

Utilization of Augmented Reality in Adaptive Arabic Language Learning in the Arabic Language Education Study Program

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INFORMASI ARTIKEL	ABSTRAK
<p>Article History: Received: 12 January 2026 Revised: 27 January 2026 Accepted: 28 January 2026 Published: 31 January 2026</p> <p>Kata Kunci: Augmented-Reality; Media-Pembelajaran; Bahasa-Arab; Adaptif</p>	<p>Pemanfaatan teknologi <i>Augmented Reality</i> (AR) dalam pembelajaran bahasa Arab merupakan inovasi strategis untuk mendukung proses pembelajaran yang lebih efektif, efisien, dan adaptif di Program Studi Pendidikan Bahasa Arab (PBA) UNM Makassar. Penelitian ini bertujuan mengkaji dan mengembangkan implementasi media pembelajaran bahasa Arab berbasis AR yang dirancang dalam bentuk media interaktif visual 3D berisi kosakata, dialog, dan konteks situasional bahasa Arab, serta dilengkapi fitur penyesuaian tingkat kesulitan sesuai kemampuan mahasiswa. Penelitian menggunakan pendekatan studi kasus untuk mengeksplorasi desain, penerapan, dan dampak penggunaan AR dalam pembelajaran. Hasil penelitian menunjukkan bahwa implementasi media AR berpotensi meningkatkan motivasi dan keterlibatan belajar mahasiswa, membantu pemahaman materi secara lebih kontekstual, serta mendorong peningkatan hasil belajar pada keterampilan menyimak, berbicara, membaca, dan menulis. Selain itu, penggunaan AR mendukung terciptanya pembelajaran yang lebih adaptif karena materi dapat disesuaikan dengan kebutuhan dan kecepatan belajar individual mahasiswa. Penelitian ini berkontribusi secara signifikan dengan menghasilkan model implementasi pembelajaran bahasa Arab berbasis AR yang adaptif, kontekstual, dan aplikatif sebagai rujukan pengembangan inovasi pembelajaran bahasa Arab berbasis teknologi di perguruan tinggi.</p>
<p>Keywords: Augmented-Reality; Learning Media; Arabic; Adaptive</p>	<p>ABSTRACT The use of Augmented Reality (AR) technology in Arabic language learning is a strategic innovation to support a more effective, efficient, and adaptive learning process in the Arabic Language Education (PBA) Study Program at UNM Makassar. This study aims to examine and develop the implementation of AR-based Arabic language learning media designed in the form of interactive 3D visual media containing Arabic vocabulary, dialogue, and situational contexts, and equipped with a feature to adjust the level of difficulty according to student abilities. The study uses a case study approach to explore the design, implementation, and impact of AR use in learning. The results show that the implementation of AR media has the potential to increase student motivation and learning engagement, help understand the material more contextually, and encourage improved learning outcomes in listening, speaking, reading, and writing skills. In addition, the use of AR supports the creation of more adaptive learning because the material can be adjusted to the needs and individual learning pace of students. This study contributes significantly by producing an implementation model for AR-based Arabic language learning that is adaptive, contextual, and applicable as a reference for developing technology-based Arabic language learning innovations in higher education.</p> <p>This is an open access article under the CC-BY-SA license</p> 

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1. Introduction

Historically, one of the oldest foreign languages to arrive in Indonesia is Arabic. Arabic has been studied since the arrival of Islam in Indonesia in the seventh century AD, based on Arabic theory. At that time, Arabic was limited to the language of the holy book, the Quran (Raudatussolihah, 2022). In the contemporary era, Arabic is highly diverse in its learning methods and media. Problems that frequently arise in Arabic language learning today include low motivation to learn, difficulty understanding contextual language use, limited communicative interaction in the classroom, and a lack of interactive and adaptive learning media that accommodate students' varying abilities. Learning models that still focus on text and memorization often discourage students from actively engaging in the learning process.

Arabic plays a vital role in Islamic religious education, especially in universities with Arabic language departments. However, many students struggle to learn Arabic because of a lack of engaging and effective learning materials. In the digital age, technologies such as Augmented Reality (AR) offer significant potential for enhancing the learning experience, particularly in Arabic (Supardi et al., 2025).

Augmented Reality (AR) can create interactive learning experiences by combining real-world and virtual objects. Furthermore, it can provide a learning experience tailored to each student's abilities and learning progress. By utilizing these two technologies, Arabic language learning in the PBA Study Program at UNM Makassar will be more engaging, effective, and adaptive. Implementing Augmented Reality (AR) technology in developing adaptive Arabic language learning media in the Arabic Language and Literature Study Program at UNM Makassar requires a systematic problem-solving approach. The following steps can be taken:

Needs Analysis: Conduct surveys and interviews with lecturers and students to understand specific needs in Arabic language learning. Identify areas where technology can enhance learning effectiveness (Aziza, 2024).

AR-Based Learning Media Design: Based on the needs analysis, design learning media that integrates AR to make the material more interactive and engaging. For example, developing an application that allows students to visualize vocabulary in 3D (Fauzan et al., 2020).

Prototype Development and Testing: Develop a prototype of the learning media and conduct initial testing to ensure its functionality and effectiveness. Involve students in the trial to obtain constructive feedback (Setiyorini, 2023).

Evaluation and Improvement: Evaluate test results and implement improvements based on feedback. Ensure that learning media meet educational standards and student needs (Aini et al., 2025).

Implementation and Training: Once the learning media are ready, implement them in the Arabic Language and Literature study program and provide training for lecturers and students on how to use them. (Fauzan et al., 2020)

Continuous Monitoring and Evaluation: Conduct regular reviews to assess the effectiveness of the learning media and make adjustments as needed.

Recent research shows that using AR in Arabic language learning can increase students' motivation and understanding. A study by Aini et al. (2025) highlighted that AR provides a more interactive and visual learning experience, which is well-suited to the characteristics of Generation Z. Furthermore, AR implementations in Android-based Arabic language learning applications have been developed, such as the one by Fauzan et al. (2020), who utilized AR technology to enrich learning media at Darussalam Gontor University.

On the other hand, AI has been applied in language learning applications to provide an adaptive learning experience (Patel, 2024). For example, Duolingo has integrated AI features that enable real-time conversational and video interactions, enhancing language practice for its users (Dr. Ni Nyoman Supuwingsih, 2025). In addition, Meta has introduced a live language translation feature through its smart glasses, demonstrating the potential of AI in supporting contextual language learning.

The novelty of implementing AR in the development of adaptive Arabic language learning media lies in combining these two technologies to create a more personalized learning experience that is responsive to individual students' needs. This integration allows the learning system to adjust material based on students' understanding levels and learning styles, while also providing real-time feedback to improve learning effectiveness.

Although no specific research has been found regarding the implementation of AR in Arabic language learning in the PBA Study Program at UNM Makassar, similar approaches have been implemented at other institutions. For example, Darussalam Gontor University has developed AR-based Arabic language learning media that can be used as a reference for implementation in the PBA Study Program at UNM Makassar (Ghofur et al., 2026). The implementation of this technology in Islamic boarding schools is expected to improve the quality of Arabic language learning and prepare students to face the challenges of the digital age (Fajar Setyadinawan & Faridi Faridi, 2024).

2. Method

This research uses a case study approach to analyze the implementation of Augmented Reality (AR) in developing adaptive Arabic language learning media in the Arabic Language Education Study Program at UNM Makassar. This approach was chosen because it allows researchers to explore complex phenomena in depth within a specific context.

The unit of analysis in this study includes several interrelated levels: 1. The learning program level, namely the implementation of AR media in certain Arabic language courses that use the media as part of the learning process. 2. The user level, including PBA students who are directly involved in the use of AR-based learning media, with a focus on their learning experiences, interaction patterns, and their responses to the available adaptive features. 3. The teaching level, namely the lecturers who design, integrate, and evaluate the use of AR in learning. 4. The product/media level, in the form of the design, features, and content of the AR learning media developed, including aspects of adaptability, interactivity, and suitability of the material to Arabic language learning outcomes.

To ensure a clear focus, this case study is limited to the following aspects: 1. The institutional context is limited to the Arabic Language and Literature Study Program at UNM Makassar. Hence, the findings are contextual and cannot be directly generalized to all other educational institutions. 2. The learning context is focused on Arabic language courses that integrate AR media, not all courses in the Arabic Language and Literature curriculum. 3. The type of technology studied is limited to the AR-based learning media developed in this study, not all forms of digital learning technology. 4. The language proficiency aspects analyzed include students' Arabic language skills (listening, speaking, reading, and writing) in the context of using AR media, not other external factors such as educational background or overall initial abilities. 5. The time span of the study is limited to the implementation period of AR media during one lecture cycle, so that long-term impacts beyond that period are not the main focus of the study.

The case study approach in this research involves several main stages, including: 1) Data Collection: Data were collected through participant observation, in-depth interviews with instructors and students, and document analysis related to the curriculum and campus policies. Observations were conducted to directly understand the use of AR in the Arabic language learning process. In-depth interviews aimed to explore the perspectives and experiences of instructors and students regarding

the implementation of this technology. Document analysis was conducted to understand the policy and curriculum context underlying the use of AR in learning. 2) Data Analysis: Data analysis was conducted through the processes of data reduction, data presentation, and conclusion (Miles et al., 2014). Data reduction involves selecting, focusing, and simplifying data from observations, interviews, and document analysis. Data are presented in a descriptive narrative format, facilitating a conclusion. Conclusions are drawn by verifying the findings from the research process. 3). Data Validation: To ensure data validity and reliability, source and method triangulation was conducted (Miles et al., 2014). Source triangulation was conducted by comparing information obtained from instructors, students, and documents. Method triangulation was conducted by comparing data obtained through observation, interviews, and document analysis. Furthermore, member checking was conducted by providing participants with the opportunity to verify the results of interviews and observations.

This research is purely qualitative with a case study design. The entire research process focuses on an in-depth understanding of the implementation of Augmented Reality (AR) technology in Arabic language learning, rather than on quantitative measurements or statistical hypothesis testing. The data collected consists of narratives, experiences, interactions, and contextual documents that represent the natural reality of learning.

The case study approach in this research involves several main stages, as shown in the following figure:

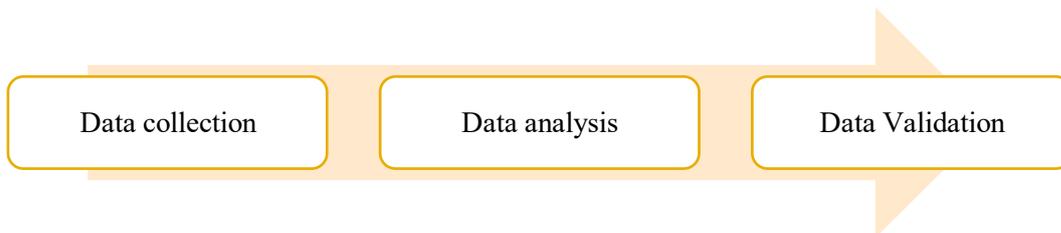


Figure 1: Case Study Approach in Several Stages

The data sources in this study consist of Primary Data: results from direct observations of the learning process using AR and from interviews with lecturers and students. Secondary Data: Curriculum documents, PBA study program educational policies, and previous literature and research related to the use of AR in Arabic language learning. The data sources in this study can be seen in the following figure:

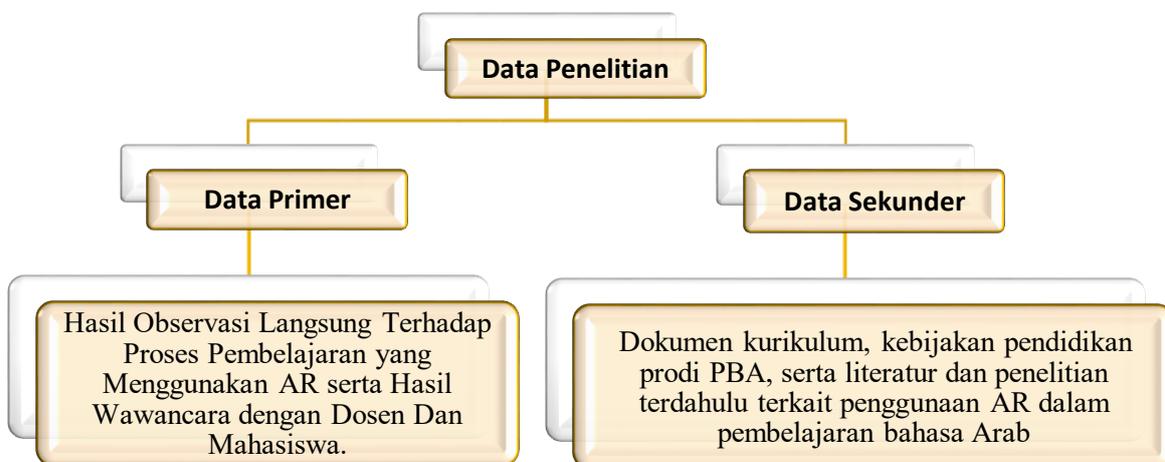


Figure 2: Data Source

According to Best, in a journal article by Raudatussolihah et al. (2022), qualitative descriptive research is a method that aims to describe and interpret objects as they are. And so is in another writing (Fathur Rahman & Raudatussolihah, 2022) البحت الكيفى هو عملية التحقيق المشابهة لعمل المخبر meaning: qualitative research is an investigative process similar to a laboratory process. As for the writing (Raudatussolihah & Rahman, 2024), God willing, المستخدم. The observation method is used to obtain information; the interview method is used to obtain data; and the documentation method is used to obtain data.

Qualitative methods aim to understand phenomena experienced by research subjects holistically, through descriptions in words and language, in a specific, natural context (Hasibuan, 2024). In Baiq Raudatuolihah's writing, the research process requires a clear method to facilitate the research in obtaining accurate research data. Case studies allow researchers to focus on a specific case in depth.

3. Result and Discussion

1. Research Results

Implementation of Augmented Reality (AR) in Learning Media

The research results show that the development of augmented reality-based Arabic language learning media in the Arabic Language and Literature Study Program at UNM Makassar has been implemented through three main components: 1. Scanning Arabic objects and text using a marker-based AR application. 2. Interactive 3D visualizations for vocabulary (mufradat), grammatical forms (qawa'id), and simple dialogues. 3. Integration of adaptive features, namely the system's ability to adjust the difficulty level of the material to the user's ability based on the results of the initial assessment. This can be seen in the following image:

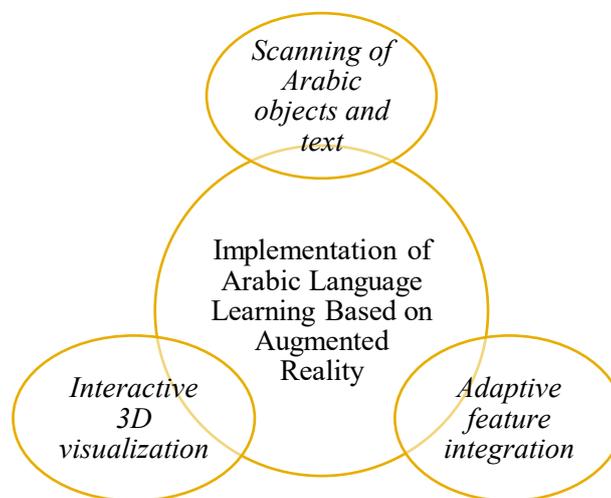


Figure 3: Development of Arabic language learning media based on Augmented Reality in the PBA UNM Study Program

Students can access the material on Android devices, and the application runs without requiring additional devices (AR headsets), making it easier to implement in the classroom.

Student Responses and Perceptions

Interviews with Students:

1. Most stated that AR media helped them understand vocabulary and contextual meaning.
2. Some felt more motivated and had a more immersive learning experience.

3. And some felt that the adaptive features helped them learn at their own pace, especially in the four Arabic language skills. This can be seen in the following image:

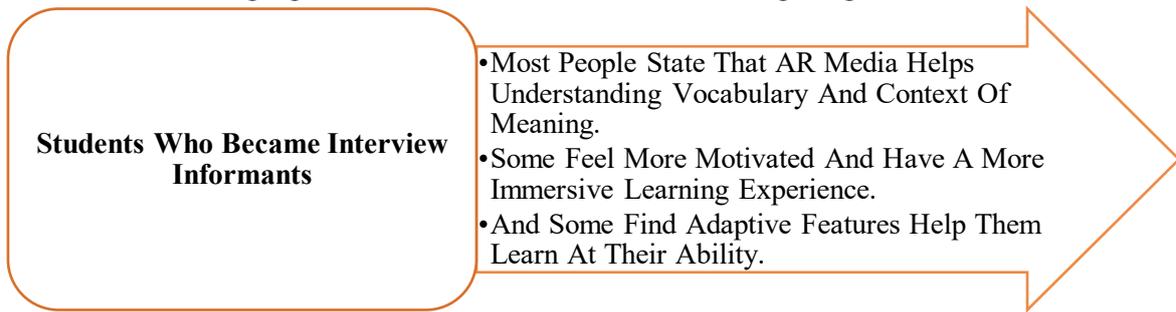


Figure 4: Interview with Students

Most students stated that using AR made learning more engaging and less monotonous. 3D object visualizations, dialogue simulations, and situational contexts helped them understand Arabic vocabulary and expressions more concretely than through text alone. Students also expressed that the interactive features in AR increased curiosity and active engagement during the learning process.

In terms of material comprehension, students felt that AR helped them connect the language to real-world contexts, particularly in learning vocabulary and conversation. Several students mentioned that they found it easier to remember vocabulary because of the visuals and everyday scenarios. Furthermore, the difficulty-adjustment feature was considered helpful for students with varying abilities, allowing them to continue learning at their own pace.

The obstacles that emerged were limited student devices (RAM and camera) and internet connection when downloading 3D models.

Effectiveness of AR Media on Learning Outcomes

The effectiveness of AR media on learning outcomes shows:

1. An increase in average class grades.
2. An increase in student learning motivation.
3. Students are more active in activities such as exploring word forms (sharf), simulating dialogues (muhadatsah), and observing sentence structures (tarkib). This can be seen in the following figure:

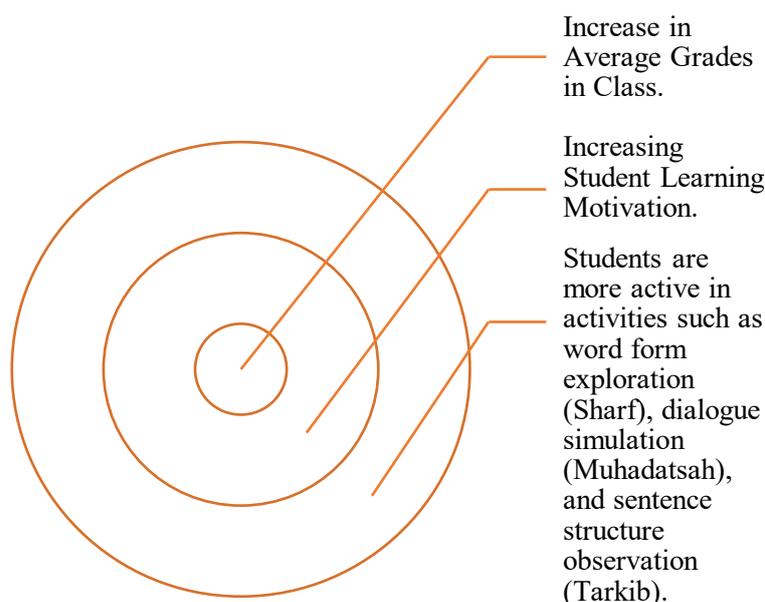


Figure 5: Effectiveness of AR Media on Learning Outcomes

2. Discussion

AR as an Adaptive Learning Medium

The implementation of AR in adaptive Arabic language learning demonstrates that this technology functions not only as a visualization tool but also as a pedagogical tool that is responsive to students' learning processes.

Overall, the findings of this study reinforce various modern learning theories that emphasize the importance of visualization, context, interactivity, hands-on experience, and personalization in the language learning process. The use of AR impacts not only cognitive aspects (language comprehension) but also affective aspects (motivation) and pedagogical aspects (adaptive learning models), making it relevant as an innovation in Arabic language learning in the digital age.

The established adaptive features, such as material level adjustment, exercises for the four Arabic language skills, and exercise recommendations, support the principle of personalized learning, which is relevant to modern Arabic language learning models. This can be seen in the following figure:

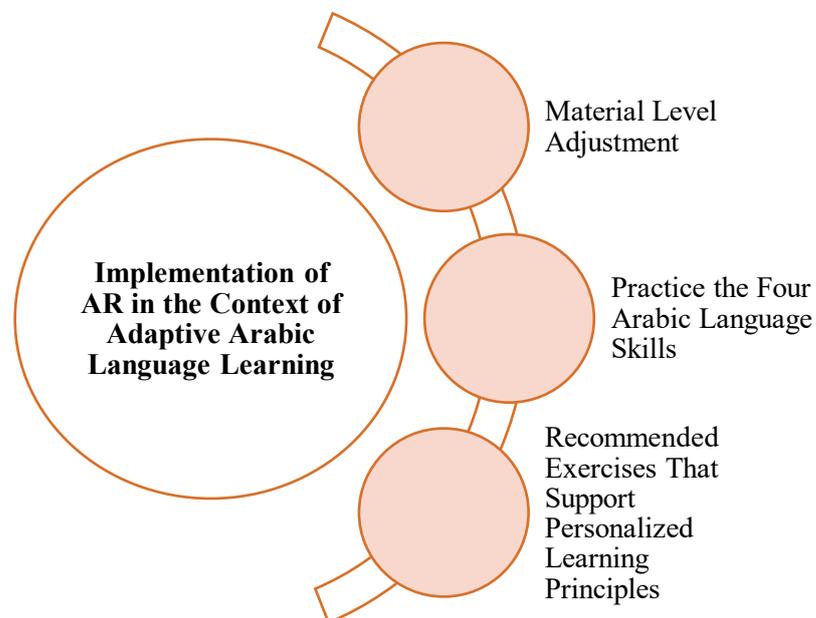


Figure 6: Implementation of AR in the context of Adaptive Arabic learning

Advantages of AR in the Context of Arabic Language Learning

1. Improving vocabulary comprehension through 3D visuals: Visualized object representations make it easier for students to understand meaning without direct association.
2. Fostering learning motivation: AR creates an immersive learning experience, thus overcoming the boredom of lectures or traditional methods.
3. Media that suits the characteristics of digital generation students: AR supports the visual-kinesthetic learning style, which is dominant among Arabic Language Education students today.
4. Encouraging self-directed learning: Using AR outside the classroom allows students to explore the material independently. This can be seen in the following image:

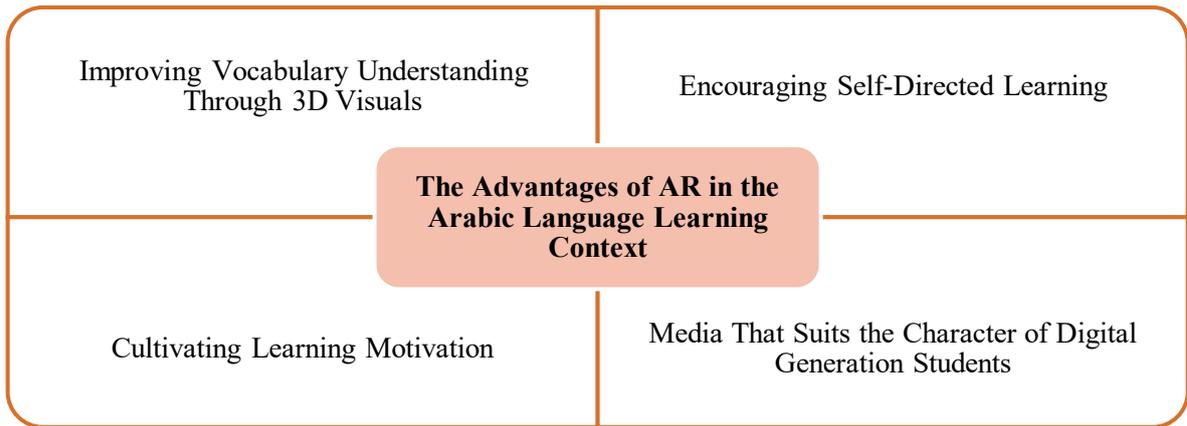


Figure 7: Advantages of AR in the Arabic Language Learning Context

AR Implementation Challenges

Some of the identified technical and pedagogical challenges include:

1. Not all student devices are compatible, especially those with low capacity.
2. Lecturers' readiness still needs to be improved, particularly in designing AR materials and utilizing adaptive features.
3. The availability of 3D models relevant to Arabic language materials is still limited, requiring time in the design process. This can be seen in the following image:

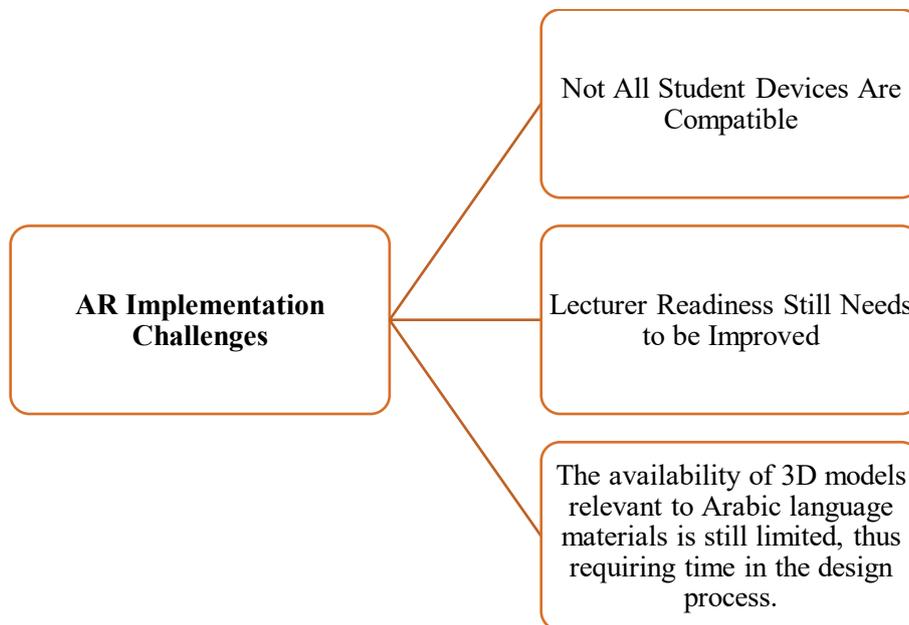


Figure 8: AR Implementation Challenges

This shows that AR adoption requires a phased implementation strategy that includes lecturer workshops and infrastructure support.

Research Limitations: Although this research provides an in-depth overview of the use of Augmented Reality (AR) in adaptive Arabic language learning, several limitations warrant consideration: 1. This research used a case study design within a single study program at a single university, so the findings

are contextual and cannot be broadly generalized to all Arabic language education institutions. Student characteristics, faculty readiness, and technological infrastructure support may vary in other settings. 2. The duration of AR implementation was limited to a single learning period, so this study does not fully describe the long-term impact of AR use on the sustainable development of students' Arabic language competencies. 3. The research focused more on learning experiences, perceptions, and the learning process, so quantitative measurement of learning outcomes was not the primary focus. Statistically measurable academic impacts require further study. 4. Technical constraints, such as limited devices, internet connection, and students' digital literacy levels, also impacted the smooth implementation of AR. These factors are beyond the direct control of the learning design but influence the learning experience.

The findings of this study open up various opportunities for further research. 1. Further research could employ a mixed methods or quasi-experimental design to quantitatively test the effectiveness of AR media on improving specific Arabic language skills, such as speaking or vocabulary mastery. 2. Longitudinal studies are needed to assess the long-term impact of AR use, including the sustainability of students' learning motivation and the development of their communicative competence. 3. AR development could be expanded with the integration of artificial intelligence (AI) to provide automated feedback, language error analysis, and increasingly personalized learning paths. 4. Further research could also explore the application of AR in different contexts, such as Arabic language learning in madrasas, Islamic boarding schools, or for non-formal learners, to gain a broader understanding of the technology's adaptability across various educational settings. 5. Pedagogical aspects could also be explored, for example, by examining the role of lecturers in designing AR-based learning scenarios and strategies for integrating them with communicative approaches.

This reflection confirms that although AR shows great potential in adaptive Arabic language learning, its development remains a rich field for further research, both in terms of technology, pedagogy, and learning evaluation.

Pedagogical Implications for the PBA Study Program at UNM Makassar

The research results indicate that the use of AR can be used as a new learning strategy with the following implications:

1. Strengthening the digital curriculum in instructional media and teaching methods courses.
2. Providing a virtual laboratory (Virtual Arabic Lab) based on AR and AI.
3. Developing a 3D model bank for vocabulary, grammar, Arabic cultural environments, and dialogue simulations. This can be seen in the following figure:

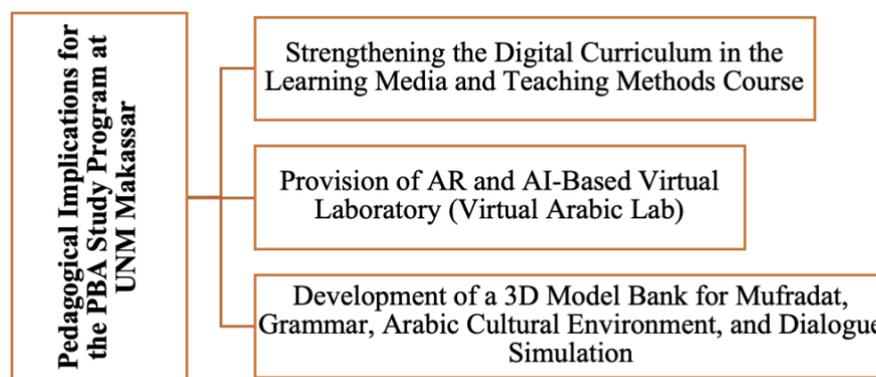


Figure 9: Pedagogical Implications for the PBA Study Program at UNM Makassar

AR integration is also in line with the vision of the PBA UNM Makassar Study Program to become a center of excellence for the development of Arabic language learning technology in Eastern Indonesia.

Alignment with Foreign Language Learning Theories

The results of the AR implementation demonstrate alignment with several theories: 1. Behaviorism (reinforcement through direct feedback). 2. Cognitivist (3D visualizations aid the encoding and retrieval process). 3. Constructivism (students construct understanding through interaction with the digital environment). This can be seen in the following figure:

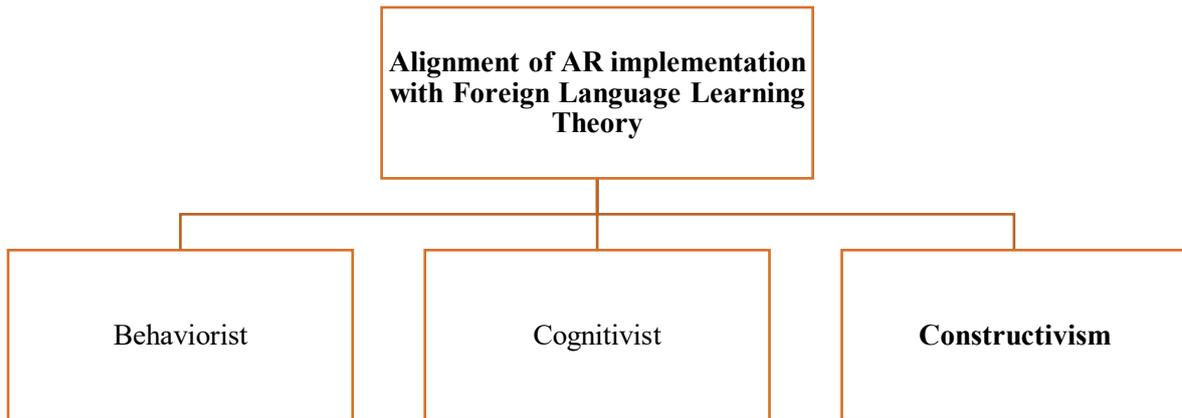


Figure 10: Alignment of AR Implementation with Foreign Language Learning Theory

Thus, AR is not just a visual medium, but also a learning tool/media that supports the holistic Arabic language learning process in the PBA Study Program at UNM Makassar.

4. Conclusion

Research on the Implementation of Augmented Reality in the Development of Adaptive Arabic Language Learning Media in the PBA Study Program at UNM Makassar yielded several important findings. First, the application of AR has been proven to provide a more immersive, interactive, and contextual learning experience for students. 3D object visualizations, dialogue simulations, and adaptive features that adjust to the material's difficulty level help students understand the four Arabic language skills more concretely and meaningfully.

Second, student responses demonstrated a high level of acceptance and motivation for using AR. The majority of students felt an improvement in their ability to understand the material and were more actively engaged in learning compared to conventional learning. Quantitative findings also confirmed that classes using AR demonstrated higher academic achievement.

Third, AR implementation still faces technical challenges, such as limited student devices and the need to improve lecturers' competency in AR content design. However, these obstacles are manageable through training, infrastructure support, and ongoing development of digital materials.

Fourth, pedagogically, the use of AR aligns with the development of technology-based curricula and supports student-centered adaptive learning. AR has great potential as an innovative learning strategy for developing Arabic language skills, particularly in vocabulary, text comprehension, and basic communication. Thus, the implementation of Augmented Reality in the PBA Study Program at UNM Makassar is not only effective in improving learning outcomes but also provides a new direction for innovation in Arabic language learning in higher education. This technology is relevant for further development as part of the digital transformation of language education in the modern era.

This research makes a significant contribution to the development of Arabic language learning theory and media, particularly in enriching studies on the integration of immersive technology in language learning. The research findings reinforce the view that Arabic language learning is no longer limited to textual and grammatical approaches and should move toward contextual, visual, and adaptive models grounded in experiential learning. From a media perspective, this study presents a conceptual model for developing augmented-reality-based Arabic language-learning media that combines 3D visualization, communicative context, and adaptive features as a pedagogical whole to support more meaningful language acquisition.

Based on the research findings, it is recommended that further research test the effectiveness of this model on a broader scale and in diverse educational contexts, as well as integrate other supporting technologies, such as artificial intelligence, to enhance personalized learning. Further studies should also explore the long-term impact of AR use on students' communicative competence and lecturers' readiness to design technology-based Arabic language learning, so that the innovations developed are not only technologically sound but also pedagogically sustainable.

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