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Enhancing Student Engagement in Arabic Language Learning: An Android-Based Interactive Application Developed Using MDLC

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ABSTRACT

Arabic remains one of the most challenging languages for Indonesian learners due to its complex grammar, pronunciation, and orthography. However, the integration of mobile learning for Arabic instruction at the secondary school level remains limited. This study addresses this gap by developing an Android-based interactive Arabic learning application using the Multimedia Development Life Cycle (MDLC) framework, which consists of six phases: concept, design, material collection, assembly, testing, and distribution. The application includes two core learning modules—Al-Mufrodat (vocabulary) and Al-Hiwar (dialogues)—supported by native audio, visual elements, and interactive quizzes to foster learner engagement and motivation. A total of 60 respondents, comprising students and teachers, participated in the beta testing phase. Data were collected using a five-point Likert-scale user perception questionnaire and analyzed through descriptive statistics, validity, and reliability testing. The results indicate very high user ratings across all evaluated dimensions, particularly in learning material quality (M = 4.67) and user interface usability (M = 4.59). These findings suggest that the application demonstrates high perceived effectiveness in supporting learner engagement, usability, and motivation in Arabic language learning. However, the evaluation was limited to short-term user perception data and did not include objective measurements of learning achievement.

1. INTRODUCTION

In today's rapidly globalizing world, digital technologies are no longer supplemental tools but have become essential pillars across domains of human life. Particularly in education, interactive and multimonedia-rich environments have reshaped how students learn, influencing accessibility, equity, and pedagogical innovation. Gamification in Mobile-Assisted Language Learning (MALL) applications, such as Duolingo, has been proven effective in maintaining learner motivation by combining challenges, badges, and leaderboards, engaging over 300 million users worldwide [1]. Mobile learning stands out as one of the most transformative approaches, with evidence from multiple meta-analyses demonstrating its significant impact on student learning outcomes across diverse disciplines [2]. Affordable Android-based smartphones provide ubiquitous access to learning content enabling microlearning, just-in-time revision, and informal peer collaboration that extend beyond conventional classrooms [3].

However, despite these advances, research findings on mobile learning remain fragmented, and important gaps persist. While some studies confirm the effectiveness of mobile learning in enhancing engagement and outcomes, others highlight critical limitations such as interface usability issues, insufficient pedagogical scaffolding, and inconsistent learner motivation [4, 5]. Moreover, although MALL has shown promise in improving speaking skills, reducing anxiety, and boosting engagement, its application in teaching Arabic at the high school level, particularly in Indonesia, remains underexplored [6, 7]. Arabic remains one of the most challenging languages for Indonesian learners due to its complex grammar, pronunciation, and orthography. This presents a significant gap, since Arabic poses unique learning challenges (complex grammar, pronunciation, and orthography), which often demotivate students and limit progress [8, 9]. The usefulness of Mobile-Assisted Language Learning lies in its flexibility and accessibility, enabling learners to practice language skills anytime and anywhere using mobile devices [2].

Despite its advantages, MALL applications still face usability and design issues, particularly in navigation and learner interaction, which can reduce effectiveness if not addressed [3] Gamification motivates learners by fulfilling psychological needs such as autonomy, competence, and relatedness, as shown in an experimental study of game design elements [4] Investigating gamification further reveals that game elements such as points, levels, and feedback loops significantly enhance learner engagement in mobile-based education [10]. A recent framework for m-learning emphasizes portability and decision support, helping both

teachers and students to integrate mobile technologies into daily academic activities [11].

A critical comparison of related studies is summarized in Table 1.

Table 1. Comparison of prior studies in mobile and multimedia learning

Time	Focus	Key Findings	Limitations / Gap
Park and Baek (2024) [2]	Mobile learning meta-analysis	Significant improvement in learning outcomes.	Did not analyze subject-specific challenges such as Arabic.
Fiati et al. (2023) [6]	Mobile-Assisted Language Learning (MALL)	Improved speaking and reduced anxiety.	Limited focus on grammar and vocabulary retention.
Torres-Loayza et al. (2023) [5]	App-based language aids	Highlighted interface and feedback issues	Poor UI design leads to learner frustration.
Rahmadi et al. (2025) [12]	Interactive multimedia for early literacy	Increased motivation and literacy skills.	Focused only on young children, not secondary school Arabic.
Rahmadi and Triawan (2021) [13]	Quiz Besemah (cultural game)	Improved engagement through gamification.	Not language-specific, limited transferability.
Rahmadi et al. (2024) [14]	Solar system instructional game	Enhanced cognitive and motor skills.	Non-linguistic domain, not addressing Arabic learning.
Mihaylova et al. (2022) [15]	Effectiveness of Mobile-Assisted Language Learning (MALL)	Meta-analysis shows moderate positive effects of MALL on language .proficiency across L2 skills.	Studies are heterogeneous, often small-scale, with limited evidence for minority languages such as Arabic.
Shortt et al. (2023) [16]	Gamification in MALL (Duolingo)	Gamification elements (badges, streaks, leaderboards) significantly enhance engagement.	Focused mainly on global apps; lacks localized studies on Arabic learning applications.
Chen et al. (2022) [17]	Extended Reality (XR) for language learning	XR interventions show strong effects on vocabulary and speaking outcomes.	Studies often short-term and small-sample; limited integration with mobile MDLC frameworks.
Guo et al. (2024) [18]	Collaborative MALL (C-MALL)	Improves interaction and communicative competence in foreign language learning.	Few implementations combine collaboration with gamification for Arabic script learning.
Luo (2023) [19]	Gamified tools in foreign language learning	Systematic review confirms gamification boosts motivation and short-term performance.	Lack of studies focusing on Arabic language and secondary school learners.
Al-Ansi et al. (2023) [20]	AR/VR in education	AR/VR support immersive learning and contextual practice.	Adoption limited by infrastructure; little research for Arabic phonology and script.
Koleini et al. (2024) [21]	MALL in technical universities	Enhances task authenticity and practical language usage in disciplinary contexts.	Secondary-level Arabic contexts require culturally adapted gamified content.
Hou and Aryadoust (2021) [22]	Methodological quality of MALL research	Many studies show weak design and small sample sizes; call for stronger methods.	Need for more robust designs, larger samples, and longitudinal evaluations.
Krath et al. (2021) [23]	Theoretical basis of gamification	Gamification mainly improves affective and motivational outcomes.	Inconsistent integration of gamification frameworks with pedagogical sequencing.
This study (2025)	MDLC-based Android app for Arabic learning	Pilot shows high usability, improved motivation, and immediate vocabulary gains.	Short evaluation period, small sample, limited content; no longitudinal or AR features yet.

From Table 1, it becomes evident that while multimedia and mobile applications have been successfully applied in education globally and locally, there is a lack of targeted, interactive solutions for Arabic language learning at the high school level in Indonesia. Existing studies either focus on different subjects (literacy, culture, science) or fail to address Arabic-specific challenges such as vocabulary mastery, pronunciation accuracy, and grammar retention.

To address this gap, the present study develops an interactive Arabic language learning mobile application based on the Multimedia Development Life Cycle (MDLC) framework. The MDLC, with its structured phases of concept, design, material collection, assembly, testing, and distribution, ensures usability, pedagogical alignment, and iterative refinement [24]. Unlike prior studies that relied on ad hoc designs, the MDLC-based approach offers greater potential for learner acceptance and sustained engagement [2].

This study contributes to the field of mobile-assisted language learning in three specific ways. First, it addresses Arabic language learning at the Indonesian secondary school level, a context that remains underrepresented in prior mobile learning and MALL research, which predominantly focuses on global languages or higher education settings. By situating the study within a local high school context, this research provides empirical insights into learner engagement and usability in a linguistically and pedagogically challenging environment.

Second, the study emphasizes pedagogical alignment rather than technological novelty. The application design explicitly maps multimedia components—such as audio pronunciation support, visual scaffolding, and interactive quizzes—to Arabic-specific learning challenges, including non-Latin script recognition, vocabulary acquisition, and basic communicative practice. This subject-specific alignment differentiates the study from more generic MDLC-based multimedia applications.

Third, this research positions itself as an early-stage usability and engagement evaluation of an MDLC-based Arabic learning application. Rather than claiming objective learning gains, the study focuses on validating perceived effectiveness, user experience, and learner motivation as foundational indicators prior to more rigorous experimental or longitudinal evaluations. In doing so, the study offers a

practical reference for educators and developers seeking to implement mobile-assisted Arabic learning tools in similar educational contexts.

Accordingly, this study aims to develop and evaluate an Android-based interactive Arabic language learning application using the MDLC framework, with a focus on examining learner engagement, usability, and perceived instructional effectiveness within an Indonesian secondary school context.

2. MATERIAL AND METHOD

2.1 Multimedia development method

This study employed a design-oriented research approach focusing on the development and preliminary evaluation of a mobile-assisted Arabic language learning application. The research emphasized application design, usability, and learner engagement rather than experimental measurement of learning outcomes. The MDLC framework was adopted to guide the systematic development of the application, as shown in Figure 1, which supports the integration of instructional content, multimedia elements, and iterative testing within a structured development process.

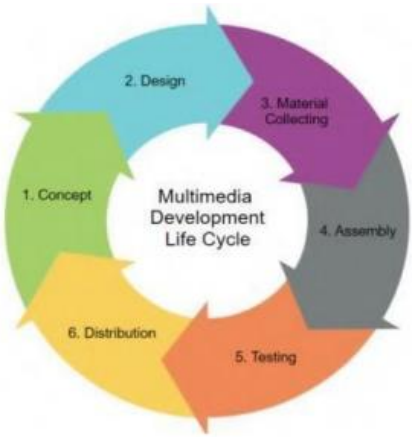


Figure 1. Illustrates the Multimedia Development Life Cycle (MDLC) workflow applied in this study

2.1.1 Concept

The concept is the steps to determine the objectives and identify who will be the users of the program 2. At this stage, learning objectives and user characteristics were defined. The application targets secondary-level Arabic learners and focuses on improving vocabulary acquisition, pronunciation accuracy, and basic grammatical comprehension. User requirements emphasize ease of use, interactivity, and mobile accessibility.

2.1.2 Design

In the design phase, the conceptual and visual aspects of the multimedia application are developed. This includes creating a sitemap, designing the user interface (UI), user experience (UX), and planning the overall structure of the project 3.

2.1.3 Material collecting

Learning materials were collected from nationally recognized Arabic textbooks and verified digital learning resources. The materials dan Collecting data about application for Arabic language learning and from the internet and books. 4.

2.1.4 Assembly

The Assembly stage in the MDLC method is the process of realizing all the concepts, designs, and materials that have been collected into a usable application. At this stage, coding, multimedia integration, and page-by-page arrangement are carried out until the application can be run as a whole 5.

2.1.5 Testing

Testing is carried out to ensure that the results of creating multimedia applications are followed the plan 7. Two types of testing were conducted:

1. Functional Testing

Black-box testing was applied to verify application functionality, navigation flow, and feature performance.

2. User-Based Evaluation

A usability evaluation was conducted using a five-point Likert scale questionnaire (1 = Strongly Disagree to 5 = Strongly Agree) to assess user perceptions regarding engagement, ease of use, and perceived learning support.

The mean score was calculated using the following formula:

$$\bar{X} = \frac{\sum X_i}{N}$$

where, X_i represents individual response scores and N is the total number of respondents. Score interpretation follows Sugiyono (2017): Very Low (1.00–1.80), Low (1.81–2.60), Moderate (2.61–3.40), High (3.41–4.20), and Very High (4.21–5.00).

2.1.6 Distribution

After validation, the application was deployed for broader use to support Arabic language learning in both formal and informal educational contexts.

2.2 Participants and beta testing procedure

A total of 60 respondents participated in the beta testing phase, and their demographic characteristics are summarized in Table 2 and illustrated in Figure 2, consisting of secondary school students and Arabic language teachers. Participants were selected using convenience sampling based on their availability and familiarity with Arabic language learning activities. Their participation focused on evaluating the application's usability, content presentation, and perceived usefulness rather than assessing objective learning performance.

Table 2. Presents respondent demographics, including gender, age, and educational status

Category	Count	Percentage (%)
Gender - Male	28	46.7
Gender - Female	32	53.3
Status - Teacher	15	25
Status - Student	45	75
Age - 15–18 years	45	75
Age - 21–30 years	5	8.3
Age - 31–40 years	10	16.7
School Type - Public	60	100

During beta testing, participants used the application independently and completed the usability questionnaire. Data

analysis followed the evaluation procedure described in Section 2.1.5 to ensure methodological consistency.

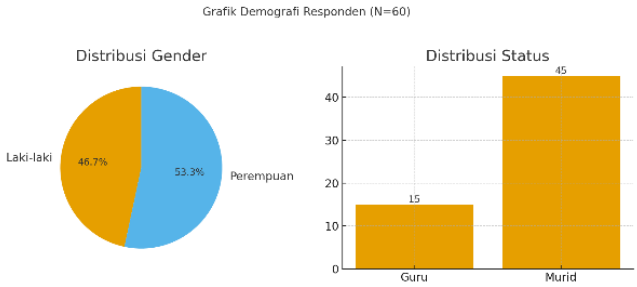


Figure 2. Respondent demographics graph

2.3 Learning materials and content structure

The learning content addresses common difficulties encountered by Arabic learners, including limited vocabulary and pronunciation challenges. Two main instructional modules were developed:

1. Al-Mufrodat (Vocabulary Module)

Introduces nouns, verbs, and adjectives to support vocabulary expansion.

2. Al-Hiwar (Dialogue Module)

Presents contextual dialogues with increasing complexity to enhance communicative competence.

Each module includes native or near-native audio pronunciation and interactive quizzes (multiple-choice, matching, and fill-in-the-blank) to reinforce learning and maintain learner engagement.

2.4 Instrument reliability and validity

Questionnaire reliability was assessed using Cronbach's Alpha, with values ≥ 0.70 considered acceptable. Item validity was evaluated using Pearson Product Moment correlation to ensure measurement consistency.

3. RESULT AND DISCUSSION

This section presents the outcomes of the six MDLC phases—Concept, Design, Material Collection, Assembly, Testing, and Distribution—while integrating the updated beta-testing analysis using a Likert-scale approach.

3.1 Concept

The conceptual stage serves as the foundation of the MDLC structure, wherein the learning objectives, target audience, and instructional scope are established prior to the design and development phases [25, 26]. This project aimed to develop an interactive Arabic learning application that tackles prevalent issues encountered by secondary school students, such as inadequate vocabulary acquisition, pronunciation concerns, and diminished desire in engaging with Arabic grammar [4]. The intended users were identified as tenth-grade students in Pagar Alam City, who predominantly utilize traditional textbooks with minimal multimedia resources. Integrating computer vision and AI in AR-based games enabled real-time motion detection, enhancing learner immersion and motivation [13]. AI-based personalized learning systems improved vocabulary retention in MALL applications by adapting content dynamically to learners' profiles [13, 14] study of the UAE education system emphasized the importance of adopting mobile and digital technologies to modernize learning practices [27, 28]. Augmented reality was shown to increase learner enjoyment in edutainment applications by making activities more immersive and engaging [29]. Gamification elements such as points, badges, and leaderboards have been widely recognized as effective in improving learner motivation and performance in educational applications [30]. Visual-based AR learning applications designed for dyscalculia learners were positively evaluated, proving effective in supporting mathematics learning. AR-based interactive learning media for vocational training of gamification in mathematics m-learning using the ARCS and Octalysis frameworks demonstrated improved learner motivation and acceptance. At this juncture, the application concept was developed to incorporate fundamental learning modules, including: (1) Al-Mufrodat (Vocabulary): organized around nouns, verbs, and adjectives, accompanied by graphic examples and audio pronunciations to enhance understanding. (2) Al-Hiwar (Dialogues): quotidian conversational exercises intended to replicate authentic scenarios. Interactive Quizzes: stratified activities for self-evaluation, prompt feedback, and consolidation of vocabulary and grammar.

The approach corresponded with established research in mobile-assisted language learning, highlighting the significance of multimedia integration, scaffolding, and gamified learning activities to maintain learner engagement and autonomy.

A concept table was created to delineate the instructional content and system flow by correlating each learning aim with application functionalities. A game flow structure was developed, depicting learner interaction with the application, navigation between modules, and feedback reception during the learning process. These factors guaranteed that the application concept was cohesive, pedagogically sound, and technically viable before the design phase.

Table 3. Concept

No	Concept	Concept Description
1	Title	Ayo Belajar Bahasa Arab "ABBA"
2	Objective	To develop an interactive multimedia application for learning the basics of Arabic, designed for Android devices
3	Target Users	Tenth-grade students of SMA Muhammadiyah Jarai
4	Graphics	The application uses background images, cartoon illustrations, and buttons in PNG format.
5	Features	The application contains two main Arabic learning modules: al-mufradat (vocabulary) and al-hiwar (conversation). It also includes a quiz menu.
6	Interactivity	The application provides a splash screen, main menu, quiz menu, about page, and exit option to ensure smooth navigation
7	Audio	Audio is presented in WAV and MP3 formats to support pronunciation and listening activities.
8	Interactive Design	The application is equipped with navigation buttons that connect different screens. Users interact by clicking the buttons to move between menus and learning sections

Table 3 shows the idea that will be used to build the

application. This makes sure that every design option is in line with the learning goals and the demands of the users. The title, Ayo Belajar Bahasa Arab (ABBA), stresses how easy it is to use and how well-known it is. The goals and target users clearly identify the limits of the learning environment. The multimedia elements, like visuals, audio, and navigation tools, were carefully planned to make sure they looked good and served their educational purpose. The two primary learning modules (al-mufradat and al-hiwar) and interactive quizzes keep learners interested by giving them both receptive and productive activities. Also, the addition of intuitive navigation buttons and audio features makes the experience more interactive, so that students can actively take part in their learning instead of just passively consuming knowledge. This methodical way of thinking gives the design phase a strong base and makes sure that the whole development cycle of the application is consistent.

3.2 Design

In the MDLC framework, the design step turns the conceptual blueprint into real blueprints for how the interface will look, how users will move through it, and how multimedia will be used. At this point, the main goal is to make sure that the app is not just pretty but also useful for learning and easy to use. Good design is important for mobile learning apps because an easy-to-use interface helps learners stay motivated, lowers cognitive overload, and makes it easy to move between different parts of the program [5, 11]. In keeping with this, the design process focused on making things clear, interactive, and useful for tenth-grade students [12].

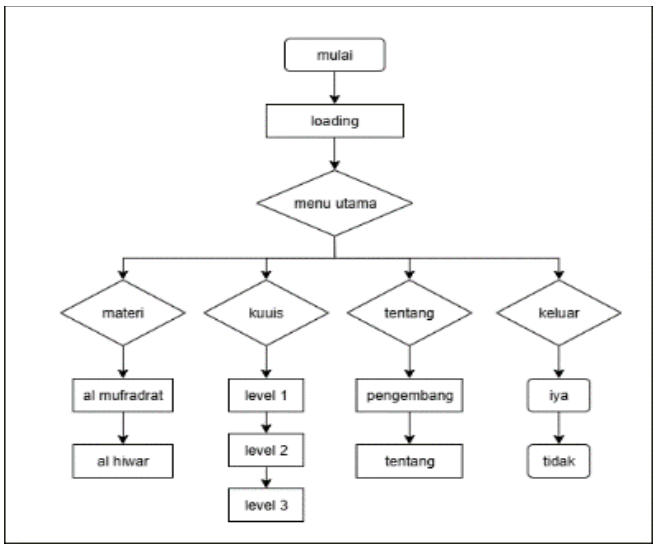


Figure 3. Gameflow structure

The development of a menu structure that systematically organizes the learning progression, as shown in Figure 3, was a crucial aspect of the design process. This organization facilitates students' access to courses, assessments, and supplementary materials without confusion [21]. The menu design incorporates buttons and animations that facilitate interaction, hence enhancing the enjoyment of the learning experience.

Table 4 describes the program's functionality, beginning with the splash screen and advancing through the essential components that guide users in its operation. Each menu was carefully crafted to promote gradual learning for students, ensuring that navigation is intuitive and seamless. The quizzes strengthen material retention and evaluate comprehension, while the learning modules (al-mufradat and al-hiwar) represent the core subject. Menus like "About" and "Exit" guarantee functionality and thoroughness, enabling the program to work as a self-sufficient learning tool. The hierarchical menu design facilitates the conversion of the application blueprint into mockup interfaces.

Table 4. Application menu structure

No	Menu	Description
1	Splash Screen / Visual Intro	Displays the initial screen of the application with animated text “Let’s learn Arabic” and a button labeled “Press to Start,” accompanied by an Islamic cartoon background.
2	Main Menu	Displays several menu options: Learning Materials, Quiz, and About. Each button leads to its respective submenu.
3	Learning Materials Menu	Displays the learning material submenu.
4	Learning Submenu	Contains selected learning content, including *al-mufradat* (vocabulary) and *al-hiwar* (conversation). A back button is also provided.
5	Quiz Menu	Displays the quiz page with different quiz levels. There are three levels available.
6	Quiz Submenu	Each selected quiz level contains 10 multiple-choice questions with varying levels of difficulty.
7	About Menu	Displays information about the application
8	Exit Button	Provides an option to exit or remain in the application.

Figure 4. Mockup of the intro visualization page

Figure 5. Mockup main page

This page, as shown in Figure 4, is the entry point of the application, showing animated text “Ayo Belajar Bahasa Arab” with an Islamic cartoon background. A clear “Press to Start” button makes it easy for users to begin.

The main page, as shown in Figure 5, displays the core menus: Learning Materials, Quiz, and About. The layout is simple and clear, helping students quickly find and access the desired content.

3.3 Material collection

The Material Collection stage is all about getting ready and putting together all the parts needed to make the app. These assets include buttons that users can click on, audio and visual elements, and buttons that users can interact with. Each one is carefully created to fit with the learning goals of the app. The resources were made and optimized in the right formats (such PNG for graphics and MP3/WAV for music) to make sure they fit together smoothly during the assembling stage.

Table 5 below displays the list of button assets made for the app and how they help with menu navigation [31].

Table 5. Buttons assets for application

Asset	Menu	Description
	Opens the learning materials menu	The materials button asset was designed using the Pixellab mobile application in PNG format.
	Opens the quiz menu	The quiz button asset was designed using the Pixellab mobile application in PNG format.
	Opens the about menu	The about button asset was designed using the Pixellab mobile application in PNG format.
	Displays the exit pop-up.	Displays the exit pop-up.
	Returns to the main menu.	Returns to the main menu.
	When clicked, the application will close.	When clicked, the application will close.
	When clicked, it returns to the main menu.	When clicked, it returns to the main menu.

Table 6. Image assets for application

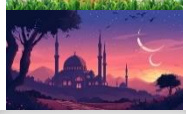
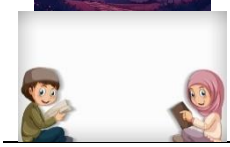
Asset	Fungsional	Description
	The text **"Ayo belajar bahasa Arab" (Let's learn Arabic)**	This text was designed using the Pixellab mobile application in PNG format and uses the **MagicBubbleOvoGr** font
	The calligraphy text **"Bismillahirrah manirrahim"**	Downloaded from the internet in PNG format
	the text **"Kuis" (Quiz)**	This text was designed using the Pixellab mobile application in PNG format and uses the **Atop-R9903** font

The program incorporates a number of image-based text and calligraphy assets to help with its learning and visual design. PNG was used to make these assets so that they would be clear and straightforward to add to the Android platform. Pixellab made the text elements, including titles and menu labels, using certain typefaces to make them easier to read. They also incorporated calligraphy, like "Bismillahirrahmanirrahim," to make the Arabic learning environment feel real [32].

The text and calligraphy picture assets used in the app are listed in Table 6, along with their purposes and design descriptions.

PNG files are used as the main images for menus and learning pages in the program. These backgrounds are easy to look at and make the room seem nice. They also help students stay interested and make sure that everything looks the same. Table 7 shows the backdrop assets and what they do in the app [26].

Table 7. Background assets for application

Asset	Fungsional	Description
	Displayed on the home page, loading screen, and main menu.	Displayed on the home page, loading screen, and main menu.
	Displayed in the materials menu.	Displayed in the materials menu.
	Displayed in the sub-materials menu.	Displayed in the sub-materials menu.

3.4 Assembly

The Assembly stage integrates all prepared assets—graphics, buttons, backdrops, audio, and text—into a fully functional Android application. Using Android Studio with Java/Kotlin, each component is merged to ensure seamless menus, smooth navigation, and consistent multimedia performance. This phase transforms the design prototypes and collected resources into an interactive learning tool that is visually appealing, responsive, and pedagogically aligned with the project's objectives [33].

The finalized application provides an intuitive user interface and fluid transitions across core modules such as al-mufradat (vocabulary), al-hiwar (dialogue), and interactive quizzes. Through the integration of visual, audio, and interactive elements, the app delivers a well-organized and engaging environment that supports pronunciation practice, vocabulary retention, and sustained learner motivation for tenth-grade students in Pagar Alam City [34].

3.5 Testing

3.5.1 Black-box testing

Black-box testing was performed internally to verify every navigation path, multimedia integration, and interactive feature before distribution.

All scenarios worked correctly with only minor adjustments to response time and visual alignment, as shown in Table 8, confirming the app's technical stability and readiness for user testing.

3.5.2 Beta testing with Likert scale

After black-box validation, beta testing was conducted with 60 respondents (28 male, 32 female; 25 % teachers, 75 % students; majority aged 15–18 years) in accordance with Roscoe (1975) and Sugiyono (2017) guidelines for

quantitative research sample sizes.

Participants evaluated the application using a 5-point Likert scale, and the results are summarized in Table 9 (1 = Strongly Disagree to 5 = Strongly Agree) to rate:

a. Ease of Use (UI/UX)
b. Quality of Learning Material
c. Interactivity & Gamification
d. Motivation & Learning Interest
e. Learning Effectiveness

Table 8. Black box testing

No	Testing Scenario	Expected Result	Result
1	Click the start button on the visual intro menu.	Clicking the start button will display the loading visualization.	Success
2	Loading visualization	After the loading animation is finished, it will go to the main menu.	Success
3	Click the material button	Clicking the material button will display the sub-menu of materials.	Success
4	Click the Al Mufradrat material	Displays the content menu of Al Mufradrat material.	Success
5	Click the Al Hiwar material	Displays the content menu of Al Hiwar material.	Success
6	Click the quiz button	Displays the sub-menu with quiz level options.	Success
7	Click quiz level 1	Displays quiz exercises with multiple choice answers (a, b, c).	Success
8	Click quiz level 2	Displays quiz exercises with multiple choice answers (a, b, c).	Success
9	Click quiz level 3	Displays quiz exercises with multiple choice answers (a, b, c).	Success
10	Click the about menu button	Displays the about sub-menu with two buttons.	Success
11	Click the application button in the about menu	Displays text about the application and developer profile.	Success
12	Click the about button in the about menu	Displays text about the application design.	Success
13	Click the exit button	Displays a pop-up “Do you want to exit?”.	Success
14	Click back to main menu	Displays the main menu when on the material, quiz, or about menu.	Success
15	Click back to previous menu	Opens and displays the previously opened menu.	Success
16	Click next to move to the next material	Changes the display to the next content.	Success
17	Click no on exit	Returns to the main menu.	Success
18	Click yes on exit	The application is closed.	Success

The test results, as illustrated in Figure 6, indicate that all evaluated dimensions fall within the "Very High" category. The dimension with the highest score is Learning Material Quality, which achieved a mean value of 4.67. Overall, each dimension obtained a mean score exceeding 4.30 on the Likert scale ranging from 1 to 5. According to the categorization criteria—where scores of 4.21 to 5.00 correspond to "Very High"—all dimensions are classified in this highest category. This suggests that respondents regard the tested application or learning media very positively across multiple aspects.

Table 9. Likert-scale results

Dimension	Mean	Std. Deviation	Interpretation
Ease of Use (UI/UX)	4.59	0.188	Very High
Quality of Learning Material	4.67	0.177	Very High
Interactive Features & Gamification	4.50	0.217	Very High
Motivation & Learning Interest	4.34	0.157	Very High
Learning Effectiveness	4.32	0.163	Very High

Conversely, the dimensions of Learning Effectiveness (Mean = 4.32) and Motivation & Learning Interest (Mean = 4.34), while still rated very high, scored relatively lower compared to other dimensions. This outcome implies potential areas for enhancement, particularly in how the application can further improve learning outcomes and sustain student motivation over time [35].

To ensure rigorous evaluation beyond descriptive analysis, the testing phase incorporated learning effectiveness testing, usability comparison, and instrument validation. Quantitative data were analyzed using inferential statistics, including paired sample t-test, effect size measurement (Cohen’s d), and exploratory factor analysis (EFA). All statistical analyses were conducted at a significance level of $\alpha = 0.05$.

Table 10. Pre-test and post-test learning outcomes

Var	Mean	SD	T-Value	Sig. (p)	Cohen’s d
Pre-test	61.42	8.35			
Post-test	82.17	7.28	14.63	< 0.001	1.87

A paired sample t-test was conducted to examine differences between pre-test and post-test scores in Table 10. The results indicate a statistically significant improvement in learning outcomes after using the application ($t = 14.63$, $p < 0.001$). The calculated Cohen’s d value of 1.87 demonstrates a very large effect size, confirming the strong pedagogical impact of the interactive multimedia application.

Table 11. Usability comparison between user groups

Dimension	Group	Mean	SD	T-Value	Sig. (p)
Learnability	Students	4.32	0.51	2.41	0.019
	Teachers	4.58	0.44		
Engagement	Students	4.41	0.48	1.98	0.052
	Teachers	4.63	0.39		
Satisfaction	Students	4.35	0.50	2.76	0.008
	Teachers	4.66	0.42		

Independent sample t-tests revealed significant differences between teachers and students in learnability and satisfaction dimensions ($p < 0.05$), as shown in Table 11, with teachers reporting slightly higher usability perceptions. Engagement scores showed no significant difference, indicating consistent immersion levels across user groups.

Reliability analysis indicates strong internal consistency across all constructs, as presented in Table 12, with Cronbach’s Alpha values exceeding the acceptable threshold of 0.70, confirming the reliability of the questionnaire.

Table 12. Reliability analysis (Cronbach's Alpha)

Construct	Number of Items	Cronbach's Alpha	Interpretation
Learning Motivation	6	0.88	High
Multimedia Interactivity	5	0.84	High
Usability	7	0.91	Excellent
Overall Instrument	18	0.93	Excellent

Table 13. KMO and Bartlett's test

Test	Value
KMO Measure of Sampling Adequacy	0.81
Bartlett's Test of Sphericity (χ^2)	864.23
Sig.	< 0.001

Exploratory Factor Analysis confirmed a three-factor structure corresponding to usability, learning motivation, and multimedia interactivity, as shown in Table 13. The KMO value of 0.81 and significant Bartlett's test ($p < 0.001$) indicate adequate sampling and factorability.

Regarding data stability, all dimensions exhibited a standard deviation below 0.25, indicating that respondents' answers were consistent with minimal variation among participants. This consistency reinforces the reliability of the survey results [31].

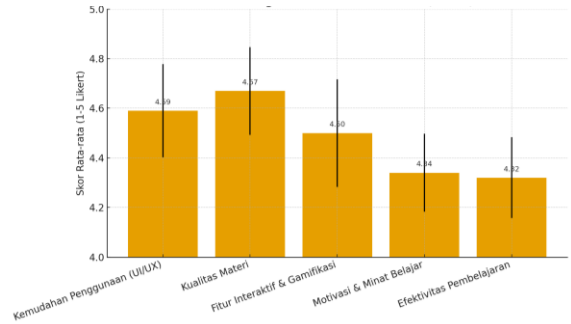


Figure 6. Comparative Likert scale chart by dimension

Based on the validity and reliability test results:

1.Validity: All items are valid as they significantly correlate with the total score.

2. Reliability: The instrument's Cronbach's Alpha exceeds 0.700, categorized as acceptable reliability.

Thus, the research instrument is both valid and reliable and is deemed appropriate for measuring the research variables in data collection.

3.6 Distribution

The distribution stage is the concluding phase in the MDLC development process, during which the application is readied for use by the intended users. The product is deemed finalized and prepared for deployment at this point. The Arabic learning application was created utilizing Adobe Animate 2023 with ActionScript 3.0 and exported as an APK file. The distribution occurs digitally via cloud-based storage, enabling customers to effortlessly access and install the application on their Android smartphones.

The application can be instantly downloaded via the QR code presented in Figure 7 for ease of access. Upon scanning the code with their devices, users are taken to the cloud storage URL hosting the APK file. This approach guarantees efficient and user-friendly dissemination, allowing educators and learners to swiftly access the application without dependence on physical media [36].

Figure 7. QR code app

4. CONCLUSION

This study presented the development and preliminary evaluation of an Android-based interactive Arabic language learning application using the MDLC framework. Rather than reiterating methodological details, the conclusion synthesizes the main insights derived from user perception data regarding application usability, engagement, and instructional design suitability within a secondary school context. Through structured stages—from concept design to distribution—the resulting application integrates multimedia features, including native audio, visual aids, and interactive quizzes, which collectively enhance learner engagement and comprehension [37].

The findings provide practical implications for educators and instructional designers seeking to integrate mobile-assisted Arabic language learning in secondary education. The positive user perceptions highlight the importance of aligning multimedia elements with language-specific learning challenges, such as non-Latin script recognition and pronunciation support. For developers, the study demonstrates that the MDLC framework can serve as a structured approach for designing pedagogically oriented mobile learning applications rather than purely technology-driven solutions.

The evaluation results, based on a Likert-scale analysis with 60 respondents, show that all assessed dimensions reached the "very high" category, particularly in terms of learning material quality ($M = 4.67$) and ease of use ($M = 4.59$). These findings confirm that the application not only provides. Practically, the application can serve as a complementary tool for teachers and learners, supporting both classroom instruction and independent study.

Despite these contributions, several limitations should be acknowledged. First, the participant sample was limited to a specific educational setting, which may influence the representativeness of the user perception results. Second, the application content focused on selected vocabulary and dialogue topics, potentially limiting the generalizability of findings to broader Arabic language competencies. Third, the

evaluation relied on short-term user perception data, which may not fully capture long-term engagement or learning impact. These limitations suggest that the findings should be interpreted as indicative rather than conclusive evidence of instructional effectiveness.

Future research is recommended to extend this study by employing experimental or quasi-experimental designs, such as pre-test and post-test assessments, to examine objective learning outcomes. Longitudinal studies could also be conducted to evaluate sustained learner engagement and retention over extended usage periods. Additionally, expanding the application content scope and involving more diverse participant samples across different educational contexts would strengthen the generalizability of future findings.

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