

DEVELOPING AN ANDROID-BASED APPLICATION USING A DEEP LEARNING APPROACH TO IMPROVE GRAMMAR AND VOCABULARY LEARNING

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Received : September 21, 2025

Revised : May 8, 2026

Accepted : June 25, 2026

Published : June 30, 2026

How to Cite (in APA Style):

Halim, M. L. A., Arifin, M., & Indarto, R. F. (2026). Developing an android-based application using a deep learning approach to improve grammar and vocabulary learning. *Pioneer: Journal of Language and Literature*, 18(1), 200-217.
<https://doi.org/10.36841/pioneer.v18i1.7236>

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Abstract: This research aims to develop an Android-based educational application that uses a deep learning approach (meaningful, mindful, and joyful learning) to improve vocabulary and grammar learning in a more fun and impactful way, tailored to the needs of students in the modern era. The needs analysis results indicated that students equally require digital learning media with highly structured material and interactive exercises that are appealing. This research used a Research and Development design based on the ADDIE model. The process included conducting a needs analysis, designing the application, validating it with experts, and performing limited trials. A limited trial involving 34 students was conducted, and 86 per cent said that it was fairly straightforward to use, which indicated it was very easy for students to use. The average for the final in the pre-test was 64.03, but the post-test rose to 84.15, meaning that this media could improve students' vocabulary mastery and grammar understanding. Therefore, this research provided a conceptual contribution to strengthening the relevance of the deep learning approach in the context of Mobile-Assisted Language Learning (MALL), particularly in the development of Android-based media applications.

Keywords: *android, deep learning, grammar, media applications, vocabulary*

INTRODUCTION

Conventional learning methods used in higher education often focus on a theoretical approach and offer little opportunity for students to understand the material in depth and apply it (Yuniarti et al., 2023). English learning that relies on memorizing grammar rules and vocabulary without engaging in learning experiences often leaves students bored and unmotivated (Makhsun et al., 2023). One of the key reasons is that these two things require structured practice and in-depth understanding, which are hard to obtain through traditional learning methods. Thus, even if students can remember grammar rules or new words, they still have a hard time using them correctly when they talk to each other every day.

Conventional learning approaches, such as the Grammar Translation Method (GTM), have several limitations in effectively improving language proficiency. This approach generally positions students as passive recipients and focuses on memorizing rules and translations, thus severely limiting opportunities to use the language in real-life situations. Various studies have shown that traditional methods are less effective in meaningfully strengthening vocabulary recall because the learning process is not supported by authentic contexts (Nguyen, 2026). Furthermore, the isolated and non-communicative nature of grammar learning also impacts students' weak conceptual understanding of language structure (Rambe, 2024). Thus, traditional approaches are considered incapable of meeting the needs of today's language learning, which demands active involvement, contextual use of language, and strengthening communicative skills.

In today's digital age, advances in information technology, particularly Android-based mobile apps, have created new opportunities for learning (Fricticarani et al., 2023). Teachers' willingness to embrace new technologies has had a significant impact on current efforts to make the learning process more effective and provide students with more engaging experiences (Sembiring et al., 2024). Using mobile devices for learning makes it easier and more flexible for students to study on their own, no matter where they are or when they want to (Husnita et al., 2023). In this context, various studies have demonstrated that the use of mobile media may enhance the effectiveness of English learning (Lyraa et al., 2024; Shortt et al., 2023).

This Android-based mobile application development may thus be a very effective alternative for enhancing students' English skills, especially grammar and vocabulary

mastery, through technology relevant to their everyday lives (Solihin, 2021). Applications used for learning English in Indonesia, such as Duolingo have been put to use with the intent of enhancing students' proficiency in English (Salsabila et al., 2024). However, the application methods are restricted to gamification and practice exercises that depend on repetition and memorization, without offering much depth of understanding or personalization to the user.

With this background, this research tried to design and construct a learning application media by utilizing Android mobile-based technology that provided at least a few key features like interactive quizzes, practice questions with feedback, videos, and simulations in real life. If implemented in practice, this may lead to an in-depth understanding and provide personalized experiences to the students. By applying a deep learning approach that encompasses meaningful, mindful, and joyful learning, this application aims to make English learning more fun, meaningful, and attentive for students (Huda et al., 2025). This application has been designed by connecting with real experiences and their relevance to students' real lives. Therefore, the media of this application were expected to become the means for guiding students to achieve the expected learning outcomes.

Along with this new application development, there would be a number of other features, including practice questions with feedback, learning films, and real-life simulations. These would help users learn more deeply and in ways tailored to them. The development of this media also included a deep learning strategy, which stressed the need for a deeper understanding and the link between what you already know and what you learn. Thus, even though the English learning apps out there now were quite popular and worked well in some ways, there was still potential for apps that used a more comprehensive, in-depth strategy to help students.

REVIEW OF LITERATURE

The rise of digital technology, especially Android-based smartphones, has made it easier to study languages in this digital age through the mobile-assisted language learning (MALL) method (Haleem et al., 2022; Reshetylov et al., 2022). Different literature has reported that mobile-based learning applications can enhance accessibility and flexibility and individualize learning for students. For instance, a meta-analysis found

that consistent use of mobile applications is positively associated with language learning outcomes, especially vocabulary gain and communication skills (Mihaylova et al., 2022). These are emphasized by the results of systematic reviews showing a positive trend in the implementation of m-learning, although its effectiveness depends very much on the used instructional design (Naveed et al., 2023). In this context, the use of Android-based application media not only functions as an aid, but also as a learning tool that is able to facilitate interaction, exploration, and personalization of language learning.

Pedagogical approaches to deep learning support the achievement of learning outcomes, as well as cognitive aspects. Deep learning is not just about knowledge acquisition but rather deep engagement through meaningful, mindful, and joyful learning (Raup et al., 2022). Applying this concept to app development allows students to relate grammar and vocabulary to real-world contexts, facilitates critical reflection, and fosters greater motivation for learning.

Conceptually, the integration of MALL into language learning can be explained through a deep-learning approach that encompasses three main dimensions: meaningful learning, mindful learning, and joyful learning. The first aspect is meaningful learning, which emphasises that the learning process will be effective if the new information is linked with previous knowledge. In the context of a mobile application, interactive features such as quizzes, multimedia, and simulation content enable students to relate the connection between vocabulary and grammar to real-life experience. This aligns with research findings that meaningful learning can improve conceptual understanding, critical thinking skills, and knowledge transfer across various situations (Fu & Hwang, 2018; Hsbollah & Hassan, 2022).

The second aspect is mindful learning, which relates to cognitive awareness and active reflection in the learning process. The use of android application allows students to control their learning pace, review material, and obtain immediate feedback, which encourages metacognitive engagement and awareness of their learning process (Wei, 2023). Thus, MALL not only improves learning outcomes but also the quality of students' thinking processes in understanding language.

The third aspect is joyful learning. It emphasises the importance of students' emotions in learning activities. The integration of game elements, interactive interface design, and interactive activities applied in the application can increase students'

motivation and engagement during the learning process. A fun learning environment has been shown to reduce language learning anxiety and encourage active student participation (Rezai et al., 2025). By integrating these three dimensions, Android-based MALLs act as a bridge between technology and pedagogy in creating more effective language learning.

Furthermore, studies in the MALL domain confirm the effectiveness of using apps for language acquisition. Mobile-based apps that provide interactive exercises, automated feedback, and contextualised materials have been shown to improve students' language skills (Halim, 2025). In fact, several studies have shown that grammar practice via mobile apps can improve grammatical accuracy compared with conventional methods (Vu et al., 2023). Motivational aspects are also crucial to the effectiveness of digital learning media. The integration of gamification elements, such as rewards, leaderboards, and progress tracking, can increase user engagement and encourage frequent use of the application. Therefore, the combination of cognitive and pedagogical (deep learning) approaches is believed to produce more effective Android-based learning media that is widely accepted by students.

Overall, the existing literature indicates that developing Android-based learning applications using a deep learning approach has a strong theoretical and empirical foundation. However, a research gap remains, namely the limited number of studies that holistically integrate cognitive theory, pedagogical aspects, and motivational aspects in language application design. This research seeks to fill this gap by developing an Android-based application that not only supports grammar and vocabulary mastery but is also designed with principles of cognitive theory of multimedia learning, a deep learning approach, and motivational features relevant to students' needs.

METHOD

This Research used a Research and Development (R&D) approach to design and develop an Android-based application as a learning medium with a deep learning approach to help students master grammar and vocabulary effectively (Risal et al., 2023). As an implementation step to produce a valid, practical, and effective application product, researchers used the ADDIE model with five stages, namely: Analyze, Design, Development, Implementation, and Evaluation (Safitri & Aziz, 2022).

The participants of this research were 34 students of the English Course I as a basic general course at Billfath University Lamongan. The instruments used by researchers include: (1) a questionnaire to identify students' learning needs and desires, (2) observation to observe the learning process, and (3) a test to measure the effectiveness of the application media. All instruments used have been previously validated by an instrument experts, namely Dr. Imam Nur Aziz, M.Pd, lecturer at the study program of English language education at the University of UNKAFA Gresik, and also Dr. Saeful Anam, M.Pd.I doctoral graduate in Educational Technology from State University of Malang, lecturer at the University of UNKAFA Gresik. All instruments were validated on July 14, 2025.

This research used a mixed-method analysis (descriptive, qualitative, and quantitative). It was used to analyze the results of observations, interviews, and the analysis of expert validation to determine the feasibility of design, content, and media. While the quantitative was used to measure the effectiveness of media in improving students' vocabulary mastery and grammar understanding. The quantitative data were analysed using the SPSS program to calculate t-values and determine whether there was a statistically significant improvement before and after implementing the media application.

FINDINGS AND DISCUSSION

Student's Needs Analysis

The results of a needs analysis of students in the preliminary study showed that many obstacles that still challenge the fundamentals of learning English extend to proficiency in grammar and vocabulary. This was proven by evidence of the student's low academic achievement shown in the high proportion of students who received low scores in, shown in the high proportion of students who received low scores in the English course. In essence, the low academic achievement discussed earlier reflected several barriers that impede the efficacy of the learning process. The analysis of the students at Billfath University provided a better understanding of the things, as illustrated by the following data from the questionnaire. The information gathered from this questionnaire provides an important basis for understanding the various factors contributing to students' low academic achievement, including material comprehension, language skill mastery,

motivational factors, and learning strategies. Therefore, this information not only became a supporting point but also served as a reference to inform the design of strategies that respond to issues using specific measures. The information from the questionnaire obtained was as follows:

Table 1. Student's Needs Analysis Results

Indicators	Description of Needs	S	N	TS	Percentage (%)
Grammar Understanding	Students require a deep understanding of grammar rules, not just memorization.	79%	12%	9%	100%
Vocabulary Mastery	Students need applicable and relevant vocabulary for everyday communication.	71%	9%	20%	100%
Learning Motivation	Students are bored with conventional methods and need interactive and engaging media.	65%	23%	12%	100%
Media Flexibility and Accessibility	Students need media that can be accessed anytime and anywhere for independent learning.	82%	12%	6%	100%
Feedback from Practice	Students need immediate feedback so that errors can be corrected immediately.	62%	23%	15%	100%

These findings exemplify the idea that the learning media should be developed in innovative, interactive, flexible, and applicable ways. The presence of such apps was believed to improve the mastery of grammar and vocabulary, motivate students, and make learning from real-life situations more meaningfully aligned with the challenges of the digital era in education.

Design and Development Results

After completing the needs analysis stage, the researcher continued with the design and development stage. The Android-based English learning application in this study was designed and developed using an R&D approach. The stages of development progressed from analysing students' needs linked to the development of instructional materials and conceptual design, to the actual implementation in the form of an application prototype, followed by early testing and refinement of the products. The entire process leading to this was to produce an application that answered students' real needs for improving grammar and vocabulary mastery while affording them a more interactive, flexible, and enjoyable learning experience than the conventional methods of learning. The results of the application's media design and development were as follows:

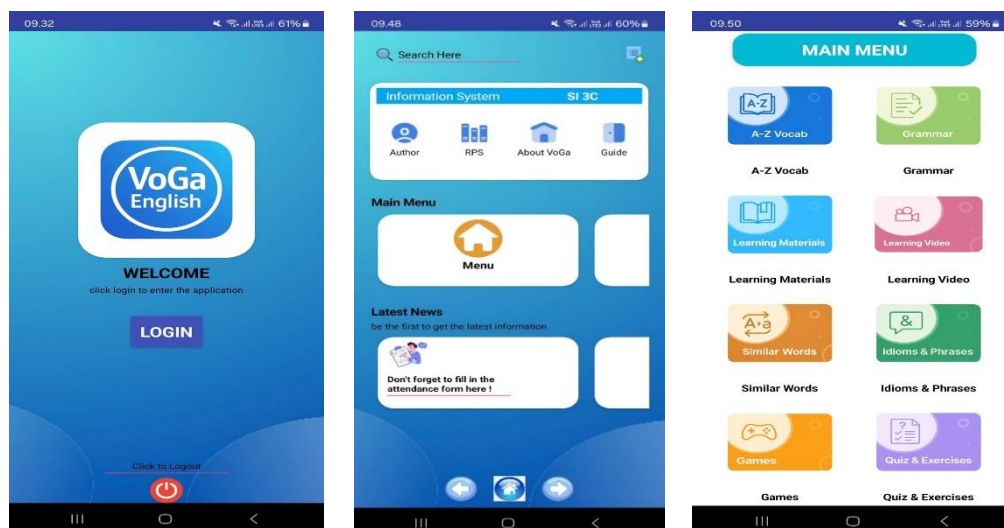


Figure 1. Application home page, system information page, and main menu page

The application's homepage is meant to be the first thing users see, with links to the main menu. The "LOGIN" button is the main way to get around the site. It takes users to the System Information page and opens the main menu. This introduction to identify it. At the bottom of the page is a "Logout" button to exit the application.

The main menu page presents the application's core menu, which includes A-Z vocabulary, grammar, learning materials, learning videos, similar words, idioms and phrases, games, and exercises or quizzes. For more details, see the following image:

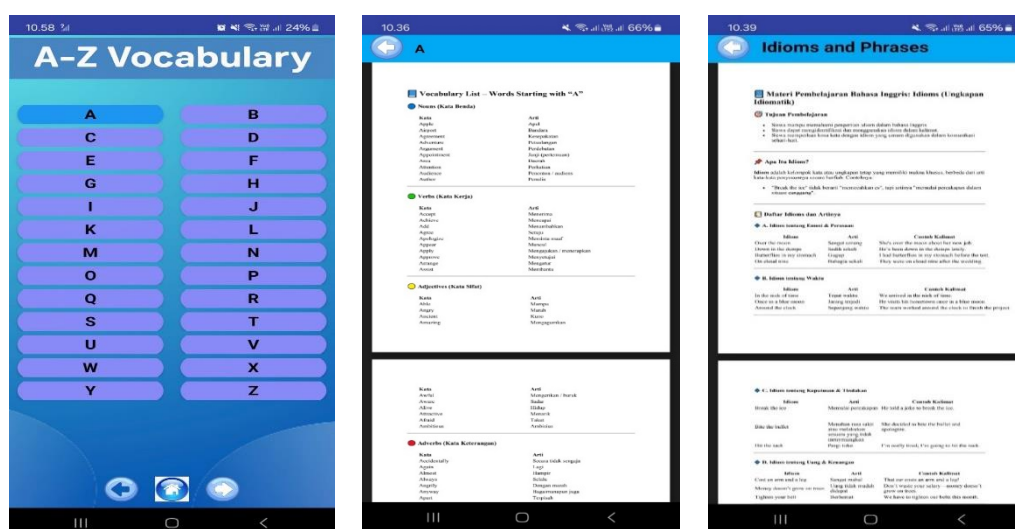


Figure 2. A-Z Vocabulary menu display, and idioms/phrases material

In the grammar menu, users are presented with several materials on basic English grammar, from parts of speech to the use of W-H questions. Meanwhile, in the learning materials menu, users are presented with several materials related to everyday life, such as meeting people, back to school, job adverts, and so on. The content of each theme also

includes short dialogue examples related to the theme so users can practice them in their daily lives. For more details, see the following image:

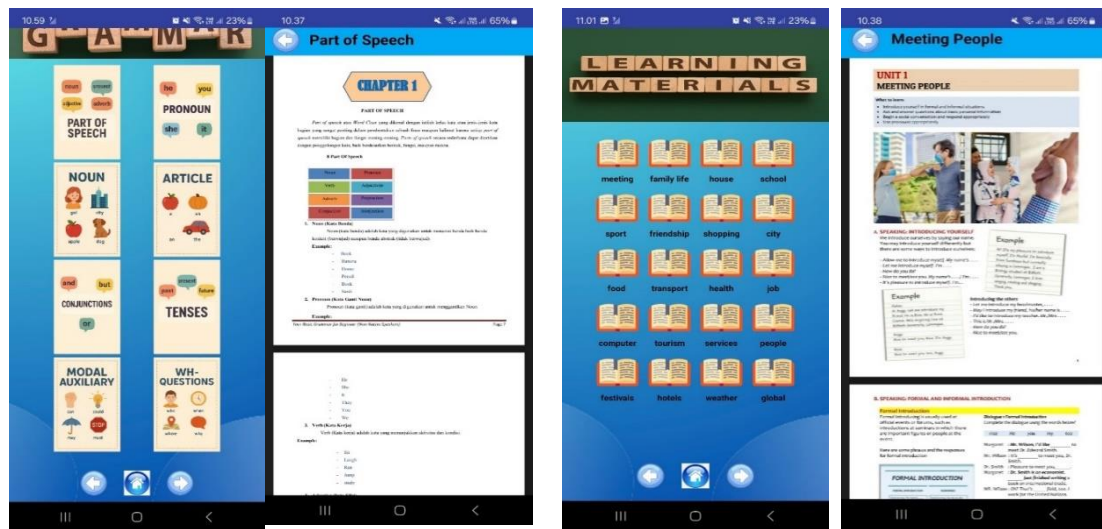


Figure 3. Grammar menu display and learning materials

The games menu offers a wide selection of games, including both vocabulary and grammar games. The videos menu offers grammar instructional videos and simulation videos relevant to the material presented. Students can use these instructional videos for independent study and review of material learned in class. For more details, see the following image:

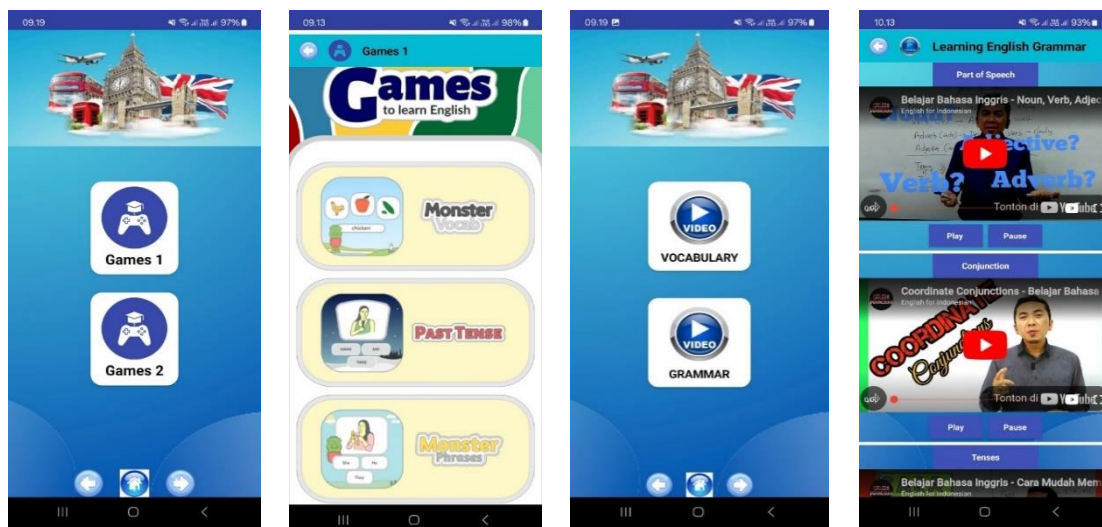


Figure 4. Display of the games menu and learning videos

Media Validation Results

The next stage of the validation process was conducted by two parties: a materials expert and a media expert. The validation by material experts indicated that the learning application media serves a number of substantial aspects in content and presentation (see

Table 2). The suitability of the material with the lesson planning, which corresponds to lesson plan and the goals from the indicators received a score of 80%, indicating its appropriateness for the curriculum. Even the clarity and explanation of the material received a perfect score of 100%, indicating that the media uses materials that are orderly and easy for learners to understand. The use of language, examples, and exercise stimulus received an average score of 80%. The average across all aspects assessed by material experts is 21 out of 25 (84%), placing it in the “very appropriate” category. This quality is not only suitable for learning needs but also establishes a communicative aspect and supports the orthoscompetence target.

Table 2. Material Validation Results

No	Aspect Assessed	Maximum Score	Score Obtained	Percentage	Category
1	Material alignment with lesson plan and indicators	5	4	80%	Very Appropriate
2	Clarity of material presentation	5	5	100%	Very Appropriate
3	Accuracy of language use	5	4	80%	Very Appropriate
4	Relevance of examples and practice questions	5	4	80%	Very Appropriate
5	Integration with learning objectives	5	4	80%	Very Appropriate
Average		25	21	84%	Very Appropriate

Second, the validation results from media experts focused on the application’s appearance, design, and technical aspects (see Table 3). The assessment of the appearance design aspect, which includes the selection of colors, typography, and icons, obtained a score of 80%, indicating that the application is visually appealing. Navigation and ease of use received a score of 100%, indicating that the application is very user-friendly and easy for students to operate. The graphic and animation quality, interactivity through the quiz feature, and consistency of display between menus each received a score of 80%. With a total score of 21 out of 25, or 84%, media experts declared the app highly usable, although some suggestions were made, such as improving the visual quality to make it more proportional and refining the text layout for better readability on various device screen sizes.

Summarizing the validation results from the two experts, both in terms of material substance and design and technical aspects, this media has met the expected standards. The overall validation, as described in the expert validation results, falls under “Very

Appropriate,” with an average percentage of 84%. However, the improvement notes provided by the validators are still used as a basis for revisions, such as adding more contextual question variations and improving the quality of graphics and typography.

Table 3. Media Validation Results

No	Aspect Assessed	Maximum Score	Score Obtained	Percentage	Category
1	Display design	5	4	80%	Very Appropriate
2	Navigation and ease of use	5	5	100%	Very Appropriate
3	Graphics and animation quality	5	4	80%	Very Appropriate
4	Interactivity (quizzes, additional features)	5	4	80%	Very Appropriate
5	Display consistency between menus	5	4	80%	Very Appropriate
Average		25	21	84%	Very Appropriate

Media Trial Results

After the development and validation, the learning application media undergoes the trial. The tryout includes all follow-up activities necessary to test the feasibility and effectiveness, as well as user responses to the developed application. This tryout was conducted with a small group and consisted of students who had characteristics similar to those of the user.

Student responses to the application were collected using a questionnaire. The collected data included several indicators of readiness, namely usability, appearance, motivation, and content efficiency. This instrument was used after students had completed the application-based learning activities. The questionnaire was also used to obtain an overview of the application’s usability. The use of the questionnaire also provided a more objective picture of how users provided appropriate feedback, both technically and didactically, on the developed application.

Based on the data analysis, the majority of respondents responded positively. Regarding usability, 88% of respondents considered the application easy to use, had clear navigation, and provided features that were easily accessible. Regarding appearance, 85% of respondents found the application design attractive and interactive, and it supported a comfortable learning experience. Furthermore, regarding motivation, 82% of respondents offered a different experience compared to conventional methods. Meanwhile, regarding content effectiveness, 88% acknowledged that the material and exercises presented were

relevant and helped them understand concepts. The following data analysis results were obtained in Table 4:

Table 4. Media Trial Results

Indicators (Assessed Aspects)	Description	S	N	TS	Percentage (%)
Usability	The application is easy to use, navigation is clear, and features are easily accessible.	88%	6%	6%	100%
Display	The design is attractive, interactive, and supports comfortable learning.	85%	6%	9%	100%
Learning Motivation	The application increases learning motivation by providing new experiences.	82%	12%	6%	100%
Content Effectiveness	The material and exercises are relevant and support conceptual understanding.	88%	9%	3%	100%
Average		86%	8%	6%	100%

Overall, the average positive response rate was 86%, indicating that this learning application has good usability and is well received by students as a supportive learning medium.

Media Effectiveness Test Results

The measurements were conducted through a pre-test before using the application and a post-test after the learning process using the application to assess the effectiveness of the application on students' learning outcomes. Based on the descriptive statistical analysis results presented in the table 5, the average student score increased from 64.03 on the pre-test to 84.15 on the post-test. Furthermore, the score distribution and the maximum from 80 to 95. These findings indicate that the application's media implementation positively contributes to improving student learning outcomes.

Table 5. The Result of Descriptive Statistics

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
pretest	34	47	80	64.03	8.390
posttest	34	73	95	84.15	6.229
Valid N (listwise)	34				

Furthermore, an analysis was conducted using a t-test to assess the level of significance between the differences in learning output. The t-test result indicated that Sig. (2-tailed) was 0.000, which was below the set significance level of 0.05. As a result, the null hypothesis is rejected, while the alternative hypothesis (H_a) is accepted. It thus shows that the use of application media significantly improves student learning outcomes. Table 6 shows the results of the t-test analysis using SPSS:

Table 6. The Result of T-test Analysis

Paired Samples Test									
Paired Differences					t	df	Sig. (2-tailed)		
					95% Confidence Interval of the Difference				
					Std. Error Mean				
		Mean	Std. Deviation		Lower	Upper			
Pair 1	pretest - posttest	-20.118	9.935	1.704	-23.584	-16.651	-11.807	33	.000

Based on the research results in Table 6, the media application has a positive impact on improving students’ learning outcomes. These findings align with multimedia-based learning theory, which states that the integration of visual, textual, and interactive elements could enhance information processing and knowledge retention (Mayer, 2024). From a previous research perspective, these research results were consistent with numerous studies demonstrating that the use of mobile applications in language learning could improve students’ engagement and learning outcomes. It means that these findings support previous research, which suggests that interactive elements and engaging learning experiences contribute to increased students’ learning outcomes. Husnita et al. (2023) and Wei (2023) confirmed that flexibility of access, interactivity, and immediate feedback were key factors in enhancing learning effectiveness.

Furthermore, the results also indicated that the integration of deep learning approaches showed a strong relationship with three main dimensions: meaningful learning, mindful learning, and joyful learning (deep learning). The first was from a meaningful learning aspect, the improvement of students’ learning outcomes indicated that the use of the application successfully helped students relate the material given with previously acquired knowledge. Interactive practice features and contextual presentation of material allowed students to understand vocabulary and language structures in more realistic situations, thus making learning more meaningful and not just rote memorization. This was in line with Bernacki et al. (2020) and Fu and Hwang (2018) that the use of mobile technology with contextual features could improve knowledge transfer and conceptual understanding.

Second, in the context of mindful learning, the use of applications provided students with the opportunity to learn independently by controlling the pace of learning, repeating material, and receiving direct feedback. This could help students develop

metacognitive awareness, where they not only learn but also understand how they learn. The result of students' improvement in learning outcomes could be interpreted as an indicator that students were able to manage their cognitive processes more effectively through technological support. Alakrash and Razak (2021) showed that a technology-based learning environment that gives students control over their learning could improve students' cognitive reflection and the quality of students' understanding.

Third, in the context of joyful learning, the high levels of student acceptance showed that the media application was able to create an enjoyable learning experience. Attractive interface design and interactive activities could contribute to improving students' intrinsic motivation. This positive learning environment plays an important role in reducing students' anxiety, especially in language learning, thus students are more confident in participating actively. This was also evident in the findings of Mohammed and Ozdamli (2021), which confirms that enjoyable learning experiences have a positive relationship with academic engagement and performance.

CONCLUSION AND SUGGESTIONS

Conclusion

This research developed an Android-based application using a deep learning approach to improve grammar and vocabulary learning. Based on the results above, theoretically this research strengthened the deep learning framework by demonstrating that the principles of meaningful, mindful, and joyful learning could be effectively integrated into the design of mobile-based learning applications. The results indicated that learning that connected material to real-world contexts (meaningful), provided space for reflection and learning control (mindful), and presented enjoyable learning experiences (joyful) produced a more comprehensive and sustainable learning process. Thus, this research provided a conceptual contribution to strengthening the relevance of the deep learning approach in the context of Mobile-Assisted Language Learning (MALL), particularly in the development of Android-based media applications. While from a practical perspective, this research provided implications that teachers and learning media developers needed to design applications that were not only visually appealing, but also based on strong pedagogical principles. The use of interactive features, instant feedback,

and designs that adapt to student needs has proven to be a key factor in improving the quality of learning.

However, it should be noted that although the results of this study indicated significant improvements, the relatively short duration of the trial was a limitation in assessing the long-term impact on the sustainability of learning. It's compared with longitudinal studies in the MALL field, sustained effectiveness still requires further testing. In addition, the integration of three aspects of deep learning could still be improved, especially in enriching reflective activities to support mindful learning and expanding authentic contexts to strengthen meaningful learning. Thus, the result of this research could give a significant academic contribution by strengthening previous findings and demonstrating that the use of Android-based applications designed based on deep learning principles could effectively improve students' learning outcomes.

Suggestions

Based on the research findings, the researchers propose that this educational application can be used effectively for teaching and learning and can be enhanced by incorporating relevant supporting elements. Furthermore, it is important to test various aspects on a large scale and contextualise them based on the needs of each student. Teachers need to receive training or coaching to ensure they use this software to its full potential.

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