Usability and User Experience Analysis of Language Learning Applications with Augmented Reality Technology

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Article Information:	ABSTRACT
	The integration of Augmented Reality (AR) technology into language learning applications has become increasingly popular due to its potential to enhance user engagement and improve learning outcomes. However, the usability and user experience (UX) of such applications are critical factors that determine their effectiveness. This study explores the usability and UX of language learning applications utilizing AR technology, aiming to evaluate how these applications meet the needs and preferences of users, and how they influence learning efficiency. The research adopts a mixed-methods approach, combining quantitative surveys and qualitative interviews with users who have engaged with AR-based language learning applications. Participants were asked to assess the usability aspects, such as ease of navigation, user interface design, and responsiveness, as well as their overall experience and satisfaction. The results show that users generally find AR-based language learning applications engaging and enjoyable, particularly for vocabulary acquisition and interactive learning activities. The study concludes that while AR has the potential to revolutionize language learning, further improvements in application stability, content design, and personalization are necessary to optimize usability and user satisfaction. **Keywords:** *Augmented Reality, Language Learning, User Experience*

INTRODUCTION

The integration of technology into education has transformed traditional learning methods, providing new opportunities for enhanced student engagement and more personalized learning experiences (Arhatia dkk., 2025; Sun dkk., 2025). Among the most promising technological advancements is Augmented Reality (AR), which overlays digital information onto the physical world, allowing users to interact with both virtual and real elements simultaneously. In the context of language learning, AR has gained attention for its potential to create immersive and interactive experiences that can enhance vocabulary acquisition, pronunciation, and cultural understanding. AR-based language learning applications offer a dynamic learning environment where learners can visualize and interact with language content in ways that traditional methods cannot. The ability to combine learning with interactive, real-world contexts has made AR a highly attractive tool for educators and learners alike (Ming dkk., 2025; Yu & Saniie, 2025). As these technologies continue to develop, understanding how users experience and interact with these applications becomes crucial to ensuring their effectiveness and widespread adoption.

In recent years, the number of AR-based language learning applications has increased significantly, with developers seeking to leverage the potential of this technology to create more engaging, user-friendly platforms. However, the success of these applications is not solely determined by their technological capabilities but by how well they align with users' needs and preferences (Bhutani dkk., 2025; Mat Sanusi dkk., 2025). Usability and user experience (UX) are key factors in determining whether learners will engage with and benefit from these applications. While the appeal of AR in education is clear, it is essential to assess how these applications perform from a usability and user experience perspective. This understanding can help developers improve their designs, address usability issues, and create applications that better meet the needs of language learners. As such, the usability and user experience of AR-based language learning applications are critical areas of study for both researchers and practitioners in the field of educational technology.

The increasing adoption of AR in educational applications calls for a comprehensive investigation into how these applications impact users, specifically in the context of language learning. Although previous studies have explored the role of AR in various educational settings, there remains a lack of in-depth analysis focusing on usability and user experience in the language learning domain (Devaraj, 2025; Williams & Nwagwu, 2025). This gap presents a timely opportunity for research to assess how AR technologies are perceived and experienced by users, ensuring that these applications contribute effectively to language learning goals and provide a satisfactory user experience.

Despite the growing popularity of AR-based language learning applications, there remains a significant gap in understanding how users perceive and interact with these technologies (Mat Sanusi dkk., 2025; Suenaga dkk., 2025). Most existing research on educational technology emphasizes the technological benefits of AR, such as its ability to enhance engagement, facilitate immersive learning, and improve information

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retention. However, little attention has been paid to understanding the usability of AR-based language learning applications from the learners' perspective. Specifically, issues related to the ease of use, user interface design, and functionality have not been systematically explored in depth. It is essential to investigate how these applications perform in terms of usability, as the user's ability to navigate the application effectively plays a critical role in their learning outcomes and overall satisfaction. Furthermore, usability issues such as technical difficulties, accessibility, and the compatibility of AR applications across different devices and platforms are key considerations that can influence user experience and determine the success or failure of such applications.

Another issue is the lack of comprehensive user experience research focused on AR language learning apps. While much of the existing literature has concentrated on the technological aspects of AR in education, there is a notable absence of studies that evaluate the learners' subjective experiences and satisfaction (Gazzotti dkk., 2025; Jin dkk., 2025). Understanding the factors that contribute to positive or negative user experiences in language learning apps is critical for improving application design and ensuring that users are not only engaged but also able to use the app efficiently and effectively. Learners' preferences, challenges, and motivations must be considered to ensure that AR technology meets the educational needs of diverse user groups. This study addresses these critical gaps by providing a focused examination of the usability and user experience of AR-based language learning applications.

By investigating the usability and user experience of AR language learning applications, this research aims to provide insights into how the design of such applications impacts learners' engagement and learning outcomes (M. Lu dkk., 2025; Vona dkk., 2025). The study will explore whether these applications successfully align with the expectations and needs of language learners, identifying the factors that contribute to effective learning experiences. The findings of this research will inform the development of future AR-based language learning applications and contribute to the broader field of educational technology.

The main objective of this research is to evaluate the usability and user experience of AR-based language learning applications. Specifically, the study aims to assess how well these applications support language learning, focusing on the ease of use, functionality, and design aspects that contribute to a positive or negative user experience. The research will explore several key factors, including the ease with which users can navigate the application, the intuitiveness of the interface, and the effectiveness of the learning tasks and interactions offered by the AR system. Another objective is to investigate how AR technology enhances or detracts from the language learning process, particularly in terms of engagement, motivation, and retention of language skills.

Through a combination of user surveys, interviews, and usability testing, the study will provide detailed insights into the user experience of AR-based language learning apps. The study will also aim to identify the most common usability issues faced by users, such as navigation challenges, technical glitches, and compatibility problems with devices (Karthikeyan & Aruna, 2025; Magrum dkk., 2025). Furthermore, the research will explore the different types of users, such as beginners versus advanced learners,

and how their experiences differ when using AR language learning apps. Understanding these variations is essential for ensuring that AR applications are designed to meet the needs of diverse learners and are adaptable across different proficiency levels.

The study will also assess the impact of AR technology on user engagement and motivation, two crucial factors that influence the success of language learning applications (Chauhan & Karthikeyan, 2025; Meirawan dkk., 2025). By evaluating both the positive and negative aspects of user experience, this research will provide a comprehensive understanding of how AR applications can be optimized for language learning, offering actionable insights for developers and educators who are looking to incorporate AR into language education (Kose & Gumusburun Ayalp, 2025; Yadav, 2025). Ultimately, the findings will contribute to improving the effectiveness and appeal of AR-based language learning applications, helping to ensure that they provide a meaningful and enriching experience for users.

A review of existing literature reveals several gaps in research related to the usability and user experience of AR-based language learning applications. While there is a significant body of work focused on the educational benefits of AR, such as its potential to enhance engagement and learning outcomes, studies examining the user experience of these applications are limited. Most research has emphasized the effectiveness of AR for learning in general terms, without considering how user interface design, navigation, and other usability aspects impact learners' ability to fully engage with the technology. There is a need for more focused studies that explore how AR technology affects users on a practical, day-to-day basis, especially in language learning environments (Arshi dkk., 2025; Ramtiyal dkk., 2025). Additionally, few studies have investigated the compatibility of AR-based applications across different devices and platforms, a critical consideration for ensuring accessibility and user satisfaction.

Another notable gap is the lack of research on the contextual factors that influence user experience, such as the specific needs and preferences of different learner groups. Much of the existing research has generalized the user experience without accounting for the diverse backgrounds, learning goals, and technological familiarity of individual users. This study addresses this gap by focusing on a variety of learners and examining how their individual experiences with AR-based language learning apps differ (Angra dkk., 2025; G. Lu dkk., 2025). Furthermore, while many studies have explored traditional language learning tools, the application of AR in language education presents unique challenges that have not been fully examined. This research contributes to the field by providing detailed insights into how AR technology intersects with language learning from a usability and experience standpoint.

By bridging these gaps, this study will provide a deeper understanding of the practical challenges and opportunities presented by AR in language education. The findings will not only inform the development of future AR-based language learning applications but will also offer valuable recommendations for improving user experience and usability, ultimately contributing to the growth of AR in educational contexts (Aththanayake dkk., 2025; Z. Lu dkk., 2025). The study's emphasis on both

technological and user-centered aspects of AR design fills a critical gap in current research and sets the stage for future innovations in educational technology.

This research introduces a novel approach to studying AR-based language learning applications by focusing specifically on their usability and user experience. While previous studies have primarily explored the educational potential of AR technology, this study emphasizes the practical aspects of how these applications function in real-world learning environments (Angra dkk., 2025; G. Lu dkk., 2025). The novelty of this research lies in its detailed examination of how user interface design, application functionality, and device compatibility affect learners' ability to engage with and benefit from AR-based language learning apps. By integrating usability testing with educational theory, the research provides a comprehensive assessment of AR applications that goes beyond traditional pedagogical evaluations.

The justification for this study is rooted in the growing interest in integrating AR technology into educational settings, particularly in language learning. As AR becomes increasingly prevalent in classrooms and self-learning environments, understanding how users interact with these applications is essential for improving their design and ensuring that they meet learners' needs (Aththanayake dkk., 2025; Z. Lu dkk., 2025). This research is particularly important as the demand for interactive and engaging language learning tools continues to rise. By addressing the critical areas of usability and user experience, the study offers a much-needed perspective on how AR can be optimized to enhance language learning experiences. Furthermore, the findings will contribute to the broader field of educational technology by providing insights into how emerging technologies, such as AR, can be integrated into pedagogical practices for maximum impact.

RESEARCH METHOD

The research design for this study follows a mixed-methods approach, combining both qualitative and quantitative methods to evaluate the usability and user experience of language learning applications using Augmented Reality (AR) technology. The study aims to assess how users interact with AR-based applications, focusing on ease of use, navigation, engagement, and overall satisfaction (Balawardhana, 2025; Indarta dkk., 2025). This approach allows for a comprehensive understanding of the strengths and limitations of AR-based language learning apps and provides actionable insights for developers to improve their design. Usability testing and user experience surveys are combined to ensure both objective data collection and in-depth feedback from users.

The population for this study consists of adult learners, including both beginner and intermediate language learners, who have experience with or are willing to engage with AR-based language learning applications. The sample includes 100 participants, divided into two groups based on their proficiency in the target language: 50 beginner learners and 50 intermediate learners (Pezzino dkk., 2025; Z. Wang dkk., 2025). These participants were selected to reflect a diverse range of language learning backgrounds and experiences with technology. The sample was drawn from university language programs, language schools, and online learning platforms to ensure a representative

mix of users with varying levels of prior experience with language learning and AR technology.

The primary instruments for data collection include a series of usability testing protocols and a comprehensive user experience (UX) survey. Usability testing will be conducted using a set of predefined tasks within the selected AR language learning applications, measuring metrics such as task completion time, error rates, and navigation difficulties (Kavitha dkk., 2025; Ravichandran & Mohan, 2025). A post-task questionnaire will assess participants' subjective experiences, gathering feedback on ease of use, visual appeal, and overall satisfaction. Additionally, a standardized UX survey based on established models (e.g., System Usability Scale - SUS and User Experience Questionnaire - UEQ) will be used to capture broader user perceptions of the application's functionality, engagement, and satisfaction.

The procedures for this study begin with the selection of AR-based language learning applications that are widely used and available on common devices, such as smartphones and tablets. Participants will be recruited through online advertisements and directly from language learning institutions (D. Wang & Huang, 2025; Yadav, 2025). Once recruited, participants will undergo an introductory session where they are familiarized with the application. They will then complete a series of tasks, such as vocabulary exercises, grammar activities, and interactive dialogues using the AR application. After completing the tasks, participants will fill out the UX survey and provide additional feedback during a follow-up interview. Data from usability testing, surveys, and interviews will be analyzed both quantitatively and qualitatively to identify key usability issues and user experience trends, ultimately offering insights into how AR technology can be optimized for language learning.

RESULTS AND DISCUSSION

The data collected from 100 participants in this study, consisting of 50 beginner and 50 intermediate language learners, was analyzed to assess the usability and user experience of AR-based language learning applications. Each participant completed a set of predefined tasks on the AR app, which included vocabulary, grammar exercises, and interactive dialogues. The tasks were timed, and the errors during task completion were recorded. Additionally, participants completed a post-task questionnaire and a standardized UX survey. In terms of usability, the average task completion time for beginners was 8.5 minutes, compared to 5.2 minutes for intermediate learners. The error rate for beginners was higher, with an average of 3.2 errors per task, while intermediate learners averaged 1.7 errors. The post-task UX survey revealed that 72% of intermediate learners rated the application as highly usable, while only 53% of beginner learners gave similar ratings.

Table 1. Regarding task completion time and error rates across proficiency levels:

Participant Group	Average Task Completion Time (minutes)	Average Error Rate (per task)	Positive UX Rating (%)
Beginner Learners	8.5	3.2	53%

Intermediate Learners	5.2	1.7	72%

The data indicates that intermediate learners were more proficient in navigating the AR language learning applications compared to beginners. This is reflected in both the shorter task completion times and the lower error rates for intermediate learners. The more experienced learners appeared to engage more quickly with the interface and were able to complete tasks more efficiently. Additionally, the positive UX ratings were higher for intermediate learners, suggesting that familiarity with language learning apps and greater confidence in using technology contributed to their more favorable experience. On the other hand, beginners, who had less experience with both language learning apps and AR technology, faced more challenges in completing tasks and had a higher incidence of errors.

The post-task questionnaire also indicated that beginners struggled with the user interface design and found the AR features somewhat overwhelming. In contrast, intermediate learners appreciated the interactive and immersive aspects of the AR application, noting that these features made learning more engaging and enjoyable. However, some beginners expressed frustration with the app's complexity, particularly the need to interact with the AR elements to complete tasks. This suggests that while AR can enhance the learning experience, the complexity of the technology needs to be carefully balanced with user experience to ensure usability for all learner levels.

In addition to usability data, the user experience survey revealed insights into participants' overall satisfaction with the AR language learning applications. Intermediate learners consistently rated the application higher for engagement, ease of use, and visual appeal. The average satisfaction score for intermediate learners was 4.2 out of 5, while beginner learners gave an average rating of 3.4 out of 5. In terms of ease of use, intermediate learners reported that they found the interface intuitive and the AR features easy to interact with. Beginners, however, reported mixed feelings, with some participants appreciating the novelty of AR, while others felt that the technology distracted them from the learning objectives. This difference in satisfaction underscores the importance of tailoring AR applications to the skill level and technological familiarity of users.

The study also found that participants who engaged with the AR features, such as interacting with virtual objects or visualizing vocabulary in 3D, reported higher levels of motivation and enjoyment. However, the usability issues faced by beginners suggest that the application could be further optimized to provide a smoother learning experience for less experienced users. The application's interface design, including its navigation and AR features, played a significant role in determining how users interacted with the content, influencing both the task completion time and their overall satisfaction.

Inferential analysis was conducted to examine the relationship between proficiency level, task completion time, error rates, and user experience ratings. The results revealed a statistically significant difference in task completion times and error rates between beginner and intermediate learners ($p < 0.05$). Intermediate learners completed tasks faster and made fewer errors, reflecting their higher comfort level with

technology and language learning apps. The analysis also showed a significant relationship between proficiency level and UX satisfaction, with intermediate learners providing higher satisfaction ratings ($p < 0.01$). This finding supports the hypothesis that more experienced users, who are better acquainted with language learning technology, are likely to have a more positive experience with AR applications.

The regression analysis further highlighted that proficiency level was the strongest predictor of task completion time ($R^2 = 0.76$) and error rate ($R^2 = 0.63$). However, the analysis also suggested that the user interface design played a moderating role in the user experience, particularly for beginners. The ease of navigation and clarity of the AR features were found to significantly affect task completion and error rates for beginner learners. This indicates that while proficiency is a key factor, the design and usability of the application are critical for ensuring a positive experience, particularly for novice users.

The relationship between AR technology and user experience was evident in how different user groups interacted with the application. Intermediate learners were able to leverage the AR features effectively to enhance their language learning, reporting high levels of engagement and enjoyment. In contrast, beginners struggled to integrate AR technology into their learning process, which impacted their task completion and error rates. This data suggests that AR applications for language learning may need to include adaptive features or a gradual learning curve to accommodate users with varying levels of proficiency and familiarity with technology.

The data also suggests a strong correlation between users' prior experience with language learning applications and their ability to utilize AR features effectively. The intermediate learners, who had prior experience with language apps, exhibited a smoother learning curve, allowing them to focus more on the language content rather than the technology itself. Beginners, on the other hand, appeared to divide their attention between mastering both the language and the application interface, which may have hindered their ability to effectively learn and engage with the content. This relationship highlights the need for designing AR applications that cater to different levels of technological fluency to ensure accessibility and optimal learning outcomes.

A case study focusing on the use of AR for vocabulary learning revealed key differences between beginner and intermediate users. For example, when tasked with learning new vocabulary words in an AR environment, intermediate learners were able to interact with virtual objects and immediately associate them with the correct words in the target language. This immersive experience enhanced their retention and engagement with the material. Beginner learners, however, found the AR interface to be a distraction, as they struggled to navigate the virtual objects and had difficulty connecting them to the target words. The study noted that some beginner users would repeatedly ask for clarification on how to interact with the AR elements, indicating that they felt overwhelmed by the complexity of the interface.

The case study also highlighted that intermediate learners showed a higher degree of autonomy and confidence in navigating the application. These users were able to explore different AR features, such as manipulating virtual objects and visualizing language in 3D, without needing much guidance. In contrast, beginners required more

structured support, with many relying on the provided instructions and tutorials. This case study exemplifies the challenges faced by less experienced users in adapting to new technology, as well as the need for AR applications to provide tailored experiences based on users' proficiency levels.

Explanatory analysis of the data highlights that while AR technology has the potential to engage and motivate learners, its effectiveness depends on the users' proficiency and familiarity with the technology. For more experienced learners, AR provides an engaging and immersive learning experience that complements traditional language learning methods. However, for beginners, the novelty and complexity of AR technology can act as a barrier to effective learning. The data suggests that AR applications need to be designed with an adaptive user interface that accommodates various skill levels, providing simpler navigation options for beginners while still offering advanced features for more proficient learners.

The findings emphasize the importance of considering both technological fluency and language proficiency when designing AR-based language learning applications. A key takeaway is that these applications should not only focus on the content but also on the user experience, ensuring that the interface is intuitive, the AR features are clearly explained, and the overall design is user-friendly. By addressing these factors, developers can create applications that are accessible and effective for a wider range of learners, ensuring that AR technology enhances rather than hinders the language learning process.

In conclusion, this study reveals that while AR-based language learning applications can provide an engaging and interactive learning experience, their usability and effectiveness are significantly influenced by users' proficiency levels and familiarity with technology. The results highlight the need for personalized experiences that cater to both beginner and intermediate learners. The findings suggest that improving the user interface design and providing adaptive features for different skill levels can enhance the usability of these applications, leading to better learning outcomes and higher user satisfaction. As AR technology continues to evolve, its potential in language learning can be maximized by focusing on both its technological capabilities and the overall user experience.

The study evaluated the usability and user experience (UX) of Augmented Reality (AR)-based language learning applications, focusing on the task completion times, error rates, and user satisfaction. The results revealed that intermediate learners completed tasks more efficiently than beginners, with faster completion times and fewer errors. Additionally, intermediate learners rated their experience more positively, particularly in terms of ease of use and engagement. Beginner learners, on the other hand, reported difficulties in navigating the application, with many expressing that the AR features were overwhelming. These challenges were reflected in their lower UX ratings and higher error rates. Despite these challenges, both groups found the AR elements engaging, indicating the potential of AR to enhance the language learning experience. The findings also highlight that usability issues, particularly for beginners, could hinder the overall learning process if not addressed.

The findings align with previous studies on AR applications in education, which have shown that AR enhances user engagement and learning outcomes, particularly when the technology is effectively integrated into the learning process (Bacca et al., 2014). However, this study also deviates from prior research by emphasizing the need for differentiated user experiences based on proficiency level. Previous research often generalizes the impact of AR, but this study demonstrates that user proficiency plays a critical role in how well AR features are utilized. While AR has been shown to improve motivation and interactivity, this research underscores that without proper usability considerations, the technology may overwhelm less experienced users. The study also resonates with work on the role of user interface design in technology adoption (Khalil et al., 2019), which suggests that the ease of navigation and intuitiveness of the interface are key to ensuring a positive user experience.

The results signify that AR-based language learning applications have the potential to engage and motivate users, but their usability varies depending on the user's familiarity with technology. The increased satisfaction and faster task completion for intermediate learners indicate that experience with both language learning applications and technology plays a significant role in determining the effectiveness of AR features. The challenges faced by beginner learners highlight that the complexity of AR technology must be carefully balanced with user needs. The findings suggest that the technology's effectiveness is not solely based on its innovative features but on how well it can be integrated into the learning process and adapted to the proficiency levels of users. This insight is important for future AR-based applications, as it emphasizes the need for personalized experiences that cater to different levels of technological fluency and learning ability.

The implications of this study are crucial for developers and educators seeking to integrate AR technology into language learning. The findings suggest that while AR can offer significant benefits in terms of engagement and interaction, its usability must be tailored to meet the needs of diverse user groups. Developers should consider creating adaptive user interfaces that adjust to the user's proficiency level, offering simpler navigation and fewer interactive elements for beginners while providing advanced features for more experienced learners. For educators, the study highlights the importance of selecting technology that aligns with students' prior knowledge and technological skills to maximize learning outcomes. These implications are essential for ensuring that AR language learning applications are not only effective but also accessible to all learners, regardless of their familiarity with the technology.

The results are reflective of the increasing complexity of technology and its interaction with varying user capabilities. Intermediate learners, who are more accustomed to digital learning tools, were able to leverage AR features effectively, enhancing their learning experience. In contrast, beginner learners, who are less familiar with technology, faced difficulties in navigating the application, resulting in lower usability ratings. This discrepancy can be explained by the cognitive load required to use AR technology, which can be higher for those who are not technologically fluent. Additionally, the overwhelming nature of AR features for beginners points to the need for applications to provide clear instructions and gradual exposure to the technology.

The complexity of AR, though beneficial in engagement, can become a barrier if not designed with the user's experience in mind.

The next steps in this area of research involve refining the design of AR-based language learning applications to cater to varying levels of proficiency and technological familiarity. Future research should focus on developing adaptive AR systems that allow for different levels of interaction based on the user's experience. Additionally, it is important to expand the sample size and include a broader range of learners, such as those with no prior experience with AR technology, to better understand how to optimize the learning experience for beginners. Further studies could also investigate the long-term impact of AR on language retention and motivation, as short-term usability studies may not fully capture the sustained effects of using AR in language education. Finally, examining the integration of AR with other educational technologies, such as AI-driven tutoring systems, could provide insights into creating more immersive and effective language learning environments.

CONCLUSION

The most important finding of this research is that Augmented Reality (AR)-based language learning applications provide a highly engaging experience for users but exhibit significant usability challenges for beginners. The study revealed that intermediate learners, who had more experience with technology and language learning applications, demonstrated faster task completion and fewer errors, as well as higher overall satisfaction ratings. In contrast, beginners faced difficulties with navigation, resulting in longer task completion times and a higher error rate. These findings highlight the need for AR applications to consider user proficiency and offer adaptive features to accommodate learners with varying levels of technological fluency and experience in language learning.

This research contributes valuable insights to the field by applying usability testing and user experience analysis to AR language learning applications, a relatively underexplored area. By combining both qualitative and quantitative data, this study provides a comprehensive understanding of how AR technology impacts the learning process and user engagement. The methodological approach of combining usability metrics with user experience surveys allows for a nuanced analysis of the interaction between learners and technology. This contribution is significant, as it offers practical guidelines for developers and educators to optimize AR-based language learning tools by focusing on user-centered design and ensuring that applications are intuitive and effective across different user groups.

One limitation of this study is the relatively small sample size, which may not fully represent the diversity of learners who use language learning applications. The study's focus on university-level learners with basic to intermediate experience with language learning applications limits the generalizability of the findings to broader populations, such as younger learners or individuals with limited technological experience. Future research could expand the sample to include a more diverse range of learners, such as older adults, children, and those with little prior exposure to technology, to examine how AR-based language learning applications perform across

different demographic groups. Additionally, a longitudinal study could explore the long-term effects of AR technology on language retention and learner motivation, providing a more comprehensive understanding of its educational potential.

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