who are intrinsically motivated often show a greater willingness to use MALL tools, especially when these tools are perceived as useful and aligned with their learning objectives [22]. AM is also shaped by social and technological contexts. Research suggests that students with higher levels of motivation tend to achieve better outcomes when using mobile learning tools [10, 11]. Moreover, the presence of peer support and positive social influence has been found to further encourage MALL adoption [25].

AM acts as a cornerstone in the effective implementation and sustained use of MALL. Learners with high levels of intrinsic motivation interact more deeply with MALL applications, achieving greater language proficiency and retention [10, 11, 26]. Central to this motivation are fundamental psychological needs, including autonomy, competence, and relatedness, which, when adequately addressed, substantially elevate learners' willingness to engage with mobile technologies for language learning [3, 23]. Consequently, effective MALL strategies should actively nurture these psychological aspects to maintain high learner AM and participation.

C. Benefits of MALL in Vocabulary Acquisition and Enhancing Learner Motivation

Adopting a balanced approach, blending traditional face-to-face instruction with mobile learning methods, is essential for comprehensive language development. This blended modality mitigates learner fatigue and ensures continuous engagement through diverse educational experiences. Effective use of MALL necessitates integrating these methodologies strategically, leveraging the strengths of each to foster dynamic, immersive learning environments [5].

While technological features drive engagement, the teacher's role remains instrumental in maximizing MALL's educational potential. Teachers who are highly skilled in integrating mobile devices into instructional approaches greatly improve the results of language acquisition [27]. Lack of organised instructional direction might lead to underutilisation and lower effectiveness of MALL instruments, therefore stressing the need of thorough teacher training programs combining technical skills with pedagogical expertise. Therefore, effective MALL integration depends much on teacher preparedness and trust in technological usage.

D. Cross-Linguistic Perspective: MALL in EFL and CFL Contexts

The majority of MALL research focuses exclusively on EFL. However, a comprehensive understanding requires comparative insights from parallel fields, such as Chinese as a Foreign Language (CFL). The drivers of technology adoption may differ significantly between learners tackling an alphabetic language like English and those mastering a logographic language like Chinese [28]. For instance, CFL learning often involves unique challenges related to character recognition, input methods, and the sheer volume of vocabulary required, which may influence how learners Perceived (PU) and Perceived Ease of Use (PEU) of MALL applications. Zhou and Goh [29] explore nuanced challenges in mobile-assisted seamless vocabulary learning that can provide a richer, cross-linguistic context and strengthen the theoretical foundation of MALL research generally. Overlooking this perspective would limit the generalisability of the findings on adoption drivers.

E. Theoretical Model

Self-Directed Learning (SDL) Theory complements this perspective by emphasizing learner autonomy, goal-setting, and self-regulation [30]. MALL naturally aligns with these principles by offering flexible, learner-controlled environments that extend beyond traditional classroom boundaries. Studies have shown that mobile devices foster autonomous engagement by allowing learners to structure their study around personal schedules and goals, thus promoting sustained interaction with language content [6].

The TAM suggests that PEU and PU significantly influence a learner's attitudes and behavioural intention toward adopting new technologies [31]. This framework strongly resonates with MALL research, where accessibility and simplicity have been repeatedly associated with increased AM and readiness to engage with mobile tools [4]. In this sense, a well-designed mobile interface transcends its technical function and becomes an instrument of pedagogical empowerment. Recently, Gorjian *et al.* [12] introduced an integrated CALL evaluation tool based on the TAM to support EFL instruction, highlighting the importance of PU and PEU in app adoption in language classrooms.

While the TAM effectively explains the cognitive factors driving initial technology adoption, it often oversimplifies the psychological depth required for long-term engagement and sustained learning [6, 7]. Conversely, SDL emphasizes psychological readiness, autonomy, and self-regulation. The novelty and significance of this integrated framework lie in

its empirical attempt to bridge this theoretical gap: modeling how psychological factors like AM from SDL interact with and often dominate technological acceptance factors in predicting consistent, long-term usage in MALL environments, rather than just initial intent. This integrated approach is critically important because it provides robust empirical evidence validating the dominance của psychological factors. Thus, the integrated model offers a more holistic and predictive view essential for understanding long-term learning success in MALL. In essence, the flexibility afforded by mobile devices aligns with SDL's call for autonomous participation, enabling learners to personalize study schedules, set vocabulary learning goals, and effectively monitor their progress [7]. At the same time, the TAM perspective ensures that such devices are not only accessible but also perceived as user-friendly and beneficial. These are key determinants that encourage frequent and sustained use of MALL tools [16]. In essence, the merging of these frameworks provides a necessary strategic blueprint [16]. It is important because it instructs designers not only to ensure the application is user-friendly and beneficial but also to strategically utilize features such as gamification and adaptive learning to actively nurture the fundamental psychological needs of autonomy and competence. This simultaneous focus on technological design and psychological enablement is what ultimately fosters a learner-centered ecosystem necessary for sustainable vocabulary development.

F. Research Hypothesis

PEU is the perception of learners that using a particular technology requires minimal effort, thereby enabling seamless and effective engagement with learning tools [31]. By means of PU, Hsu and Lin [8] demonstrated that behavioural intentions are much influenced by PEU. Likewise, studies by Ebadi and Raygan [32] found that EFL learners' sentiments towards MALL were significantly correlated with their perceived ease of use, Emphasising the importance of simplicity in MALL effectiveness, Zakian *et al.* [21] strengthened these conclusions by proving that mobile apps greatly help build vocabulary knowledge. Alhadiah [9] also observed that Saudi EFL students had good opinions of vocabulary study tools such as Quizlet, mostly because of their simplicity of use. These consistent results across several scenarios lead one to hypothesise as follows:

H1: Perceived ease of use has an impact on EFL learners' intention to use MALL to learn English vocabulary.

Especially in language learning activities, PU describes the extent to which students feel using a certain technology would improve their performance [31]. The behavioural intention of EFL learners to use MALL is much influenced by PU. Particularly, students are more likely to keep using mobile apps if they believe they help to improve their vocabulary development [8, 9, 32, 33]. For example, PU greatly influenced Iranian EFL students' opinions of MALL, which therefore predicted their propensity to use these tools for language learning [32]. Likewise, perceived utility directly affected the intrinsic drive of Taiwanese college students, thereby influencing their behavioural intention to interact with MALL [8]. Several studies have also shown that ease of use may support students' perception of utility, thus increasing their readiness to utilise mobile apps for vocabulary acquisition [8, 32]. Furthermore, numerous studies have shown how well mobile apps help students acquire and retain. Learners tend to view these tools as practical and efficient solutions for language learning [34–36]. These results lead one to generate the following theory:

H2: Perceived usefulness has an impact on EFL learners' intention to use MALL to learn English vocabulary.

AM plays a pivotal role in shaping learners' intentions to engage with MALL for English vocabulary development. AM, described as an inherent interest or enjoyment in a task, has been shown to positively influence students' behavioral intention to use MALL by enhancing PU and task-technology fit [22]. According to SDT, fulfilling learners' fundamental psychological needs, namely autonomy, competence, and relatedness, is critical for sustaining AM [3]. In practice, leveraging communication tools such as WhatsApp has demonstrated significant improvements in AM among EFL learners, illustrating how MALL supports a more self-directed learning process [3].

Moreover, the concept of motivational transfer indicates that activity-specific intrinsic motivation for using MALL applications, such as Duolingo, can positively affect overall motivation for learning a second language [24]. This transfer underscores the broader impact of MALL on learners' engagement and intention to adopt mobile technologies for academic purposes. Additionally, collaborative mobile learning practices, for example using Telegram for team-based tasks, have been shown to substantially increase AM and engagement, creating a supportive environment that further encourages learners to continue using MALL [2]. Studies also highlight that integrating technology into EFL settings, particularly through learning-oriented assessments, effectively addresses challenges linked to vocabulary acquisition, thereby influencing the psychological dimensions of motivation and involvement [37]. In line with this, research has documented significant improvements in vocabulary knowledge among learners who engaged with MALL, suggesting a profound psychological impact on both immediate and long-term learning outcomes [38]. Consequently, this study posits the following hypothesis:

H3: Autonomous motivation has an impact on EFL learners' intention to use MALL to learn English vocabulary.

Research on MALL adoption has highlighted the crucial role of learners' intentions in predicting their actual usage behavior. Habit and performance expectancy are identified as key factors influencing EFL learners' behavioral intentions, with habit exerting a notable impact on real-life usage [25]. There is also a strong positive correlation between learners' intentions and their subsequent engagement with MALL, indicating that high intention levels lead to more frequent utilization of mobile applications for vocabulary learning. Furthermore, empirical findings have demonstrated the efficacy of mobile apps like Quizlet in enhancing vocabulary acquisition. These findings reveal students' positive attitudes toward MALL and emphasise the technological potential of mobile tools in language education [9]. Students with high behavioral intention were likely to increase the frequency and the duration of using mobile English learning apps [39]. Therefore, the following hypothesis is proposed:

H4: Intention to use MALL has a positive effect on the frequency of actual use behaviors.

H5: Intention to use MALL has a positive effect on the duration of actual use behaviors.

Below is frameworkapplied conceptual (Fig. 1):

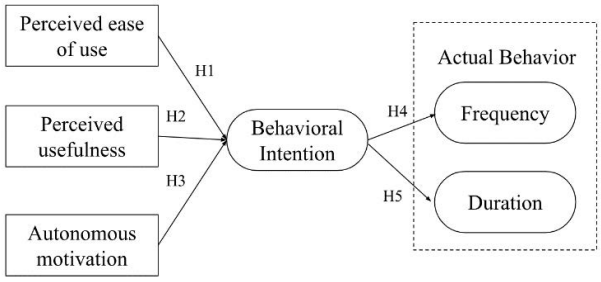

Fig. 1. Framework conceptual.

III. Materials and Methods

A. Participants

A convenience sampling strategy was employed to recruit EFL learners from several universities that offer English language programs. An invitation link was disseminated through institutional mailing lists, social media groups, and online learning platforms. A total of 201 valid responses were obtained, representing a diverse range of demographic backgrounds. As displayed in Table 1 of the results section, the sample comprised 94 male (46.77%) and 107 female (53.23%) participants, with varying frequencies and durations of MALL usage. This sample size aligns with guidelines suggesting a minimum of 10 observations per estimated parameter in structural equation modeling [40].

Table 1. Descriptive statistics of the sample

Demography	Category	Frequency	%
Gender	Male	94	46.77
	Female	107	53.23
Frequency	Less than once a week	3	1.49
	Once a week	19	9.45
	2–3 times a week	74	36.82
	4–5 times a week	52	25.87
	At least once every day	53	26.37
Duration	<1 h	5	2.49
	≥1 h, <3 h	21	10.45
	≥3 h, <5 h	61	30.35
	≥5 h, <7 h	78	38.81
	>7 h	36	17.91

In terms of frequency of MALL usage, the data reveal that only 1.49% of participants use mobile learning tools less than once a week, whereas 9.45% report using them once weekly. Notably, 36.82% use MALL two to three times per week, followed by 25.87% who do so four to five times a week. An additional 26.37% utilize mobile apps for language learning on a daily basis. Overall, these figures suggest a moderately high level of engagement with MALL, as more than half of the learners (62.19%) access mobile learning tools at least two to three times weekly.

The duration of MALL usage further highlights the intensity of learners' engagement. Although 2.49% spend less than an hour on MALL tools per session, nearly 10.45% devote one to three hours. A substantial percentage (30.35%) use MALL for three to five hours at a time, while 38.81% allocate between five and seven hours. Meanwhile, 17.91% exceed seven hours of usage per session. Taken together, these results point to a notable subset of learners who invest significant time in mobile-based language learning.

B. Materials

This study adopted a quantitative, cross-sectional design to investigate the relationships among PEU, PU, M, BI, and AB in a MALL context. A self-administered online questionnaire (Appendix 1) was chosen as the primary data collection instrument, enabling efficient gathering of responses from a sizable population of EFL learners within a relatively short timeframe. This approach was deemed suitable given the study's objectives and the need to assess latent constructs pertinent to technology acceptance and learner motivation [40]. Prior to distribution, each set of items underwent a two-stage review process. First, a panel of three TESOL experts evaluated item wording for clarity and contextual relevance to EFL learners. Next, a bilingual linguistics specialist performed back-translation to verify semantic equivalence in both English and the participants' native language. Any discrepancies were resolved via iterative revisions until consensus was reached on item accuracy.

The questionnaire was developed based on previously validated scales in educational technology and psychology. Items measuring PEU and PU were adapted from Han and Chen [41] and Farros *et al.* [42]. AM was operationalised using constructs grounded in the study by Chen and Zhao [43]. BI items were adapted from Hoi and Mu [44] and tailored to reflect participants' willingness to use mobile applications for vocabulary acquisition. Finally, AB encompassed two constructs, frequency (F) and duration (D) of MALL use, which were collected through self-reported measures of participants' average daily or weekly app utilisation [43]. All items employed a five-point Likert scale (1 = strongly disagree; 5 = strongly agree), except for actual usage items that requested numerical frequency or duration data.

C. Data Collection Procedure

Data collection took place over a five-month period, from December 2024 to April 2025. The online questionnaire was distributed through university mailing lists, social media platforms, and online learning forums. Before formal data analysis, responses were screened for completeness and consistency. Surveys that were incomplete or displayed patterned responses were excluded.

To analyze the data, the study employed SmartPLS 3.2.9 for both measurement and structural model assessment. The measurement model was first evaluated for reliability using Cronbach's Alpha and Composite Reliability (CR), and for convergent validity using Average Variance Extracted (AVE). Discriminant validity was assessed using the Fornell–Larcker criterion. Structural Equation Modeling (SEM) was then conducted to test the proposed hypotheses and examine the relationships among the latent constructs. Multicollinearity was checked using the Variance Inflation Factor (VIF), and predictive relevance was evaluated through the Q^2 statistic.

IV. Result and Discussion

A. Results

The reliability and convergent validity of the measurement

model were assessed using Cronbach's Alpha (CA), Composite Reliability (CR), Average Variance Extracted (AVE), and outer loadings. As suggested by Hair *et al.* [40], acceptable thresholds for CA and CR are 0.70 or higher, while AVE values should exceed 0.50 to confirm convergent validity.

The results presented in Table 2 show that all constructs satisfy these criteria. Specifically, the CA values ranged from 0.802 (BI) to 0.939 (AM), and CR values varied between 0.883 and 0.956, indicating high internal consistency. AVE values also met the required threshold, with the lowest being 0.666 (AB), and the highest at 0.846 (AM). Moreover, all outer loadings exceeded the 0.70 benchmark, with the lowest being 0.819, further confirming strong convergent validity across all constructs [40]. In addition, multicollinearity was evaluated using the Variance Inflation Factor (VIF). As all VIF values were below the critical value of 5.0 (ranging from 1.124 to 4.179), it can be concluded that multicollinearity is not a concern in the model [40].

Table 2. Reliability and convergent validity

Concepts	CA	CR	AVE	Outer loadings max	VIF max
AB	0.847	0.887	0.666	0.819	1.124
BI	0.802	0.883	0.716	0.852	1.732
AM	0.939	0.956	0.846	0.930	4.179
PEU	0.869	0.911	0.718	0.870	2.394
PU	0.934	0.953	0.834	0.920	3.788

Note: AB: Actual Behavior; BI: Behavioral Intention; AM: Autonomous motivation; PEU: Perceived ease of use; PU: Perceived usefulness; CA: Cronbach's Alpha; CR: Composite Reliability; AVE: Average Variance Extracted.

Discriminant validity was evaluated using the Fornell–Larcker criterion. According to this approach, the square root of AVE (displayed in bold on the diagonal in Table 3) for each construct should exceed its highest correlation with any other construct. The results demonstrate that this criterion was fully satisfied. For example, the square root of AVE for PU is 0.913, which is greater than its correlations with all other constructs, such as BI (0.842) and PEU (0.836). Similar patterns were observed for all constructs in the model, indicating that each construct is empirically distinct from the others and that discriminant validity is well established [45].

Table 3. Fornell-Larcker

Concepts	AB	BI	AM	PEU	PU
AB	**0.816**				
BI	0.687	**0.846**			
AM	0.682	0.824	**0.920**		
PEU	0.639	0.741	0.596	**0.847**	
PU	0.751	0.842	0.780	0.836	**0.913**

The explanatory power of the model was evaluated using the Coefficient of Determination (R^2) and predictive relevance (Q^2). As reported in Table 4, the R^2 value for BI is 0.797, and for AB it is 0.472. These values indicate that the model explains approximately 79.7% of the variance in BI and 47.2% in AB. According to Hair *et al.* [40], R^2 values of 0.25, 0.50, and 0.75 can be interpreted as weak, moderate, and substantial, respectively. Thus, the model exhibits substantial explanatory power for BI and moderate power for AB. Furthermore, the Q^2 values, which were used to assess predictive relevance, were 0.792 for BI and 0.555 for AB. Since both values exceed zero, they suggest that the model has strong predictive relevance for the endogenous constructs [40].

Table 4. Hypothesis testing

Concepts	R^2	R^2 adjusted	Q^2
AB	0.472	0.469	0.555
BI	0.797	0.794	0.792

The relationships among the constructs were evaluated through hypothesis testing using bootstrapping with 1,000 subsamples [46]. Table 5 summarizes the path coefficients (β), p-values, and the decision regarding each hypothesis. All hypothesized relationships were statistically significant at the 5% level. Specifically, AM had the strongest influence on BI ($\beta = 0.446$, p = 0.001), followed by PU → BI ($\beta = 0.338$, $p = 0.000$) and PEU → BI ($\beta = 0.193$, $p = 0.000$). Additionally, BI significantly predicted both outcomes, namely F ($\beta = 0.564$, $p = 0.009$) and D ($\beta = 0.557$, $p = 0.004$), highlighting the mediating role of intention in the model. The statistical significance of all five hypotheses confirms the theoretical structure of the model and supports its application in the context of behavioral studies in education or technology-enhanced language learning [31, 47].

Table 5. Hypothesis testing

Hypothesis	β	p-value	Results
H1: PEU → BI	0.193	0.000	Accepted
H2: PU →BI	0.338	0.000	Accepted
H3: AM → BI	0.446	0.001	Accepted
H4: BI → F	0.564	0.009	Accepted
H5: BI → D	0.557	0.004	Accepted

B. Discussion

The present study reaffirms the critical role of behavioral intention in connecting motivational determinants to actual usage behaviors within MALL. As evidenced by the significant relationships in Table 5, all proposed hypotheses (H1 to H5) were supported ($p < 0.05$), underlining the centrality of intention in bridging motivational constructs with concrete language learning actions. Notably, among these antecedents, H3 emerged as the strongest predictor of behavioral intention ($\beta = 0.446$, $p = 0.001$). All significant path relationships visually summarized in Fig. 2. The reason why AM was identified as the strongest predictor in the context of English vocabulary learning through MALL among EFL learners can be explained by several key aspects. First, MALL naturally aligns with the principles of SDL, which emphasize learner autonomy, self-regulation, and goal setting. For EFL learners, MALL provides a flexible and fully learner-controlled environment. This allows them to personalize study schedules, select vocabulary content suited to their needs, and monitor their own progress, thereby satisfying basic psychological needs. More than half of the sample reported (Table 1) using mobile language-learning applications multiple times per week, with a notable proportion committing extended periods (between three to seven hours). These high-frequency, long-duration engagement habits suggest that individuals who possess strong AM or perceive MALL tools as purposeful for their language goals are more inclined to integrate them consistently into their daily routines [10, 11].

Second, the interactive and entertaining nature of many MALL applications directly stimulates learners' intrinsic motivation. When learners find the learning process

enjoyable, they are more motivated to persist and to engage more deeply with MALL tools. Fišer and Pongračić [13] reevaluated the L2MSS scale using structural equation modeling among non English major students, similarly underscoring the predictive power of motivational constructs in influencing learner behaviours in technology mediated contexts.

Finally, in an informal learning environment with less pressure compared to classroom settings, EFL learners may feel freer to experiment, make mistakes, and learn at their own pace. Even peer support and positive social influence through collaborative mobile learning activities can enhance both motivation and engagement. Therefore, the ability of MALL to foster autonomy, provide engaging learning experiences, and fulfill psychological needs explains why motivation emerged as the strongest predictor of behavioral intention in this study context.

In parallel, the significant impact of PU (H2, $\beta = 0.338$) and PEU (H1, $\beta = 0.193$) demonstrates that learners' beliefs regarding the practicality and user-friendliness of mobile applications further reinforce their commitment to employing MALL tools for learner interaction with vocabulary content [8, 32]. Such alignment with the TAM highlights that usability factors are not merely technical considerations but integral pedagogical facilitators that lower psychological barriers and bolster engagement. To optimize both motivation and ease of use, the design of MALL applications should focus on incorporating specific interactive features. For instance, gamification elements such as point systems, badges, leaderboards, and engaging challenges can transform vocabulary learning into an enjoyable and competitive experience, thereby directly enhancing learners' intrinsic motivation. When learners feel positively stimulated and challenged, they are more willing to dedicate greater time and effort to their learning [9]. Similarly, adaptive learning technologies allow applications to adjust content and difficulty levels according to each learner's proficiency and pace [31]. This not only enhances PU, as learners recognize that personalized content supports more effective progress, but also improves PEU by preventing cognitive overload or the discouragement caused by tasks that are either too difficult or too easy. As a result, learners are more likely to sustain engagement and confidence throughout the learning process.

Meanwhile, learners who use MALL less frequently or for shorter durations may represent a demographic that is less convinced of its usefulness, or they may face barriers such as low digital literacy or insufficient technological infrastructure. The findings highlight H1 and H2 as significant drivers of behavioral intention and thus remain highly relevant for these groups. Consistent with the TAM, addressing usability concerns, such as simplifying interfaces, providing brief tutorials, or offering personalized support, could encourage more hesitant learners to explore MALL more intensively. Additionally, educators might capitalize on peer collaboration strategies, such as group-based vocabulary tasks or gamified challenges, to enhance social influence and increase perceived relevance [4]. Over time, such interventions could gradually shift sporadic or short-term users toward the higher-engagement cohort, ultimately fostering more robust gains in English vocabulary acquisition.

Beyond intention, the study extends its scope by examining F and D of MALL usage (H4 and H5). The positive and statistically significant path coefficients ($\beta = 0.564$ for F; $\beta = 0.557$ for D) reveal that strong learner intention translates into both increased regularity and extended length of use. These findings align with prior research indicating that when learners form solid intentions, they more consistently integrate mobile applications into their daily study habits [39]. Consequently, educational practitioners can capitalize on this insight by fostering supportive learning environments through peer collaboration, teacher-led initiatives, and contextualized feedback. Such environments help strengthen learners' intentions, which in turn promote sustained MALL engagement.

Overall, the results underscore the multifaceted nature of MALL adoption, shaped by motivational and cognitive factors, while reaffirming intention as a decisive mediator of actual behavior. With the strong explanatory power for Behavioral Intention ($R^2 = 0.797$) and moderate for Actual Behavior ($R^2 = 0.472$), the study provides robust evidence for integrating user-centered strategies, motivational supports, and clear pedagogical frameworks. Mobile platforms facilitate collaborative learning by connecting learners beyond classroom settings, creating dynamic communities that foster mutual support, social motivation, and shared educational growth [48]. Hence, developing robust online learning communities should be strategically prioritized to amplify the social dimensions of language acquisition through MALL. Such integration not only facilitates immediate adoption of MALL but also encourages learners to maintain long-term, in-depth engagement, ultimately fostering an environment conducive to sustained vocabulary practice and deeper engagement in EFL contexts.

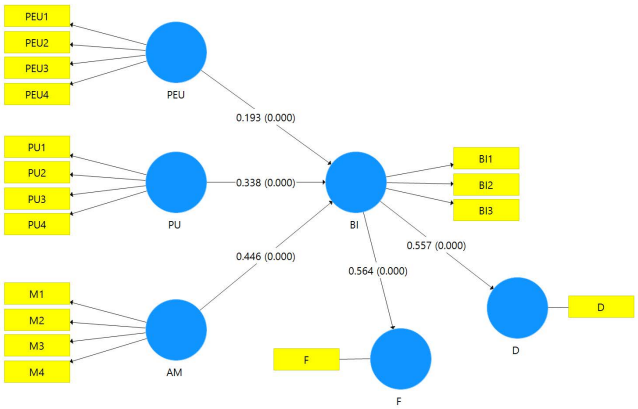

Fig. 2. Structural model results.

V. Conclusion

The findings of this study shed light on the multifaceted nature of MALL adoption and the factors driving learners' engagement with mobile learning tools for English vocabulary development. From a theoretical standpoint, the strong explanatory power of the research model underscores the significance of PEU, PU, and especially AM in predicting BI to use MALL. Once a robust intention to use MALL is established, learners are more likely to engage frequently and persistently with mobile applications. This sustained engagement, as revealed by the study's findings on actual

usage frequency and duration, indicates a strong commitment to integrating MALL into their learning routines, which is a crucial prerequisite for potential vocabulary improvement. This cyclical process, where positive experiences reinforce motivation and ease of use, confirms that technology design and pedagogical frameworks are intrinsically linked.

MALL emerges as a viable and learner-centered approach to language learning, bridging instructional gaps and accommodating diverse learner needs. The rich data on behavioral intention and actual usage behaviors provide insights for practitioners seeking to sustain language learners' momentum over extended periods. By addressing both intrinsic and extrinsic motivators, educators can leverage MALL's unique capabilities to create dynamic, social, and context-rich learning environments, ultimately nurturing deeper engagement and fostering conditions conducive to long-term efficacy in English vocabulary development.

This study's cross-sectional design restricts the ability to establish cause-and-effect relationships. Convenience sampling may also limit generalizability, as respondents primarily consisted of self-selected university students. Additionally, reliance on self-reported data for measuring MALL usage could distort actual usage patterns. Future research should incorporate longitudinal or experimental approaches and more diverse participant pools to strengthen the findings. Specifically, longitudinal studies can be designed as follows: three-wave design should be applied over the course of an academic semester (e.g., 12–16 weeks). Phase 1 will measure antecedent structures (AM, PEU, PU) and baseline vocabulary level (Objective Vocabulary Pre-test). Phase 2 and Phase 3 (Post-test) will repeat the BI, AB, and most importantly, the actual vocabulary acquisition measures (Vocabulary Post-test). This will help establish a causal relationship between sustained interaction and improved learning outcomes. Despite these constraints, the results point to the strong influence of AM, PU, PEU on MALL adoption. Educators can leverage these insights by integrating context-rich, interactive learning tasks that spark autonomy and competence. Institutions should also invest in digital infrastructure and teacher training to maintain high-quality learning experiences. Such efforts can significantly enhance learner engagement, thereby fostering an environment that supports consistent vocabulary practice and contributes to overall language proficiency over time.

APPENDIX

A. Questionnaire Survey

Dear Students,

This survey aims to explore the factors influencing the use of Mobile-Assisted Language Learning (MALL) for learning English vocabulary among first-year university students in Ho Chi Minh City.

The purpose of this study is to collect students' opinions regarding their use of MALL and to analyze the factors affecting their behavior in using MALL to learn English vocabulary. The information collected will play an important role in providing recommendations to help students use technology more effectively in their learning.

The survey will take approximately 5 to 10 minutes to complete. All information you provide will be kept strictly confidential and used solely for academic research purposes. It will not be used for any commercial or personal purposes.

Your participation will make a valuable contribution to this research, helping to improve the quality of learning and the application of technology in education. We sincerely appreciate your support and cooperation.

Thank you very much for your participation and valuable contribution.

Personal Information Section

1) Gender: Male ☐ Female ☐
2) Have you ever used MALL? Yes ☐ No ☐
3) Are you a first-year student? Yes ☐ No ☐

Please mark (**X**) at one of the following levels: 1 (**Strongly disagree**), 2 (**Disagree**), 3 (**Neutral**), 4 (**Agree**), 5 (**Strongly agree**).

No.	Code	Items	1	2	3	4	5
1	PEU1	The functions of mobile vocabulary learning applications are clear and easy to understand for me.					
2	PEU2	I find it easy to learn how to use mobile vocabulary learning applications.					
3	PEU3	I can easily access and use the vocabulary learning resources provided in mobile vocabulary learning applications.					
4	PEU4	I can easily access mobile vocabulary learning applications anytime and anywhere.					
8	PU1	In my opinion, using mobile phones for vocabulary learning is not limited by time or location.					
9	PU2	I believe that learning vocabulary through mobile phones enables me to easily access the necessary information.					
10	PU3	I believe that learning vocabulary through mobile phones helps me improve my English learning ability.					
11	PU4	I believe that learning vocabulary through mobile applications supports me in completing English tasks more effectively.					
12	AM1	I use English vocabulary learning applications because I think they help me develop myself.					
13	AM2	I use English vocabulary learning applications because I think they benefit my English learning.					
14	AM3	I use English vocabulary learning applications because they provide enjoyment.					
15	AM4	I use English vocabulary learning applications because I find them engaging and appealing.					
16	BI1	I intend to continue using mobile devices to learn English vocabulary.					
17	BI2	I think I will use mobile devices to learn English vocabulary more frequently in the future.					
18	BI3	I will recommend using mobile devices for English vocabulary learning to my friends.					

4) Frequency
☐ Less than once a week
☐ Once a week
☐ 2–3 times a week
☐ 4–5 times a week
☐ At least once a day

5) Duration
☐ <1 h

☐ ≥1 h, <3 h
☐ ≥3 h, <5 h
☐ ≥5 h, <7 h
☐ >7 h

B. Questionnaire Survey (Original Version)

Dear Students,

This survey aims to explore the factors influencing the use of Mobile-Assisted Language Learning (MALL) for learning English vocabulary among first-year university students in Ho Chi Minh City.

The purpose of this study is to collect students' opinions regarding their use of MALL and to analyze the factors affecting their behavior in using MALL to learn English vocabulary. The information collected will play an important role in providing recommendations to help students use technology more effectively in their learning.

The survey will take approximately 5 to 10 minutes to complete. All information you provide will be kept strictly confidential and used solely for academic research purposes. It will not be used for any commercial or personal purposes.

Your participation will make a valuable contribution to this research, helping to improve the quality of learning and the application of technology in education. We sincerely appreciate your support and cooperation.

Thank you very much for your participation and valuable contribution.

Personal Information Section

1) Gender: Male ☐ Female ☐
2) Have you ever used MALL? Yes ☐ No ☐
3) Are you a first-year student? Yes ☐ No ☐

Please mark (**X**) at one of the following levels: 1 (**Strongly disagree**), 2 (**Disagree**), 3 (**Neutral**), 4 (**Agree**), 5 (**Strongly agree**).

No.	Clusters	Items	1	2	3	4	5
1	Perceived ease of use	The functions of mobile vocabulary learning applications are clear and easy to understand for me.					
2		I find it easy to learn how to use mobile vocabulary learning applications.					
3		I can easily access and use the vocabulary learning resources provided in mobile vocabulary learning applications.					
4		I can easily access mobile vocabulary learning applications anytime and anywhere.					
5	Perceived usefulness	In my opinion, using mobile phones for vocabulary learning is not limited by time or location.					
6		I believe that learning vocabulary through mobile phones enables me to easily access the necessary information.					
7		I believe that learning vocabulary through mobile phones helps me improve my English learning ability.					
8		I believe that learning vocabulary through mobile applications supports me in completing English tasks more effectively.					
9	Autonomous motivation	I use English vocabulary learning applications because I think they help me develop myself.					
10		I use English vocabulary learning applications because I think they benefit my English learning.					
11		I use English vocabulary learning applications because they provide enjoyment.					
12		I use English vocabulary learning applications because I find them engaging and appealing.					
13	Behavioral Intention	I intend to continue using mobile devices to learn English vocabulary.					
14		I think I will use mobile devices to learn English vocabulary more frequently in the future.					
15		I will recommend using mobile devices for English vocabulary learning to my friends.					

4) Frequency
☐ Less than once a week
☐ Once a week
☐ 2–3 times a week
☐ 4–5 times a week
☐ At least once a day

5) Duration
☐ <1 h
☐ ≥1 h, <3 h
☐ ≥3 h, <5 h
☐ ≥5 h, <7 h
☐ >7 h

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Ngoc Thanh Phan Thi: conceptualization, original draft preparation, writing, exploring, software, supervision, validation; Tuan Thanh Nguyen: exploring, writing, software, editing, reviewing; all authors had approved the final version.

REFERENCES

[1] N. Aljasir, "Vocabulary learning strategies among Saudi EFL learners: A proficiency-level comparison using think-aloud protocols," *Cogent Educ.*, vol. 12, no. 1, 2472480, 2025. doi: 10.1080/2331186X.2025.2472480

[2] D. Imamyartha, E. Wahjuningsih, A. Puspa, M. Bilqis, and R. F. A. R. F. Andika, "An experiment on mobile learning to leverage EFL learners' engagement, emotional intelligence, and learning motivation," *J. Asia TEFL*, vol. 18, no. 4, pp. 1285–1301, 2021. doi: 10.18823/asiatefl.2021.18.4.13.1285

[3] A. Alamer and A. Al Khateeb, "Effects of using the WhatsApp application on language learners' motivation: A controlled investigation using structural equation modelling," *Comput. Assist. Lang. Learn.*, vol. 36, no. 1–2, pp. 149–175, 2023. doi: 10.1080/09588221.2021.1903042

[4] S. Habib, A. Haider, S. S. M. Suleman, S. Akmal, and M. A. Khan, "Mobile assisted language learning: Evaluation of accessibility, adoption, and perceived outcome among students of higher education," *Electronics*, vol. 11, no. 7, 1113, 2022. doi: 10.3390/electronics11071113

[5] B. A. S. Mohamed, A. R. Salam, and H. M. Alwahoub, "Acceptance of learning vocabulary via mobile-assisted language learning among Community College of Qatar foundation students: Quizlet as a tool," *Indones. J. Appl. Linguist.*, vol. 14, no. 2, pp. 301–318, 2024. doi: 10.17509/ijal.v14i2.74909

[6] L. Fredrick and J. Karthikeyan, "Exploring the reach of

mobile-assisted language learning among mechanical engineering students," *Int. J. Mech. Eng. Technol.*, vol. 9, no. 8, pp. 738–742, Aug. 2018.

[7] K.-O. Jeong, "Facilitating sustainable self-directed learning experience with the use of mobile-assisted language learning," *Sustainability*, vol. 14, no. 5, 2894, Mar. 2022. doi: 10.3390/su14052894

[8] H. T. Hsu and C. C. Lin, "Extending the technology acceptance model of college learners' mobile-assisted language learning by incorporating psychological constructs," *Br. J. Educ. Technol.*, vol. 53, no. 2, pp. 286–306, 2022. doi:10.1111/bjet.13165

[9] A. Alhadiah, "EFL learners' experience of a MALL-based vocabulary learning tool," *Indones. J. Appl. Linguist.*, vol. 10, no. 2, pp. 283–291, 2020. doi: 10.17509/ijal.v10i2.28590

[10] X. Lei, J. Fathi, S. Noorbakhsh, and M. Rahimi, "The impact of mobile-assisted language learning on English as a foreign language learners' vocabulary learning attitudes and self-regulatory capacity," *Front. Psychol.*, vol. 13, 872922, 2022. doi: 10.3389/fpsyg.2022.872922

[11] B. Guo, Y. Wang, and J. Yin, "A multi-perspective reflection on college students' English vocabulary and language skills learning under the theory of epistemology," *Eur. J. Philos. Relig.*, vol. 15, no. 4, pp. 304–329, 2023. doi: 10.24204/ejpr.2023.4000

[12] B. Gorjian, F. Mir, and B. Nasiri, "Designing an integrated CALL evaluation tool via a Technology Acceptance Model (TAM) approach to teach EFL: The case of Vadana," *Iran. J. Lang. Teach. Res.*, vol. 13, no. 1, pp. 147–169, Mar. 2025. doi: 10.30466/ijltr.2025.55119.2657

[13] Z. Fišer and L. Pongračić, "Re-evaluating the L2MSS scale in the context of non-English major students," *Iran. J. Lang. Teach. Res.*, vol. 13, no. 1, pp. 45–62, Mar. 2025. doi: 10.30466/ijltr.2025.55206.2687

[14] L. A. Latypova, O. V. Polyakova, and D. D. Sungatullina, "Mobile applications for English learning performance upgrade," in *Proc. First International Conference on Innovative Technologies and Learning, ICITL 2018*, 2018, vol. 11003, pp. 403–411. doi: 10.1007/978-3-319-99737-7_43

[15] Y. Zhao, M. M. Muhamad, S. S. Mustakim, W. Li, X. Wu, and A. Wang, "Adaptive mobile-assisted language learning: A Bayesian framework study for optimal learning content selection," in *Proc. 2023 3rd Int. Conf. Mobile Networks Wirel. Commun. (ICMNWC)*, Dec. 2023, pp. 1–6. doi: 10.1109/ICMNWC60182.2023.10436013

[16] K. Zhang and Z. Yu, "Extending the UTAUT model of gamified English vocabulary applications by adding new personality constructs," *Sustainability*, vol. 14, no. 10, 6259, 2022. doi:10.3390/su14106259

[17] R. Gafni, D. B. Achituv, and G. Rahmani, "Learning foreign languages using mobile applications," *J. Inf. Technol. Educ. Res.*, vol. 16, pp. 301–317, 2017. doi: 10.28945/3855

[18] R. Zhang and D. Zou, "Influential factors of working adults' perceptions of mobile-assisted vocabulary learning with multimedia annotations," *Int. J. Mob. Learn. Organ.*, vol. 14, no. 4, pp. 533–548, 2020. doi: 10.1504/IJMLO.2020.110798

[19] L. Noor and K. Islam, "Leveraging Mobile-Assisted Language Learning (MALL) to enhance personalized learning for ESOL learners," *J. Interact. Learn. Res.*, vol. 35, no. 4, pp. 481–496, 2024.

[20] S. Dutt and N. J. Ahuja, "Intelligent tutoring effects on induced emotions and cognitive load of learning-disabled learners," *Disability and Rehabilitation: Assistive Technology*, vol. 20, no. 1, pp. 135–149, 2025. doi: 10.1080/17483107.2024.2357685

[21] M. Zakian, I. Xodabande, M. Valizadeh, and M. Yousefvand, "Out-of-the-classroom learning of English vocabulary by EFL learners: Investigating the effectiveness of mobile assisted learning with digital flashcards," *Asian-Pac. J. Second Foreign Lang. Educ.*, vol. 7, 16, 2022. doi: 10.1186/s40862-022-00143-8

[22] Y. Sun and F. Gao, "An investigation of the influence of intrinsic motivation on students' intention to use mobile devices in language learning," *Educ. Technol. Res. Dev.*, vol. 68, no. 3, pp. 1181–1198, 2020. doi: 10.1007/s11423-019-09733-9

[23] S. Al-Abidi, A. Owais, and F. Alabedi, "The effects of using MS Teams mobile application on language learners' motivation during and after the COVID-19 pandemic," *World*, vol. 13, no. 2, pp. 260–270, 2023. doi: 10.5430/wjel.v13n2p260

[24] C. Zeng and L. Fisher, "Opening the 'Black Box': How out-of-class use of Duolingo impacts Chinese junior high school students' intrinsic motivation for English," *ECNU Rev. Educ.*, vol. 7, no. 2, pp. 283–307, 2024. doi: 10.1177/20965311231171606

[25] A. Alhadiah, "Undergraduate EFL learners' use and acceptance of mobile assisted language learning: A structural equation modeling approach," *World J. Engl. Lang.*, vol. 13, no. 3, 253, 2023. doi: 10.5430/wjel.v13n3p253

[26] K. A. Raj and A. Baisel, "Empirical study on the influence of mobile apps on improving English speaking skills in school students," *World J. Engl. Lang.*, vol. 14, no. 2, 339, 2024. doi: 10.5430/wjel.v14n2p339

[27] M. A. M. Kassem, "The effect of a suggested in-service teacher training program based on MALL applications on developing EFL students' vocabulary acquisition," *J. Lang. Teach. Res.*, vol. 9, no. 2, pp. 250–260, Feb. 2018. doi:1 0.17507/jltr.0902.05

[28] Y. Fan and S. Tangkiengsirisin, "Translanguaging and Metacognitive Instruction: Effects on Listening and Metacognitive Awareness in CFL Learners," *Arab World English Journal*, vol. 16, no. 2, pp.215–232, 2025. doi: 10.24093/awej/vol16no2.13

[29] X. Zhou and Y. S. Goh, "What shapes tertiary learners' experiences and challenges in mobile-assisted seamless vocabulary learning? A case of Chinese as a foreign language." *Acta Psychologica*, vol. 257, 105123, 2025. doi: 10.1016/j.actpsy.2025.105123

[30] A. Towle and D. Cottrell,. "Self directed learning," *Archives of Disease in Childhood*, vol. 74, no. 4, pp. 357–359, 1996. doi: 10.1136/adc.74.4.357

[31] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User acceptance of computer technology: A comparison of two theoretical models," *Management Science*, vol. 35, no. 8, pp. 982–1003, 1989.

[32] S. Ebadi and A. Raygan, "Investigating the facilitating conditions, perceived ease of use and usefulness of mobile-assisted language learning," *Smart Learn. Environ.*, vol. 10, no. 1, 30, 2023. doi: 10.1186/s40561-023-00250-0

[33] Bacca-Acosta and C. Avila-Garzon, "Student engagement with mobile-based assessment systems: A survival analysis," *J. Comput. Assist. Learn.*, vol. 37, no. 1, pp. 158–171, 2021. doi: 10.1111/jcal.12475

[34] X. Ma and B. Yodkamlue, "The effects of using a self-developed mobile app on vocabulary learning and retention among EFL learners," *PASAA J. Lang. Teach. Learn. Thailand*, vol. 58, no. 1, pp. 166–205, 2019. doi: 10.58837/CHULA.PASAA.58.1.7

[35] A. Rahmani, V. Asadi, and I. Xodabande, "Using mobile devices for vocabulary learning outside the classroom: Improving the English as Foreign Language learners' knowledge of high-frequency words," *Front. Psychol.*, vol. 13, 899, 2022. doi: 10.3389/fpsyg.2022.899885

[36] M. Mohammadi, M. Valizadeh, P. Z. Jalal, and I. Xodabande, "University students' academic vocabulary development through mobile-assisted learning: Exploring the impacts on receptive and productive knowledge," *Heliyon*, vol. 10, no. 7, e28103. 2024. doi: 10.1016/j.heliyon.2024.e28103

[37] A. Al-Abri, F. R. Madiseh, and M. M. Moghaddam, "Exploring learning-oriented assessment in enhancing students' lexical fluency through MALL," *Asia-Pac. Educ. Res.*, vol. 34, no. 1, pp. 1–13, 2025. doi: 10.1007/s40299-024-00832-7

[38] I. Xodabande and M. R. Atai, "Using mobile applications for self-directed learning of academic vocabulary among university students," *Open Learn.*, vol. 37, no. 4, pp. 330–347, 2022. doi: 10.1080/02680513.2020.1847061

[39] J. Nie, C. Zheng, P. Zeng, B. Zhou, L. Lei, and P. Wang, "Using the Theory of Planned Behavior and the role of social image to understand mobile English learning check-in behavior," *Comput. Educ.*, vol. 156, 103942, 2020. doi: 10.1016/j.compedu.2020.103942

[40] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, "When to use and how to report the results of PLS-SEM," *Eur. Bus. Rev.*, vol. 31, no. 1, pp. 2–24, 2019. doi:10.1108/EBR-11-2018-0203

[41] Y. Han and C. Chen, "Examining Chinese EFL learners' acceptance of mobile-assisted vocabulary learning applications and its influencing factors," *J. China Comput. Assist. Lang. Learn.*, 2024. doi: 10.1515/jccall-2024-0005

[42] H. Farros, A. Shinta, Z. Zaid, and M. P. Al Bahy, "Evaluating the effect of EFL college students' intention to utilize mobile English vocabulary in the learning process: A TAM framework," *Voices English Lang. Educ. Soc.*, vol. 6, no. 1, pp. 91–101, 2022. doi: 10.29408/veles.v6i1.5277

[43] Y. Chen and S. Zhao, "Understanding Chinese EFL learners' acceptance of gamified vocabulary learning apps: An integration of self-determination theory and technology acceptance model," *Sustainability*, vol. 14, no. 18, 11288, 2022. doi: 10.3390/su141811288

[44] V. N. Hoi and G. M. Mu, "Perceived teacher support and students' acceptance of mobile-assisted language learning: Evidence from Vietnamese higher education context," *Br. J. Educ. Technol.*, vol. 52, no. 2, pp. 879–898, 2021. doi: 10.1111/bjet.13044

[45] S. U. Rehman, A. Bhatti, R. Mohamed, and H. Ayoup, "The moderating role of trust and commitment between consumer purchase intention and online shopping behavior in the context of Pakistan," *J. Glob. Entrep. Res.*, vol. 9, no. 1, pp. 1–25, 2019. doi: 10.1186/s40497-019-0166-2

[46] W. W. Chin, J.-H. Cheah, Y. Liu, H. Ting, X.-J. Lim, and T. H. Cham, "Demystifying the role of causal-predictive modeling using partial least squares structural equation modeling in information systems

research," *Industrial Management & Data Systems*, vol. 120, no. 12, pp. 2161–2209, 2020. doi: 10.1108/IMDS-10-2019-0529
[47] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User acceptance of information technology: Toward a unified view," *MIS Quarterly*, vol. 27, no. 3, pp. 425–478, 2003. doi: 10.2307/30036540
[48] K. C. Hsu and G. Z. Liu, "A systematic review of mobile-assisted oral communication development from selected papers published between 2010 and 2019," *Interact. Learn. Environ.*, vol. 31, no. 6, pp. 3851–3867, 2023. doi: 10.1080/10494820.2021.1943690