

# Gamified Mobile Application for Enhancing Vocabulary Retention among ESL University Students

Nur Anis Adnin Suhaimi<sup>1</sup>, Nur Hasni Nasrudin<sup>1\*</sup>, Samsiah Ahmad<sup>1</sup>,  
Nurkhairizan Khairudin<sup>1</sup>, Samsiah Abdul Razak<sup>1</sup>

<sup>1</sup>*Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Perak Branch, Tapah Campus,  
35400, Tapah Road, Perak, Malaysia*

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## ABSTRACT

Vocabulary retention poses a major challenge for English as a Second Language (ESL) university students, as traditional methods often lack long-term engagement. While many English learning apps exist, few incorporate gamifications tailored to ESL undergraduates. This study designed, developed, and evaluated LexiLearn, a gamified mobile application tailored to support vocabulary retention among ESL university students. Adopting the Mobile Application Development Life Cycle (MADLC), LexiLearn was built using the Flutter framework with Firebase as a backend. The app aligns vocabulary content with the Common European Framework of Reference for Languages (CEFR) and incorporates gamification mechanics—including avatars, points, levels, progress tracking, badges, rewards, and interactive quizzes—to sustain motivation. LexiLearn's usability and perceived effectiveness were evaluated using a 5-point Likert scale survey with 17 university respondents. Findings revealed overwhelmingly positive user perceptions regarding usability, navigation, engagement, and efficacy for vocabulary retention. The results indicate that integrating targeted gamification into mobile-assisted language learning (MALL) fosters learner motivation and encourages consistent practice. Overall, LexiLearn demonstrates the potential of tailored, gamified platforms to enhance vocabulary learning outcomes for ESL university students.

## 1. INTRODUCTION

Vocabulary is an essential component of language proficiency, as it enables English as a Second Language (ESL) learners to comprehend texts, communicate fluently, and express complex ideas effectively (Koleini et al., 2024; Sabilla & Daulay, 2025). In the modern educational landscape, technology has become a crucial element, and students increasingly favor engaging and interactive learning methods facilitated by digital

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<sup>1\*</sup>Corresponding author. *E-mail address:* nurha932@uitm.edu.my

tools and mobile applications (Cigerci et al., 2025; Hafiza & Pratolo, 2024). Traditional rote memorization approaches often fail to sustain learners' attention, leading to boredom and a lack of motivation. Consequently, educators are shifting towards game-based and mobile-assisted language learning (MALL), which have demonstrated promising results in increasing learner engagement, motivation, and long-term vocabulary retention (Adzmi et al., 2024; Koleini et al., 2024). By utilizing gamification concepts such as rewards, challenges, avatars, and progress tracking, modern pedagogical strategies aim to overcome the shortcomings of traditional methods and foster a more immersive learning experience (Grab, 2025; Simsek & Karakus Yilmaz, 2025). Nevertheless, many existing mobile vocabulary learning applications are designed for general language learners and do not specifically address the vocabulary learning needs of ESL university students through structured, CEFR-based content and a comprehensive combination of gamification techniques. This limitation highlights the need for a mobile application that integrates structured vocabulary learning with appropriate gamification elements to better support vocabulary retention among ESL university students.

Despite the advantages of digital learning, many ESL university students still struggle to retain newly learned vocabulary effectively. They often find conventional lecture-based methods insufficient for promoting active involvement and deep understanding within contexts (Adzmi et al., 2024; Fithriani, 2021). Although various commercial language learning applications are available, many primarily emphasise translation-based exercises or general language learning, providing limited support for the structured academic vocabulary needs of ESL university students. This limitation may reduce learners' engagement and negatively affect their vocabulary acquisition, overall language proficiency, academic performance, and confidence in using English (Vnucko et al., 2024).

To address these challenges, this study proposes the development of a gamified mobile application named LexiLearn, specifically designed to enhance English vocabulary retention among ESL university students through interactive and motivating learning activities. By integrating structural gamification strategies, the application encourages consistent practice and supports long-term memory transfer. Accordingly, the study was conducted with the following objectives:

- (i) To identify gamification techniques in facilitating vocabulary learning and retention.
- (ii) To develop a gamified mobile application that is intended to support vocabulary retention among ESL university students.
- (iii) To evaluate the usability and effectiveness of the developed mobile application in facilitating vocabulary learning and retention.

The scope of this study focuses on English vocabulary acquisition for ESL university students through an Android-based mobile application aligned with the Common European Framework of Reference (CEFR). The application covers CEFR proficiency levels from A1 to C2, providing structured vocabulary lessons organized according to learners' proficiency levels. The vocabulary content consists of CEFR-based English vocabulary designed to support progressive vocabulary learning and retention among university students. This project is significant as it provides a targeted, structured, and engaging digital resource that can be integrated into classroom learning or used for self-study. Ultimately, it contributes to the growing body of research on mobile-assisted language learning (MALL) and gamification by offering practical insights for educators and future developers seeking to improve vocabulary learning outcomes.

## 2. LITERATURE REVIEW

Vocabulary acquisition is a fundamental component of English language learning, particularly in higher education where students are expected to comprehend academic texts, participate in discussions, and communicate effectively in English. Vocabulary knowledge directly influences learners' reading comprehension, writing ability, and overall language proficiency. However, many ESL university students continue to experience difficulties in retaining newly learned vocabulary due to the fast-paced academic environment and limited opportunities for repeated practice outside the classroom. Conventional learning approaches, such as rote memorization and repetitive exercises, are often insufficient to sustain learners' motivation and promote long-term vocabulary retention (Arif, 2025; Panmei & Waluyo, 2023). As a result, researchers have increasingly explored more interactive learning approaches that encourage active participation and continuous engagement throughout the learning process. Consequently, recent studies have increasingly explored interactive learning approaches that encourage active participation and continuous engagement throughout the learning process. Among these approaches, gamification has consistently been reported as an effective strategy for improving learners' motivation and supporting vocabulary retention, although the implementation methods and target learners differ across previous studies.

One promising approach is gamification, which refers to the application of game design elements in non-game contexts to increase users' motivation and engagement. In education, gamification has been widely adopted to transform conventional learning activities into more interactive and enjoyable experiences. Previous studies have shown that gamification can positively influence learners' motivation, participation, and knowledge retention by encouraging continuous interaction with learning materials. Gamification can generally be categorized into structural and content gamification. Structural gamification enhances the learning process by incorporating game elements without modifying the educational content, whereas content gamification integrates game mechanics directly into the instructional material. Since this study aims to improve learner engagement while maintaining the integrity of the vocabulary content, structural gamification was selected as the primary approach for the development of LexiLearn.

Numerous studies have identified several gamification techniques that effectively support vocabulary learning and retention (Allehyani, 2025; Tsai, 2024). Avatar customization encourages learner identity and personalization, allowing users to develop a stronger connection with the learning environment. Points and levels provide immediate feedback and visual indicators of learning progress, motivating learners to complete lessons and achieve higher performance. Progress bars enable users to monitor their advancement throughout the learning process, while badges and rewards recognize learning achievements and encourage continuous participation. Previous research suggests that combining multiple gamification techniques creates a more engaging learning experience than relying on a single motivational element, as each technique contributes differently to learner motivation, persistence, and long-term vocabulary retention. These findings formed the basis for selecting the gamification techniques implemented in the proposed application.

Several existing vocabulary learning applications, including Duolingo, Memrise, and Drops, have successfully incorporated gamification into English language learning. Table 1 presents a comparison of existing vocabulary learning applications based on the structural gamification techniques selected in this study, together with structured CEFR-based vocabulary learning and target users. Duolingo, Memrise, and Drops have successfully incorporated gamification into English language learning and have demonstrated positive effects on learner engagement. However, each application implements different combinations of gamification features and adopts distinct learning approaches. Furthermore, these applications are primarily designed for general language learners rather than specifically addressing the vocabulary learning needs of ESL university students. As shown in Table 1, none of the existing applications integrate all the selected

structural gamification techniques while simultaneously providing structured CEFR-based vocabulary learning tailored for ESL university students. This identified gap motivated the development of LexiLearn, which combines these features within a single mobile application to better support vocabulary retention among its target users.

Table 1. Comparison of Existing Vocabulary Learning Applications Based on Selected Criteria

| Criteria                                  | Duolingo | Memrise | Drops | LexiLearn |
|-------------------------------------------|----------|---------|-------|-----------|
| Avatar                                    | ✓        | X       | X     | ✓         |
| Points                                    | ✓        | X       | ✓     | ✓         |
| Levels                                    | ✓        | ✓       | ✓     | ✓         |
| Progress Bar                              | ✓        | ✓       | ✓     | ✓         |
| Badges                                    | ✓        | X       | X     | ✓         |
| Rewards                                   | ✓        | ✓       | ✓     | ✓         |
| Structured CEFR-based vocabulary learning | ✓        | X       | X     | ✓         |
| Targeted for ESL university students      | X        | X       | X     | ✓         |

Source: Authors' comparative review of Duolingo, Memrise, and Drops, and the features implemented in LexiLearn

Based on these findings, there is a need for a gamified mobile application that combines appropriate gamification techniques with structured vocabulary learning tailored to ESL university students. Therefore, this study proposes the development of LexiLearn, which integrates avatars, points, levels, progress bars, badges, rewards, quizzes, and CEFR-based vocabulary learning into a single mobile application. By addressing the limitations identified in existing applications, LexiLearn aims to provide a more engaging, structured, and effective learning environment that supports long-term vocabulary retention among ESL university students.

### 3. METHODOLOGY

This study adopted the Mobile Application Development Life Cycle (MADLC) as the project methodology to guide the development of LexiLearn, a gamified mobile application for enhancing vocabulary retention among ESL university students. MADLC was selected because it provides a systematic and structured framework specifically designed for mobile application development, taking into consideration mobile-specific requirements such as usability, user experience, device performance, and interface design. Compared with general software development methodologies, MADLC offers a more suitable approach for developing educational mobile applications by ensuring that each development stage is completed systematically while maintaining a strong focus on the end-user experience. According to Roslan and Haron (2024), the complete MADLC consists of seven phases: Identification, Design, Development, Prototyping, Testing, Deployment, and Maintenance. However, this study adopted only the first five phases which are Identification, Design, Development, Prototyping, and Testing as the project focused on developing and evaluating a functional prototype rather than a fully deployed commercial application. Therefore, the Deployment and Maintenance phases were excluded to ensure that the project could be completed within the defined scope, available time, and resource constraints. Each adopted phase contributed directly to achieving the research objectives. The Identification phase involved reviewing previous studies and existing vocabulary learning applications to identify suitable gamification techniques for facilitating vocabulary learning and retention, addressing the first research objective. The Design, Development, and Prototyping phases focused on translating these findings into the design and implementation of the LexiLearn mobile application, thereby fulfilling the second objective. Finally, the Testing phase evaluated

the developed prototype through a questionnaire-based evaluation to assess its usability and perceived effectiveness, addressing the third research objective. The overall development process of Mobile Application Development Life Cycle (MADLC) is illustrated in Fig. 1.

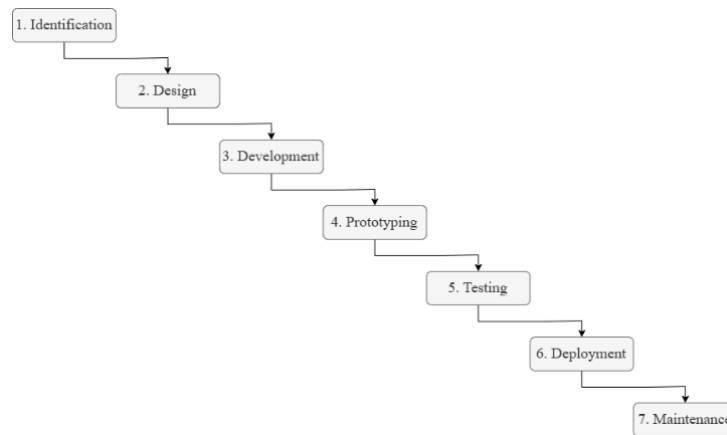


Fig. 1. Mobile Application Development Life Cycle (MADLC) Phases

Source: Authors' illustration of the MADLC phases adopted for LexiLearn

The Identification phase served as the foundation of the project by examining the challenges associated with vocabulary retention among ESL university students through an extensive literature review. Previous studies related to English language learning, gamification in education, vocabulary acquisition, and existing vocabulary learning applications were reviewed to identify current limitations and research opportunities. In addition, a comparative analysis of popular vocabulary learning applications, namely Duolingo, Memories, and Drops, was conducted to examine their learning approaches, gamification features, strengths, and limitations. The findings obtained during this phase were used to establish the project objectives, determine the scope of the study, define the functional requirements of the application, and justify the development of a new gamified vocabulary learning application tailored to ESL university students.

During the Design phase, the conceptual ideas identified in the previous phase were translated into a structured application design. This phase involved designing the storyboard, system flowchart, user interface, database structure, and overall system architecture to ensure that all functional requirements were addressed before implementation. The application interface was designed to provide simple and engaging learning experience while incorporating the selected gamification techniques into the learning process. In addition, the learning content was organized according to the CEFR proficiency levels, enabling learners to progress systematically based on their language proficiency. Careful planning during this phase ensured consistency between the learning objectives, application features, and user interaction flow. The overall system architecture developed during this phase is presented in Fig. 2.

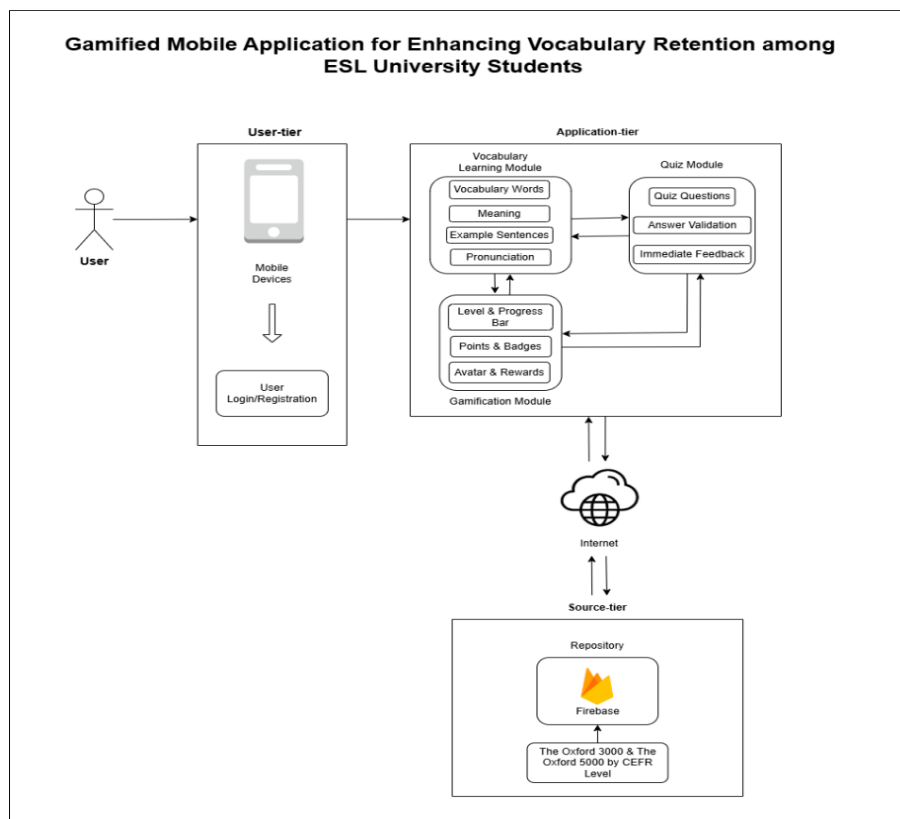


Fig. 2. Overall System Architecture of the LexiLearn Mobile Application

Source: Authors' design of the LexiLearn mobile application architecture

The Development phase focused on implementing the application based on the approved design specifications. Flutter was selected as the development framework because of its ability to support cross-platform mobile application development using a single codebase, while the Dart programming language was used to implement the application logic. Firebase Authentication was integrated to provide secure user registration and login functionality, whereas Cloud Firestore was utilized as a cloud-based database for storing vocabulary content, learner progress, quiz performance, and gamification data. During this phase, the core modules of LexiLearn, including user authentication, vocabulary learning, quizzes, gamification, and user profile management were developed and integrated into a complete mobile application. The selected structural gamification techniques, namely avatars, points, levels, progress bars, badges, rewards, and quizzes, were implemented to enhance learner engagement and encourage continuous vocabulary learning. Table 2 summarizes the software configuration and development environment used to implement and test the LexiLearn mobile application.

Table 2. Development Environment and Software Configuration

| Component               | Specification                                                                       |
|-------------------------|-------------------------------------------------------------------------------------|
| Development Environment | Visual Studio Code (VS Code)                                                        |
| Framework               | Flutter 3.41.3                                                                      |
| Dart SDK                | 3.11.1                                                                              |
| Backend Services        | Firebase Authentication 5.3.1, Cloud Firestore 5.4.4, Firebase Core 3.6.0           |
| Key Dependencies        | Flutter TTS 4.2.2, Shared Preferences 2.5.5, Audioplayers 6.0.0, Google Fonts 8.1.0 |
| Target Platform         | Android                                                                             |
| Testing Environment     | Android SDK 36.1.0                                                                  |
| Test Device             | Redmi Note 12 (Android)                                                             |

Source: Authors' records of the software configuration and development environment

Following the development stage, the Prototyping phase was conducted to refine the developed application before the final evaluation. A working prototype of LexiLearn was produced to verify that the implemented features functioned correctly and fulfilled the identified user requirements. This phase allowed improvements to be made to the user interface, application navigation, learning flow, and gamification features through iterative testing and refinement. Any inconsistencies or usability issues identified during the prototyping process were addressed to improve the overall user experience before proceeding to the evaluation stage. This iterative refinement ensured that the application was sufficiently stable and representative of the proposed solution.

Finally, the Testing phase evaluated the developed application through a questionnaire-based evaluation administered using Google Forms. The evaluation involved 17 university students from several Malaysian universities who voluntarily participated after exploring the LexiLearn mobile application and its features. The questionnaire consisted of four sections, namely respondent demographics, usability evaluation, perceived effectiveness evaluation, and overall user acceptance. The usability and perceived effectiveness items were measured using a five-point Likert scale. The collected responses were analyzed using descriptive statistics, including frequency and percentage, to determine users' perceptions of the application's usability, ease of navigation, engagement, and perceived effectiveness in supporting vocabulary learning and retention. The findings provided valuable insights into the overall performance of LexiLearn and served as the basis for assessing whether the proposed application successfully achieved the objectives of the study. The results and discussion of this evaluation are presented in the following section.

#### 4. RESULTS AND DISCUSSION

Following the completion of the LexiLearn mobile application, a questionnaire-based evaluation was conducted to evaluate its usability and perceived effectiveness in facilitating vocabulary learning and retention among ESL university students. The questionnaire was administered through Google Forms after respondents had explored the application and its main features. A total of 17 respondents participated in the evaluation. The questionnaire consisted of four sections: Section A (Respondent Demographics), Section B (Usability), Section C (Perceived Effectiveness), and Section D (Overall User Acceptance). The collected responses were analyzed using descriptive statistics, including frequency and percentage, to describe respondents' perceptions of the application's usability, perceived effectiveness, and overall user acceptance.

#### 4.1 Part A: Respondent Demographics

The demographic profile of the respondents who participated in the questionnaire-based evaluation is presented in Table 3. The demographic information includes the respondents' gender, age, and university.

Table 3. Respondents Demographics

| Characteristic | Category    | Frequency (n) | Percentage (%) |
|----------------|-------------|---------------|----------------|
| Gender         | Male        | 4             | 23.5           |
|                | Female      | 13            | 76.5           |
| Age            | 18–21 years | 3             | 17.6           |
|                | 22–25 years | 14            | 82.4           |
| University     | UiTM        | 9             | 52.9           |
|                | USM         | 2             | 11.8           |
|                | UUM         | 2             | 11.8           |
|                | UPSI        | 1             | 5.9            |
|                | UTP         | 1             | 5.9            |
|                | UPNM        | 1             | 5.9            |
|                | POLIMAS     | 1             | 5.9            |

Source: Authors' questionnaire survey of 17 participants

Table 3 presents the demographic profile of the respondents who participated in the questionnaire-based evaluation. A total of 17 respondents completed the evaluation, comprising 13 females (76.5%) and 4 males (23.5%). Most respondents (82.4%) were aged between 22 and 25 years, while the remaining 17.6% were between 18 and 21 years. In terms of university distribution, the majority of respondents were from Universiti Teknologi MARA (UiTM), representing 52.9% of the total participants. The remaining respondents were from several other Malaysian higher education institutions, including Universiti Sains Malaysia (USM), Universiti Utara Malaysia (UUM), Universiti Pendidikan Sultan Idris (UPSI), Universiti Teknologi PETRONAS (UTP), Universiti Pertahanan Nasional Malaysia (UPNM), and Politeknik Sultan Abdul Halim Muadzam Shah (POLIMAS). Although the respondents were drawn from multiple institutions, the sample size was relatively small and unevenly distributed across gender and university. Therefore, the findings primarily reflect the perceptions of the participants involved in this study and should not be generalized to the wider population of ESL university students. Nevertheless, the evaluation provides useful preliminary insights into the usability and perceived effectiveness of the developed application.

#### 4.2 Part B: Usability Evaluation

The usability evaluation assessed respondents' perceptions of the LexiLearn mobile application in terms of its interface design, navigation, functionality, accessibility, and overall ease of use. The responses from 17 respondents were analyzed using descriptive statistics, specifically frequency and percentage, to summarize the distribution of responses for each usability statement. The results of the usability evaluation are presented in Table 4. The respondents generally expressed positive perceptions towards the usability of the LexiLearn mobile application. Most respondents selected Agree and Strongly Agree across all five usability statements, indicating that the application is simple, easy to navigate, and user-friendly. Among the evaluated statements, 70.6% of respondents strongly agreed that the features in LexiLearn are easy to access and use, representing the highest positive response in this evaluation. Although 5.9% of respondents selected Strongly Disagree for the statement regarding the application's technical performance, this response represented only one respondent, while the majority of respondents reported positive perceptions of the application's functionality. Overall, these findings suggest that LexiLearn provides a usable and accessible learning environment for university students.

Table 4. Results of Usability Evaluation (n=17)

| Statement                                                                | Strongly Disagree, n | Disagree, n | Neutral, n | Agree, n  | Strongly Agree, n |
|--------------------------------------------------------------------------|----------------------|-------------|------------|-----------|-------------------|
| The interface of the LexiLearn application is simple and well designed.  | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 5 (29.4%) | 11 (64.7%)        |
| Navigation within the LexiLearn application is easy to understand.       | 0 (0.0%)             | 0 (0.0%)    | 1 (5.9%)   | 7 (41.2%) | 9 (52.9%)         |
| The LexiLearn application functions smoothly without technical problems. | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 8 (47.1%) | 8 (47.1%)         |
| The features in the LexiLearn application are easy to access and use.    | 0 (0.0%)             | 0 (0.0%)    | 1 (5.9%)   | 4 (23.5%) | 12 (70.6%)        |
| Overall, the LexiLearn application is easy to use.                       | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 6 (35.3%) | 10 (58.8%)        |

Source: Authors' analysis of usability questionnaire responses from 17 participants

The positive usability findings suggest that LexiLearn successfully provides an intuitive and accessible learning environment for ESL university students. This can be attributed to the application's simple interface, consistent navigation, and well-organized learning content based on the CEFR proficiency levels, allowing users to complete learning activities with minimal difficulty. These findings are consistent with previous studies by Ahmed et al. (2025) and Grab (2025), which reported that user-friendly interface design and effective navigation improve learners' engagement, motivation, and overall learning experience in mobile-assisted language learning applications. Overall, the usability evaluation demonstrates that LexiLearn successfully achieved its objective of providing an engaging and user-friendly mobile learning environment.

### 4.3 Part C: Perceived Effectiveness Evaluation

The perceived effectiveness evaluation assessed respondents' perceptions of how the LexiLearn mobile application supports English vocabulary learning and retention. The evaluation consisted of seven statements covering vocabulary learning, lesson clarity, quizzes, pronunciation, gamification features, vocabulary retention, and revision activities. The results of the effectiveness evaluation are presented in Table 5.

Table 5. Results of Perceived Effectiveness Evaluation (n=17)

| Statement                                                                                                        | Strongly Disagree, n | Disagree, n | Neutral, n | Agree, n  | Strongly Agree, n |
|------------------------------------------------------------------------------------------------------------------|----------------------|-------------|------------|-----------|-------------------|
| The LexiLearn application makes learning English vocabulary easier.                                              | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 5 (29.4%) | 11 (64.7%)        |
| The vocabulary lessons are easy to understand.                                                                   | 0 (0.0%)             | 0 (0.0%)    | 1 (5.9%)   | 5 (29.4%) | 11 (64.7%)        |
| The quizzes help reinforce my vocabulary learning.                                                               | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 7 (41.2%) | 9 (52.9%)         |
| The pronunciation feature helps me learn the correct pronunciation of vocabulary words.                          | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 4 (23.5%) | 12 (70.6%)        |
| The gamification features (e.g., points, badges, levels, avatars, and rewards) motivate me to continue learning. | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 4 (23.5%) | 12 (70.6%)        |
| The LexiLearn application helps me remember vocabulary better.                                                   | 0 (0.0%)             | 0 (0.0%)    | 1 (5.9%)   | 9 (52.9%) | 7 (41.2%)         |
| The revision activities and quizzes in LexiLearn help me retain newly learned vocabulary over time.              | 1 (5.9%)             | 0 (0.0%)    | 0 (0.0%)   | 7 (41.2%) | 9 (52.9%)         |

Source: Authors' analysis of perceived effectiveness questionnaire responses from 17 participants

The respondents generally expressed positive perceptions regarding the effectiveness of LexiLearn in supporting vocabulary learning and retention. Most respondents selected Agree and Strongly Agree for all seven statements, indicating that the application effectively supports vocabulary learning through its learning modules and interactive features. Among the evaluated statements, the pronunciation feature and gamification features received the highest positive responses, with 70.6% of respondents selecting Strongly Agree, demonstrating that these features effectively encouraged learners to improve their vocabulary knowledge and remain motivated throughout the learning process. Although the statement related to LexiLearn helping users remember vocabulary better recorded a comparatively lower number of Strongly Agree responses, the majority of respondents still selected Agree or Strongly Agree, reflecting an overall positive perception of the application's effectiveness.

The positive perceptions reported by the respondents suggest that the integration of structured vocabulary lessons with gamification techniques provided an engaging vocabulary learning experience. The organization of vocabulary based on CEFR proficiency levels was perceived to support progressive learning according to their language proficiency, while quizzes and revision activities were perceived to reinforced vocabulary through continuous practice. In addition, respondents perceived that the pronunciation feature provided guidance on the correct pronunciation of vocabulary words, whereas gamification elements such as points, badges, levels, avatars, and rewards motivated learners to continue learning and complete more lessons. These findings are consistent with previous studies by Arif (2025) and Fithriani (2021), which reported that gamification elements and interactive mobile learning environments can improve learners' motivation, engagement, and long-term vocabulary retention. Overall, the findings indicate that respondents perceived LexiLearn as an engaging and useful mobile application for supporting vocabulary learning and retention among ESL university students.

#### 4.4 Part D: Overall User Acceptance

The final section of the questionnaire focused on respondents' overall perceptions and acceptance of the LexiLearn mobile application after experiencing its learning features. This section examined respondents' overall learning experience, their perceptions of the application's ability in facilitating vocabulary learning and retention, and their willingness to recommend LexiLearn to other ESL university students. The evaluation was based solely on closed-ended Likert-scale responses, and no open-ended feedback was collected. Therefore, the interpretation of respondents' overall acceptance was limited to their quantitative perceptions measured through the questionnaire. The findings are presented in Table 6.

Table 6. Results of Overall User Acceptance (n=17)

| Statement                                                                                          | Strongly Disagree, n | Disagree, n | Neutral, n | Agree, n  | Strongly Agree, n |
|----------------------------------------------------------------------------------------------------|----------------------|-------------|------------|-----------|-------------------|
| I enjoyed learning English vocabulary using the LexiLearn application.                             | 1 (5.9%)             | 0 (0.0%)    | 1 (5.9%)   | 4 (23.5%) | 11 (64.7%)        |
| Overall, the LexiLearn application is effective in facilitating vocabulary learning and retention. | 1 (5.9%)             | 0 (0.0%)    | 1 (5.9%)   | 7 (41.2%) | 8 (47.1%)         |
| I would recommend the LexiLearn application to other ESL university students.                      | 0 (0.0%)             | 0 (0.0%)    | 2 (11.8%)  | 5 (29.4%) | 10 (58.8%)        |

Source: Authors' analysis of overall user acceptance questionnaire responses from 17 participants

As shown in Table 6, the respondents expressed positive overall perceptions of the LexiLearn mobile application. Most respondents selected Agree and Strongly Agree for all three statements, indicating a high level of acceptance of the application. The statement "*I enjoyed learning English vocabulary using the LexiLearn application*" received the highest positive response, with 64.7% of respondents selecting Strongly Agree, suggesting that the application provided an enjoyable learning experience. Similarly,

58.8% of respondents strongly agreed that they would recommend LexiLearn to other ESL university students. Nevertheless, a small number of respondents selected Neutral or Strongly Disagree for several statements. For example, one respondent (5.9%) strongly disagreed with the first and second statements, while two respondents (11.8%) selected Neutral regarding their willingness to recommend the application. As no open-ended feedback was collected, the specific reasons for these responses could not be determined. These responses may indicate that some users experienced different learning preferences or expectations, highlighting opportunities for future improvements through qualitative feedback and further usability evaluation. Overall, the findings indicate that LexiLearn was well accepted by the respondents.

The positive overall user acceptance demonstrates that LexiLearn successfully achieved its intended purpose of providing an engaging and effective mobile learning platform for ESL university students. The integration of structured vocabulary lessons with gamification elements, such as points, badges, levels, avatars, and rewards, created an enjoyable learning experience while encouraging learners to remain motivated throughout the learning process. These findings are consistent with previous studies by Allehyani (2025) and Simsek and Karakus Yilmaz (2025), which reported that gamification enhances learners' motivation, engagement, and willingness to continue using mobile-assisted language learning applications. Overall, the positive findings across usability, effectiveness, and overall user acceptance sections indicate that LexiLearn successfully fulfilled the objectives of this study by providing a user-friendly and effective platform for enhancing vocabulary retention among ESL university students.

## 5. CONCLUSION

This study successfully developed LexiLearn, a gamified mobile application designed to support vocabulary learning and retention among ESL university students by integrating structural gamification elements with CEFR-based vocabulary learning. The application was developed using the Mobile Application Development Life Cycle (MADLC), incorporating five development phases: Identification, Design, Development, Prototyping, and Testing. The findings from the questionnaire-based evaluation indicate that respondents positively perceived the application in terms of its usability, perceived effectiveness, and overall user acceptance. The results further suggest that respondents viewed the integration of gamification elements, including points, badges, levels, progress bar, avatars, rewards, and also quizzes, as engaging and supportive of vocabulary learning and retention. Overall, the study demonstrates that LexiLearn was positively received by the respondents and shows the potential of integrating gamification into mobile-assisted language learning (MALL) to support vocabulary learning among ESL university students. Future studies should involve larger and more diverse samples and incorporate objective measures, such as pre-test and post-test assessments, to evaluate the actual impact of the application on vocabulary retention.

Overall, the findings indicate that respondents positively perceived LexiLearn as an engaging, user-friendly, and useful mobile learning platform for supporting vocabulary learning and retention among ESL university students. This study also contributes to the growing adoption of gamification in MALL by demonstrating the potential of integrating structured gamification techniques into a mobile vocabulary learning application. Nevertheless, this study has several limitations. The evaluation involved a relatively small sample of 17 respondents and was conducted over a short evaluation period. In addition, the findings were based solely on respondents' self-reported perceptions collected through a questionnaire, without a control group or baseline comparison to objectively measure vocabulary retention. Future work may involve evaluating the application with a larger and more diverse group of participants, incorporating additional learning features, and conducting objective evaluations, such as pre-test and post-test assessments, to investigate the long-term effects of gamification on vocabulary learning and retention.

## 6. ACKNOWLEDGEMENTS/FUNDING

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## 7. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any commercial or financial conflicts of interest and declare that there are no competing interests related to this study.

## 8. AUTHORS' CONTRIBUTIONS

Nur Anis Adnin Binti Suhaimi conceptualized the research, conducted the literature review, designed and developed the LexiLearn mobile application, performed data collection and analysis, and drafted the manuscript. Nur Hasni Binti Nasrudin supervised the research, provided guidance throughout the project, reviewed the manuscript, and approved the final version for publication. Samsiah Ahmad and Samsiah Abd Razak contributed to the conceptualization, formal analysis, and validation of the research. Nurkhairizan Khairudin contributed to the conceptualization, supervision, manuscript review and editing, and validation.

## 9. DECLARATION OF GENERATIVE AI IN THE WRITING PROCESS

During the preparation of this work, the authors used Open AI ChatGPT to support language refinement and organization of selected sections of the manuscript. After using this tool, the authors carefully reviewed and edited the content as needed and took full responsibility for the content of the publication.

## 10. DATA AVAILABILITY/SUPPLEMENTARY MATERIALS

The questionnaire data collected during this study, together with the source code and supplementary materials related to the design and implementation of the LexiLearn mobile application, are available from the corresponding author upon reasonable request. The materials are not publicly archived because they form part of an undergraduate final year project; however, they may be provided for academic and research purposes upon reasonable request.

## 11. ETHICS STATEMENT

This study involved voluntary participation from university students who completed a questionnaire after using the LexiLearn mobile application. Before completing the questionnaire, all participants were informed about the purpose of the study and voluntarily provided their informed consent to participate. Participation was entirely voluntary, and respondents could choose not to participate or withdraw at any time without consequence. The responses were collected anonymously and used solely for academic and research purposes, with respondents' confidentiality maintained throughout the study. As the study involved only adult university students, no minors participated in the evaluation. Formal ethics approval was not required for this undergraduate research project in accordance with the institutional requirements.

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