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Design And Development of an Augmented Reality Module For Learning Arabic Collocations

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Abstract
This study investigates an instructional module's design, development, and effectiveness for learning Arabic collocations using Augmented Reality (AR) technology. A needs analysis was conducted to identify students' challenges with Arabic collocations and their preferred learning strategies. Based on these insights, the module was designed using the ADDIE Model, integrating multimedia elements such as text, images, audio, animations, video, and 2D/3D models to improve engagement and comprehension. The AR-based module, AR Collocation, was implemented among 30 advanced learners at the International Islamic University Malaysia (IIUM). Data were collected through interviews, questionnaires, and student feedback, focusing on usability and learning outcomes. The results showed that the AR module significantly enhanced students' understanding of Arabic collocations, with a mean score of 4.3 ($p < 0.05$). Students also rated the readability of fonts and the multimedia components highly (mean values: 4.73 and 4.87), expressing overall satisfaction with the interactive features. This study concludes that AR-based instructional modules can improve Arabic language learning and recommends further exploring AR's potential in teaching Arabic as a second language.
Keywords: Arabic Collocation; Augmenty Reality; Teaching Arabic; Learning Arabic; Education Technology

INTRODUCTION

Vocabulary is the foundation of Arabic language learning, and the extensive vocabulary often confuses learners. Understanding vocabulary and word collocations is crucial for effective language acquisition, particularly in Arabic. Many applications now offer dictionary and translation features; however, learning Arabic grammar through apps is still uncommon. Mobile apps that support Arabic grammar practice are especially needed for non-native Arabic speakers. Collocations are essential for language practice;

knowledge of Arabic collocations helps learners create more fluent, natural, and nuanced language expressions. Thus, understanding collocations is vital for Arabic learners striving for fluency. Collocations are word combinations that frequently occur together in a language. A significant number of exercises are needed to practice word collocations. The environment established in seminars or classrooms is often insufficient to achieve this goal, and many digital resources do not adequately support the practice of collocations. Extracting co-occurrence relationships combined with deep learning technologies is an important yet challenging issue in the field of natural language processing. The currently unsatisfactory results of Arabic collocation extraction have seriously hindered the effectiveness of Arabic vocabulary practice (Saito, 2020).

Augmented Reality (AR) is an innovative technology that has recently emerged in the educational landscape, including in the context of language learning and teaching. In Malaysia, studies have explored the integration of AR into Arabic language education, revealing its potential to enrich learning experiences (Yusof et al., 2024; Majid and Salam, 2021). AR allows for the incorporation of virtual objects into the real world, creating opportunities for contextual and interactive multimedia content. This enhances the Arabic language learning process by making it more engaging for students. Research shows that learners are more actively involved when using AR tools, as they provide interactive experiences that encompass various language skills such as listening, reading, speaking, and writing. Most notably, AR fosters an interactive and motivating environment, enabling learners to build their knowledge of the Arabic language in realistic contexts. In summary, the advancement of AR technology—particularly in mobile applications—holds considerable promise in revolutionizing Arabic language teaching and learning in Malaysia, offering innovative methods to enhance educational experiences and outcomes (Wen, 2021).

However, the development of AR-based interactive software for language learning, particularly for teaching Arabic to non-native speakers, has not been explored as extensively as other languages. Most research has focused on English, Japanese, and to a lesser extent Chinese, followed by other languages like Korean (Belda-Medina & Marrahi-Gomez, 2023). Given AR's potential to revolutionize language education, this paper addresses the identified gaps by proposing an approach to enhance learning experiences through the development of an AR module for learning Arabic collocations tailored for students in the Arabic for International Communication program. The focus on Arabic collocation instruction is justified due to the pivotal role collocations play in learning and communicating in the language. The AR module is particularly beneficial for international students, as it aids in delivering a more immersive environment for Arabic culture and tradition in a cost-effective manner (Tolba et al., 2024; Yusof et al., 2024).

AR technology superimposes digital content—such as text, images, animations, videos, holograms, or 3D models—onto the real world through devices like smartphones, tablets, or AR headsets, creating an interactive and immersive learning environment (Noor et al., 2020). In educational contexts, AR provides unique opportunities to enhance traditional learning experiences by integrating virtual elements into real-world settings, thereby enriching educational processes with interactive visualizations and experiential learning activities that foster deeper understanding and engagement (Hamzah et al., 2021).

In conclusion, the increasing incorporation of AR in education—driven by its unique capabilities to merge virtual and real worlds—marks a paradigm shift in how educational content is delivered and consumed. Continued exploration of AR's applications, especially in domains like language learning and technical education, will further illuminate its role as a catalyst for innovative pedagogical strategies and tools. The centrality of AR in reshaping modern education is evident not only in its current applications but also in its potential to meet future educational challenges and opportunities. AR represents a pivotal innovation in education, combining the power of digital technology with the benefits of experiential learning. Its ability to make learning more interactive, engaging, and accessible underscores its central role in shaping the future of education, where the boundaries between physical and virtual learning environments continue to blur. As AR evolves, its integration into educational practices will likely lead to more personalized, effective, and equitable learning experiences.

Arabic is one of the languages that utilize collocations, and every language possesses unique collocational features. A group of words that are frequently found together is known as a collocation. Scholars recognize that collocational learning is the dominant strategy employed by foreign language learners who have intermediate-level proficiency. Arabic language scholars have introduced several terms to explain the concept of collocation. Among them are الرَصْف (al-rasf) by Umar (1998), المُتَلَازمَات اللفْظِيَّة (al-mutalazimat al-lafziyyah) by Said (2014), and المُتَصَاحِبَات (al-mutasahibat) by Al-Tahir ʻAbd al-Salam (2004). For example, سِتْرُ العَوْرَةِ (sitr al-ʻawrah), meaning "to cover the private parts," is an accepted collocation, whereas غُلِق العَوْرَةِ (ghuliq al-ʻawrah), which translates to "to close the private parts," is not, despite غلق (ghalq) meaning "to cover." Thus, the meaning of collocation is easier to understand through collocated words, even though they are slightly bound by certain rules.

According to Santillán Grimm (2009), collocations are easier from a semantic perspective yet more flexible than regular expressions and idioms in terms of syntactic structure. Collocation efficiency is considered a determinant of a student's mastery of a second or foreign language (Hill, 2000; Lewis, 2000; Mansoor, 2019; Nation, 2001; Wray, 2002). In comparison to students at the basic level, Lewis (2000) believes that second language learners at the intermediate and advanced levels require greater collocational information to master more complex target language skills.

Recent studies have further emphasized the importance of collocations in language acquisition. For instance, Al-Hamly (2021) highlights that collocational knowledge significantly enhances learners' fluency and comprehension in Arabic. Additionally, Al-Mansoori (2022) discusses the role of collocations in improving writing skills among Arabic language learners, suggesting that explicit instruction in collocations can lead to better language outcomes.

In summary, the study of Arabic collocations is essential for understanding the nuances of the language and improving proficiency among learners. By focusing on collocational patterns, educators can provide students with the tools necessary to communicate effectively and naturally in Arabic.

METHOD

The "Analysis, Design, Development, Implementation, and Evaluation" model, commonly known as the ADDIE model, outlines a series of steps typically employed by instructional designers and training developers. These steps include:

1. Analysis: Identifying instructional materials, methods, and tools, as well as recognizing any limitations and challenges.
2. Design: Preparing the materials to be used during step-by-step instruction.
3. Development: Creating and assembling the material format and content.
4. Implementation: Evaluating the materials through their actual usage in instructional programs.
5. Evaluation: Assessing the outcomes and achieving operational and financial goals.

In the field of language education, instructional design models provide a systematic and efficient approach to creating effective language communication materials. The literature offers an abundance of principles for designing learning materials. However, teachers and instructional material developers often face the challenge of navigating the vast number of potential designs for media and methodology, leading to a situation where "no one clear 'blueprint' exists that can be directly transferred from theory to the classroom." Despite this, successful and well-established process models can be customized to meet diverse learning objectives while maximizing the educational potential of resources to create engaging learning environments.

The ADDIE model is one of the most widely recognized instructional design frameworks. Its origins trace back to the instructional systems design of the 1950s, and the model has been widely utilized over the past several decades to enhance various language training programs and, in some instances, to facilitate the implementation of national language policies (Almelhi, 2021; Spatioti et al., 2022).

The findings, supported by a Cronbach's Alpha reliability statistic of 0.969 (N of items: 22), indicate that learners face significant challenges in mastering Arabic collocations, primarily due to the lack of interactive and contextual learning tools. Based on this reliable needs analysis, which reflects high internal consistency, the researchers designed and developed an instructional module for learning Arabic collocations. This module is carefully crafted to meet student needs, incorporating their feedback and perceptions of the multimedia elements essential for the AR collocation module, as well as the user interface design for a mobile application.

Image 1. Realibility Statistics

Reliability Statistics

Cronbach's Alpha	N of Items
.969	22

Design and Development

The researchers initiated the design and development of the module by creating 40 lessons focused on teaching and learning Arabic collocations through augmented reality technology. This development was guided by student feedback from the needs analysis, which highlighted preferences for interactive features and user-friendly multimedia elements, directly influencing the design choices, such as the inclusion of 3D animations and audio cues.

Upon completing the design process, the researchers produced the AR Collocation module with the following features:

1. Module Structure: Comprises 40 lessons.
2. Learning Method: Mobile Learning.
3. Operating System: Compatible with Android smartphones.

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4. Download Method: Available for download via an APK file.
5. Module Development Process

The development of the AR module began with the careful selection of primary Arabic verbs, essential for mastering grammatical structures. Each of the 40 lessons focuses on a specific verb, allowing learners to explore its usage and meaning in different contexts. This modular approach ensures progressive learning, where each lesson builds on the previous one, enhancing learners' proficiency over time. To create an engaging and effective learning experience, the researchers used advanced design platforms like Unity3D, Vuforia, and Adobe Photoshop. Unity3D served as the main framework, enabling the integration of interactive 3D models and animations for dynamic verb pattern visualization. Vuforia enhanced the module's interactivity by overlaying digital content onto the physical environment through image recognition, allowing learners to interact with 3D Arabic scripts and verb models. Adobe Photoshop was used to design high-resolution images and aesthetic elements, ensuring that the module remained visually appealing and engaging for learners.To ensure the AR module is both engaging and pedagogically sound, the researchers employed several well-established design platforms recognized for their effectiveness in creating immersive learning experiences. The platforms used include Unity3D, Vuforia, and Adobe Photoshop, each selected for its specific strengths in AR content creation.

RESULTS AND DISCUSSION

Embedded Multimedia Elements in the AR Collocation Module

The AR Collocation module uses 3D models and animations to bring Arabic collocations to life. For example, when learners encounter verbs like "أخذ" (to take), the module displays 3D models in different contexts, such as "أخذ القرار" (to make a decision) or "أخذ الدواء" (to take medicine). These interactive visualizations help learners understand the meanings and uses of collocations in various scenarios, providing a concrete learning experience. Similarly, animations illustrate verbs like "شرب" (to drink) in context, enhancing the understanding of collocative phrases like "شرب الماء" (drinking water). In addition to visual aids, the module incorporates audio elements with high-quality contextual recordings. These audio cues demonstrate how intonation and stress vary depending on the collocation's context, aiding learners in grasping the correct pronunciation and usage of each collocation. The text and visual content further support this by overlaying definitions, examples, and synonyms onto the screen when learners interact with AR features, offering immediate explanations without interrupting the learning process.

Finally, the module includes instructional videos and augmented reality (AR) demonstrations that showcase the usage of collocations in real-life settings. These videos are triggered by scanning images and present various scenarios, such as markets or doctor's offices, where learners can see collocations used in context. This approach reinforces learners' understanding of collocations and their proper usage in everyday conversations.

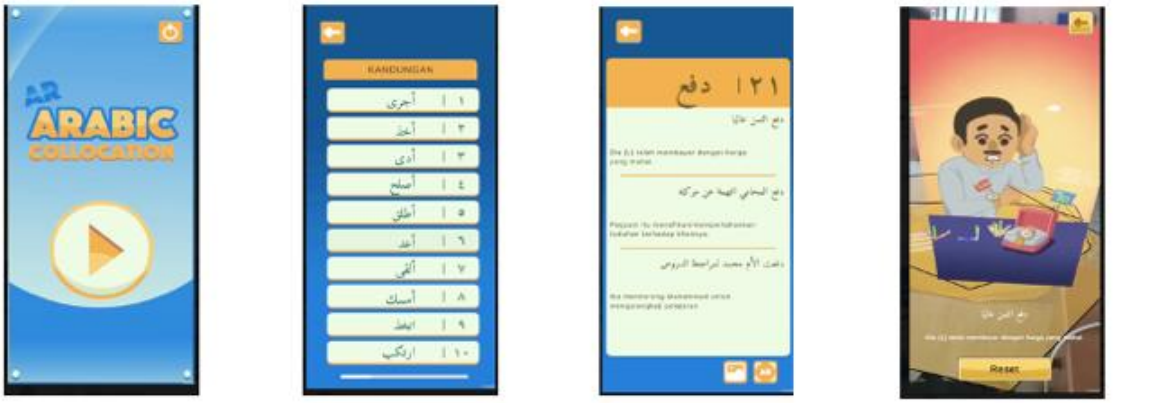
Pedagogical Approach in Learning Arabic Collocation Using Augmented Reality

Integrating multimedia elements within the AR Collocation module enhances its pedagogical effectiveness by providing a multisensory, interactive learning environment (O'Malley et al., 2014). The use of 3D visualizations, contextual animations, and dynamic

audio cues helps bridge the gap between abstract language concepts and concrete understanding, making the learning of Arabic collocations more accessible and engaging (Dede, 2009).

By demonstrating how different collocations are used in varying contexts, learners are exposed to the nuances and subtleties of the Arabic language, thus improving their comprehension and ability to use these phrases correctly in conversation (Ahmad & Ainsworth, 2019). This approach aligns with cognitive learning theories that emphasize the importance of context-based learning, where understanding is constructed through interaction with realistic and meaningful content (Brusilovsky & Millán, 2018).

Image 2. Images AR for Learning AC



User Interface 40 AR Collocation's Lesson 40 AR Collocation's Lesson

Implementation and Evaluation

The researcher assessed the usability of the mobile application for learning Arabic collocations among 30 students majoring in Arabic at the International Islamic University Malaysia (IIUM). This assessment was conducted using a five-level scale based on Rebecca Oxford's standards, with ratings ranging from 1 (least favorable) to 5 (most favorable) (Oxford, 1990). The evaluation results indicated that all criteria received very high ratings, with two items receiving high ratings. This reflects a positive reception of the AR Collocation module among participants. Following the successful implementation of the AR Collocation module, an evaluation was conducted to assess its usability and effectiveness in enhancing student learning outcomes. The results from this evaluation suggest that the module significantly contributed to improving comprehension and retention of Arabic collocations, aligning with previous studies that emphasize the role of interactive tools in language acquisition (Chi et al., 2018).

Table 1. Students' perception toward using AR in AC

No	Evaluation Criteria	Mean	Result
1	The font size is readable	4.87	Very High
2	Suitable use of colors	4.8	Very High
3	The font type is suitable	4.73	Very High
4	Attractive animation	4.7	Very High
5	User friendly	4.7	Very High
6	Interactive graphics and pictures	4.67	Very High
7	Clear sound and voice	4.6	Very High

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8	Overall performance	4.6	Very High
9	Interactive main interface	4.53	Very High
10	Interactivity	4.3	High
11	This Programs helps better understanding of lesson	4.3	High

The usability evaluation of the mobile application for learning Arabic collocations was conducted among 30 students majoring in Arabic at the International Islamic University Malaysia (IIUM). The evaluation focused on several key criteria related to the application's design, functionality, and effectiveness in enhancing learning experiences. The results are summarized based on the mean scores assigned to each segment by the participants.

The font size and color usage in the AR Collocation module received the highest ratings, with mean scores of 4.87 and 4.8, respectively. This reflects the application's strong visual appeal and readability, significantly enhancing user comfort and supporting learning retention (Mayer, 2009). A larger font size combined with a well-chosen color palette contributes to a more accessible and enjoyable learning environment, allowing students to focus on content without straining their eyes.

Additionally, the choice of font type and the incorporation of animations also garnered high ratings, with mean scores of 4.73 and 4.7, respectively. These results demonstrate the text's suitability for readability and highlight the stimulating effect of the animations. The animations not only engage learners but also visually represent complex concepts, making them easier to understand and remember (Wang & Shen, 2012).
User-friendliness, overall performance, and the inclusion of interactive graphics and pictures were similarly well-received, with mean scores of 4.7, 4.6, and 4.67, respectively. This indicates that students found the interface not only engaging but also easy to navigate. Effective navigation is essential for maintaining learners' focus and flow, allowing them to benefit from visual aids that are known to enhance memory retention and understanding of the material (Mayer, 2005).

Furthermore, the clarity of sound and voice received a high rating of 4.6, underscoring the significance of auditory quality in teaching pronunciation and intonation. Clear audio is vital in language learning as it aids in the correct modeling of sounds, which is essential for students to develop proper speaking skills (Baker et al., 2017). The interactive main interface scored 4.53, reflecting its effectiveness in engaging users. An engaging interface promotes deeper interaction with the content, facilitating a more immersive learning experience. Interactivity encourages exploration and experimentation, both of which are critical in enhancing language acquisition (Lee & Chan, 2020). However, interactivity and the application's ability to help users better understand lessons received lower scores of 4.3. While these results are positive, they also suggest areas for potential improvement in enhancing engagement and content delivery. Encouraging more active participation and providing additional support mechanisms, such as guided tutorials or hints, could help increase comprehension and user satisfaction moving forward.

The findings from the evaluation indicate that the mobile application is perceived as highly usable and satisfactory by the students. The overall ratings reflect strong approval, particularly in key aspects such as font readability, graphics, sound quality, and user-friendliness. With most scores falling into the very high category, it suggests that the design elements effectively meet user needs, contributing to a positive learning

experience (Baker et al., 2017). By prioritizing visual and auditory quality, the application fosters an environment that enhances user comfort and encourages effective learning. Despite the overall positive feedback, the ratings for interactivity (4.3) and the application's ability to help users understand the lesson better (4.3) indicate potential areas for enhancement. While these scores are still commendable, they are relatively lower compared to other criteria, signaling that further development could yield even better learning outcomes. For instance, incorporating more interactive features, such as quizzes, instant feedback mechanisms, or gamified elements, could significantly boost engagement and comprehension (Lee & Chan, 2020). Additionally, refining content delivery methods—perhaps by integrating more contextual examples or case studies—could further support learners in grasping complex concepts within Arabic collocations.

While this study demonstrates the significant potential of Augmented Reality (AR) technology in language learning, it is not without its limitations. The sample size was restricted to 30 advanced learners from a single institution, which may limit the generalizability of the results. A larger and more diverse sample spanning multiple institutions would provide a broader perspective on the effectiveness of the AR module across different learner demographics and educational contexts.

Additionally, the study primarily focused on short-term learning outcomes, leaving the long-term effects of AR-enhanced learning unexplored. Understanding how AR technology influences language retention and mastery over time is vital for evaluating its overall effectiveness. Future research should consider longitudinal studies that track learners' progress and retention in the months and years following their engagement with AR-based learning tools. Such studies could yield valuable insights into the sustained impact of immersive educational technologies on language acquisition.

CONCLUSION

The data from the usability study suggest that the mobile application designed for learning Arabic collocations is efficient regarding user satisfaction, engagement, and usability. Most evaluated criteria received high ratings, indicating strong support for their use in educational contexts. The app's positive attributes, such as its visual design, interactive elements, and sound quality, contribute to an engaging learning experience, highlighting the potential of AR technology to transform language education.

However, there remains room for improvement in interactivity and instructional design. Enhancing these aspects could further boost the application's effectiveness in supporting language learning by promoting deeper engagement and understanding among users. Overall, the application demonstrates considerable potential as a tool for Arabic language education, providing an engaging, user-friendly platform that can be adapted for broader educational use. Future iterations should build upon the positive feedback received, addressing areas for enhancement while exploring its applicability in various educational settings, including formal and informal learning environments. In conclusion, developing the mobile application for learning Arabic collocations involved a systematic design process that included creating 40 lessons based on authoritative classical texts. A usability study revealed high user satisfaction, engagement, and usability ratings. While the application demonstrated strong effectiveness in educational contexts, feedback indicated the need for improvements in interactivity and instructional design. Overall, the application shows significant potential as an engaging and user-friendly tool for Arabic language education.

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