

WEB APPLICATIONS AS A MEDIA OF ARABIC LANGUAGE LEARNING: A STUDY OF CONCEPTS AND DEVELOPMENT STRATEGIES

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ABSTRACT

This study explores the development of web-based Arabic learning media applications in the digital era. The research highlights fundamental concepts, theoretical foundations, design principles, and development stages, while addressing challenges and solutions. Web-based applications are presented as interactive, flexible, and adaptive tools that support modern students' needs. Theoretical perspectives include behaviorism, cognitivism, constructivism, and Mayer's multimedia learning theory. Design principles emphasize interactivity, usability, consistency, feedback, and motivation, while language development focuses on contextualization and communicative approaches. Application components consist of learning content, interface design, multimedia support, and interactive evaluation systems. Development stages cover needs analysis, planning, design, technology selection, development, testing, implementation, and evaluation. Key challenges involve technical limitations, low teacher digital competence, internet constraints, and the complexity of Arabic digital design. Proposed solutions include training in educational technology, use of open-source platforms, lightweight application design, and collaboration between teachers and programmers. The study concludes that web-based applications can enhance Arabic learning quality in line with digital transformation demands.

Keywords: *Arabic Learning, Digital Era, Multimedia, Technology Integration, Web-Based Application*

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INTRODUCTION

Digital transformation in the world of education has become one of the most significant phenomena in the development of education in the 21st century. The development of information and communication technology has encouraged a paradigm shift in learning from conventional models to digital learning that is more flexible, interactive, and student-oriented. In this context, web-based learning media applications have emerged as a strategic innovation that allows the learning process to take place without space and time limits through the integration of various multimedia elements such as text, audio, video, animation, and interactive evaluation systems in one digital platform (Rahimi & Oh, 2024). The presence of web-based applications provides great opportunities for the development of language learning because language learning requires intensive interaction, continuous practice, and a multimodal learning experience so that students can develop communicative competencies optimally. In Arabic language learning, the use of web-based applications is becoming increasingly relevant because Arabic has complex linguistic characteristics, including the mastery of listening, speaking, reading, and writing skills that require the support of interactive media as well as a communicative learning environment.

Despite the rapid development of educational technology, the reality of learning Arabic in various educational institutions still faces a variety of actual problems that affect the quality of the learning process and outcomes. On the other hand, today's generation of students lives in a digital environment that is very close to interactive technology and visual media, so a monotonous

and minimal technology approach to learning is often considered unattractive. This problem is exacerbated by the limitations of digital-based Arabic learning media that are able to integrate various languages in an integrated learning system. In fact, learning Arabic requires media that can support pronunciation exercises, audio comprehension, conversational exercises, and interactive evaluation simultaneously.

Theoretically and philosophically, the development of web-based learning media applications in Arabic language learning has a strong foundation in the constructivism paradigm, multimedia learning theory, and communicative learning approaches (Sa'adi & Thohir, 2024). Although research on educational technology and digital-based language learning has continued to develop in recent years, there is still a significant research gap related to the development of web-based learning media applications specifically for Arabic language learning. Most of the previous research focused more on analyzing educational technology research trends, the effectiveness of the use of certain media, or the implementation of digital platforms in general without examining in depth the conceptual, pedagogical, and technical aspects of the systematic development of web-based Arabic language learning applications.

This condition shows the need for academic and practical studies to develop studies that not only discuss the use of technology in Arabic language learning, but also elaborate in depth on basic concepts, development principles, pedagogical design, and systematic stages in building web-based learning media applications. Based on this description, this article focuses on a discussion of understanding the concept and how to create web-based learning media applications for learning Arabic in the perspective of modern digital education. In line with the formulation of the problem, this article aims to provide a conceptual understanding of web-based learning media applications, explain the theoretical and philosophical foundations for its use in Arabic language learning, and outline the steps for developing web-based applications that can be used as guidelines in designing innovative Arabic learning media.

METHOD

This research uses a qualitative approach with a type of library *research* that focuses on conceptual analysis of the understanding and development of web-based learning media applications for Arabic language learning. This approach was chosen because the research aims to examine in depth the concepts, theories, development principles, and implementation models of web-based learning applications in the context of Arabic language education through various relevant scientific sources.

The data sources in this study consist of primary data and secondary data obtained from various scientific publications with international and national reputations that are relevant to the research topic. Primary data is in the form of Scopus Q1-indexed scientific journal articles and open access scientific sources published in the last two years regarding educational technology, web-based learning media, digital Arabic learning, multimedia learning, and interactive learning application development. Meanwhile, secondary data is obtained from academic books, international proceedings, research reports, and other scientific documents that support the conceptual study of the research. The data search process was carried out through various academic databases such as Scopus, ScienceDirect, SpringerOpen, Frontiers, and Google Scholar using keywords such as "web-based learning", "Arabic language learning technology", "educational technology", "interactive learning media", and "digital language learning". The selection of data sources is carried out selectively by considering the quality of the publication, the relevance of the theme, the novelty of the research, and the openness of access to the article so that the data used has strong academic validity.

The data collection technique in this study is carried out through documentation and systematic search of scientific literature with stages of identification, selection, classification, and evaluation of data sources relevant to the focus of the research. The articles and scientific documents that have been obtained are then analyzed using content *analysis* techniques and thematic analysis to identify the main concepts, patterns of development of web-based learning media, and their relevance to Arabic language learning. The analysis process is carried out through the stages of data reduction, thematic

categorization, data interpretation, and conclusion drawing in a critical and systematic manner. In addition, this study also uses a literature synthesis approach to integrate various previous research results so that a complete conceptual understanding of the development of web-based learning media applications in Arabic language learning is obtained.

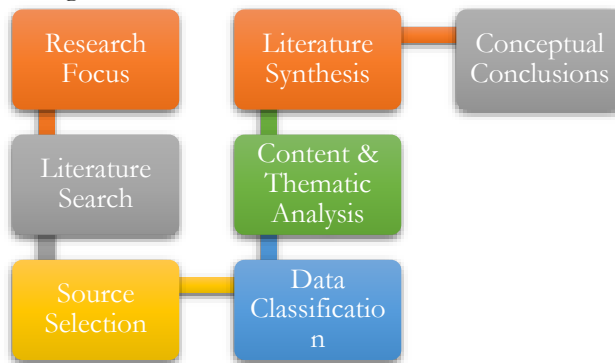


Figure 1. Research Flow of the Library Research

RESULTS AND DISCUSSION

1. Basic Concepts of Web-Based Learning Media Applications
 - a. Application Definition

Applications are software designed to help users carry out certain tasks systematically through digital devices. In the context of education, applications are not only understood as ordinary computer programs, but as digital means that are able to facilitate the learning process in an interactive, adaptive, and integrated manner with the needs of students. The development of digital technology has changed the function of educational applications from just a tool for delivering materials to a digital learning environment that allows two-way interaction, personalization of learning, and multimedia integration that supports learning effectiveness. In learning Arabic, learning applications have an important role in helping students understand mufradat, practice listening and speaking skills, and improve reading and writing skills through technology-based interactive features. Modern educational applications are also designed to provide a flexible learning experience

so that learners can learn independently anytime and anywhere through internet-based devices. Recent research shows that the use of digital applications in language learning can increase learning motivation, student engagement, and the effectiveness of interactive multimedia-based learning (Zaini, Bukhori, & Salsabilla, 2025)

b. Learning Media Concep

Learning media is any form of means used to convey learning messages from educators to students so that the learning process takes place effectively and efficiently. In the perspective of modern education, learning media not only functions as a visual aid, but also as a pedagogical instrument capable of creating interactive, contextual, and meaningful learning experiences. Learning media has an important role in helping students understand abstract concepts, increase learning motivation, and create a more interesting and communicative learning atmosphere. In learning Arabic, the use of learning media is very important because language is a skill that requires visualization, audio, communication practice, and intensive repetition so that students are able to master language competence optimally. Therefore, Arabic learning media must be able to integrate visual, auditory, and interactive practice elements to support the development of *maharah al-istima'*, *al-kalam*, *al-qira'ah*, and *al-kitabah* in an integrated manner (Syarifah, 2024)

Digital-based learning media allows the integration of various elements such as text, images, sounds, animations, videos, and interactive simulations in a single learning platform. This transformation has had a major impact on Arabic learning because it allows for a more communicative and contextual presentation of material compared to traditional methods based on lectures and memorization alone. In addition, digital learning media also allows students to gain an independent learning experience through interactive exercises and automatic evaluations that can increase understanding and motivation to learn (Syarifah, 2024).

c. Integration of Web-Based Learning Media Application Concepts

Web-based learning media applications are an integration between digital application technology, learning media, and internet-based learning systems designed to support the learning process interactively and flexibly. This concept combines the function of an application as an interactive software with the function of learning media as a means of delivering educational materials through a web-based platform. In the context of Arabic language learning, web-based learning media applications are a strategic means to provide communicative, multimedia, and learning experience oriented to students. Through web-based applications, students can access Arabic materials in the form of text, audio, video, interactive exercises, and automatic evaluations in one integrated learning system. This integration allows Arabic learning to take place more effectively because students can learn independently while gaining a multimodal learning experience that supports the mastery of overall language skills (Zaini et al., 2025; Nurhikmah, 2024).

2. The Essence of Learning Arabic in the Digital Era

Learning Arabic is a process of mastering linguistic skills that includes four main skills, namely *maharah al-istima'* (listening), *maharah al-kalam* (speaking), *maharah al-qira'ah* (reading), and *maharah al-kitabah* (writing). These four skills are interrelated and must be developed in an integrated manner so that students are able to use Arabic communicatively and contextually. In the digital era, the characteristics of Arabic language learning have undergone a significant transformation because the learning process is no longer only oriented towards mastering grammar and memorization of *mufradat*, but also emphasizing the development of communication competencies based on digital technology. The integration of digital technology allows Arabic learning to be carried out through interactive media such as digital audio, learning videos, conversation simulations, and web-based applications that can improve the learning experience of students in a more dynamic

and participatory manner. In addition, technological developments allow students to gain wider access to authentic learning resources in Arabic so that learning becomes more contextual and adaptive to global communication needs. Recent research shows that digital-based Arabic learning is able to improve students' communication skills through multimedia approaches and technology-based interactive learning (Hadid Asfar et al., 2024).

3. Theoretical Foundations of Web-Based Learning Media Development

In the context of web-based learning media, constructivism is an important foundation in creating an interactive, collaborative, and activity-oriented learning environment for students. Constructivism-based web-based learning media is designed to provide space for exploration, problem-solving, online discussion, and project-based learning so that learners can actively build knowledge through digital learning experiences. In Arabic language learning, the constructivist approach allows learners to learn the language through more authentic communication practices, conversation simulations, and context-based interactions. Web technology enables the creation of collaborative learning that supports interaction between learners and real-world experiential learning in the use of the Arabic language. Recent research shows that the integration of constructivism in multimedia design and web-based learning is able to improve students' critical thinking skills, active participation, and engagement in the digital learning process. Multimedia Learning Theory from Richard E. Mayer

The *Cognitive Theory of Multimedia Learning* developed by Richard E. Mayer explains that learners learn more effectively when information is presented through a combination of words, images, audio, and visual elements rather than through text alone. This theory is based on three main assumptions, namely the existence of *dual channels* in the processing of visual and verbal information, limited *working* memory, and active *processing* which involves the process of selecting, organizing, and integrating information. In the development of web-based learning media, Mayer's theory is the main basis for designing effective learning multimedia so that students can understand the material without experiencing

excessive cognitive burden. In learning Arabic, multimedia principles are essential because language learning requires integration between Arabic texts, audio pronunciation, visualization of meaning, and interactive communication exercises. The use of web-based multimedia in accordance with Mayer's principles can significantly improve vocabulary comprehension, listening skills, and the effectiveness of Arabic language learning (Mayer, 2024).

4. Learning Media Design Principles

a. Interactivity

Interactivity is the main principle in the development of web-based learning media because it allows students to be actively involved in the learning process. Interactive learning media provides opportunities for learners to participate through exercises, simulations, discussions, quizzes, and other learning activities that involve direct feedback from users. In learning Arabic, interactivity is essential to actively practice communication skills, vocabulary mastery, and language understanding. The use of interactive features such as automated quizzes, conversation simulations, and educational game-based exercises can increase students' motivation and engagement in the Arabic learning process (Arifah, L. Heny Nirmayani, & Tegeh, 2025).

b. User Friendly

The principle of *user friendliness* emphasizes that web-based learning media must be easy to use, easy to understand, and have simple navigation so that students can focus on the learning process without experiencing technical difficulties. Simple, responsive, and intuitive interface design is an important factor in improving the user experience in digital learning. In learning Arabic, *user-friendly* design is very important because students also have to adapt to Arabic characters and language structures that are different from their everyday language. Therefore, learning media must be designed with clear navigation, convenient display, and easy access so that learning takes place effectively and does not confuse users.

- c. **Display Consistency**

Consistency includes the use of uniform colors, typography, icons, layouts, and navigation structures across parts of the learning app. In web-based Arabic learning media, display consistency is important to help learners focus on the learning material without being distracted by confusing design changes. Visual consistency also helps improve learning comfort and accelerate user adaptation to digital learning systems (Cavanagh & Kiersch, 2023).
 - d. **Feedback**

Feedback is an important component of web-based learning media because it helps learners know their learning success rate firsthand. In digital learning, feedback can be provided automatically through answer corrections, evaluation scores, material recommendations, and learning improvement instructions. In learning Arabic, feedback is very important to correct pronunciation errors, language structure, and vocabulary comprehension of students quickly and precisely. Web-based learning systems allow for real-time feedback so that the learning process becomes more effective and responsive to the needs of students (Lawson & Mayer, 2024).
 - e. **Learning Motivation**

Engaging, interactive, and multimedia-based learning media can increase learning motivation through fun and challenging learning experiences. In learning Arabic, learning motivation is very important because many learners consider Arabic to be a difficult and complex subject. Therefore, web-based learning media needs to be designed with a gamification approach, interactive multimedia, and communicative activities that are able to increase students' interest in learning.
5. **Key Components of Web-Based Arabic Learning Media Applications**
- a. **Learning Content**
 - 1) **Mufradat Material**

Mufradat is one of the main components in learning Arabic because mastery of vocabulary is

the basis for understanding and using language communicatively. In web-based Arabic learning media applications, mufradat materials must be designed systematically, contextually, and interactively so that students can understand the meaning of vocabulary and its use in real communication situations. Web-based mufradat presentation can be done through the integration of Arabic texts, transliteration, illustrative images, audio pronunciation, as well as interactive exercises that help learners understand the relationship between sounds, meanings, and the use of words in sentences. The use of interactive multimedia in mufradat learning has been proven to be able to improve students' memory, learning motivation, and communication skills because learning takes place visually and auditory at the same time. In addition, web technology allows the development of mufradat learning based on educational games and adaptive exercises that can increase students' involvement in the Arabic learning process in a more active and enjoyable manner.(Syarifah, 2024)

2) Arabic Dialogue

Arabic dialogue is an important component in web-based learning applications because it functions to train students' communication skills in the use of Arabic contextually. Interactive dialogue allows learners to understand the use of language in real-world situations through conversations that reflect daily activities, academic environments, and social communication. In web-based applications, Arabic dialogue can be developed through conversational audio, virtual communication simulations, interactive videos, and user response-based speaking exercises. This approach is very important because language learning is not only oriented towards mastering the structure of language, but also on the ability to use language in

the context of real communication. The use of multimedia-based dialogue and web technology has been proven to improve speaking skills, the ability to understand the context of communication, and the active participation of students in learning Arabic (Zaini et al., 2025)

3) Grammar (Nahwu and Sharaf)

Nahwu and sharaf are fundamental aspects of learning Arabic because they are the basis for understanding sentence structure and word form changes in Arabic. In web-based learning media applications, nahwu and sharaf materials need to be presented in a simple, visual, and interactive manner so that students do not have difficulty understanding complex grammatical concepts. The use of interactive diagrams, infographics, sentence structure animations, and web-based exercises can help learners understand grammatical patterns more easily and systematically. In addition, web technology allows the presentation of grammar materials gradually and adaptively according to the level of ability of students so that the learning process becomes more effective. Recent research shows that the use of web-based multimedia in learning Arabic grammar can significantly improve students' understanding of grammatical concepts, learning motivation, and language analysis skills (Abdul Hamid, Sahrir, Yahaya, & Muassomah, 2025)

4) Practice Questions

Practice questions are an important component of a web-based Arabic learning application because it serves to measure students' understanding of the material that has been learned while strengthening the learning process through repetitive exercises. In web-based applications, practice questions can be designed interactively in various forms such as multiple choice, word matching, completing

sentences, or communication simulation-based exercises. The web-based practice system allows students to get direct feedback on the answers given so that the evaluation process becomes more effective and helps students correct mistakes quickly. In addition, web-based interactive exercises can also increase learning motivation and student engagement because learning takes place dynamically and based on digital experiences. Recent research shows that interactive exercises based on web technology are able to improve Arabic learning outcomes and strengthen students' thinking skills through more active and responsive learning (Zaini et al., 2025)

b. User *Interface* Design

1) Arabic Color Selection and Typography

The choice of colors and typography is an important aspect of the interface design of a web-based Arabic learning application because it affects the visual comfort and effectiveness of user learning. Harmonious and not excessive colors can help students focus on the learning material and create a comfortable learning atmosphere. In the context of learning Arabic, the selection of Arabic typography must also be considered so that Arabic letters can be read clearly and easily understood by students. The use of appropriate Arabic fonts, proportional font sizes, and neat text layouts can improve the readability of learning materials and reduce misunderstandings in reading Arabic texts. Recent research shows that good visual design and typography in digital learning media have a major influence on the user experience and effectiveness of web-based learning (Wahyuni, Zulaeha, Budiarti, & Nasiru, 2024)

2) Simple Navigation

Simple navigation is an important principle in the development of web-based learning apps because it makes it easy for users to access learning features and materials without experiencing technical confusion. In

an Arabic learning app, navigation should be designed intuitively with clear menus, easy-to-understand icons, and an organized page structure so that learners can focus on learning activities. Complex navigation can hinder the learning process and reduce user motivation to use the app. Therefore, navigation design must consider ease of access and user experience for the learning process to be effective. Recent research shows that the ease of navigation in web-based learning applications has a significant effect on user satisfaction and the effectiveness of digital learning (Zaini et al., 2025)

3) Responsive Display

Responsive displays are an essential component in web-based learning apps because they allow apps to be optimally accessed through various devices such as computers, tablets, and smartphones. In the modern digital era, students tend to access learning through mobile devices so Arabic learning applications must be able to automatically adjust the display according to the screen size of the user's device. Responsive design helps improve learning accessibility and allows learners to learn anytime and anywhere flexibly. In addition, the responsive display also increases user convenience in accessing web-based multimedia learning materials. Recent research shows that responsive design in digital learning improves the accessibility and effectiveness of the use of web technology-based learning applications (Riwanda, Ridha, & Islamy, 2024)

c. Supporting Multimedia

1) Audio Pronunciation

Audio pronunciation is an important component of Arabic learning apps because it helps learners understand how to pronounce Arabic letters, words, and sentences correctly. In learning Arabic, the phonological aspect has an important role because many Arabic letter sounds are not found in other languages so it requires intensive listening and

pronunciation practice. The use of digital audio in a web-based application allows students to listen to Arabic pronunciation repeatedly and independently so that it can effectively improve the ability of maharah al-istima' and maharah al-kalam. Recent research shows that the use of audio media in digital-based Arabic learning can significantly improve students' listening and pronunciation skills (Hanik, Nashihah, & Salam, 2025)

2) Learning Videos

Learning videos are a very effective multimedia media in learning Arabic because they are able to integrate visual and audio elements at the same time. In web-based learning applications, videos can be used to present Arabic dialogues, grammatical explanations, communication simulations, and contextual illustrations of Arabic culture. The use of video allows learners to understand the use of language in real-life situations while increasing motivation to learn through engaging visual learning. In addition, learning videos also help students understand expressions, intonation, and the context of Arabic communication more authentically. Recent research shows that the use of multimedia video in Arabic learning is able to improve material understanding, communication skills, and student engagement in digital learning (Hanik et al., 2025; Syarifah, 2024).

d. Evaluation System

1) Interactive Quiz

Interactive quizzes are digital-based evaluation systems that allow students to actively evaluate learning through various forms of interactive questions. In a web-based Arabic learning application, interactive quizzes can be used to measure students' understanding of mufradat, grammar, reading skills, and listening skills. Web-based quizzes provide a more engaging evaluation experience as they come with multimedia features, automatic scoring, and live feedback. Recent research

shows that web-based interactive quizzes are able to significantly increase learning motivation and the effectiveness of language learning evaluations (Syarifah, 2024)

2) Automated Assessment

Automated assessments are an important feature in web-based learning applications because they allow the system to provide evaluation results quickly and accurately without having to wait for manual corrections from educators. In Arabic learning, automated assessments can be used to evaluate the answers to exercises, quizzes, and other learning activities in real-time. This system helps learners know their level of understanding directly while providing feedback for learning improvement. In addition to improving evaluation efficiency, automatic assessments also allow learning to take place independently and adaptively according to students' abilities. Recent research shows that web-based automated evaluation systems are able to increase the effectiveness of digital learning and strengthen learners' self-learning experiences (Riwanda et al., 2024)

6. Stages of Creating a Web-Based Learning Media Application for Arabic

a. Needs Analysis

1) User Identification

The initial stage in the development of web-based Arabic learning media applications is *user identification*. This stage aims to find out the characteristics of potential application users, such as age, education level, Arabic language skills, digital literacy skills, learning styles, and their learning needs. User identification is essential because effective app design must be tailored to the user's needs and characteristics for the app to truly help the learning process. In the context of learning Arabic, users can come from madrasah students, Arabic language education students, Islamic boarding school students,

or independent learners. Each group has different needs, so the application design approach should also be different.

2) Arabic Material Analysis

The next stage is to analyze the Arabic material that will be included in the application. Material analysis is carried out to determine the scope of learning, the level of difficulty of the material, the order of presentation of the material, and the language skills to be developed. Arabic materials in web-based applications generally include mufradat, hiwar (dialogue), qira'ah, nahwu, sharaf, listening exercises, and writing exercises. The selection of materials must be adjusted to the learning curriculum and the ability level of the application user so that the learning process takes place systematically and gradually. Recent research shows that multimedia- and web-based Arabic learning is more effective when the material is structured contextually and integrated with the real communication needs of students (Zaini et al., 2025).

3) Learning Needs Analysis

A learning needs analysis is carried out to identify the main problems in the Arabic language learning process that are to be solved through web-based applications. This analysis includes the identification of students' learning difficulties, the limitations of the learning media used by teachers, the need for learning interactivity, and the need for digital evaluation in Arabic language learning. In the digital era, students tend to need learning media that is interactive, flexible, and accessible through mobile devices. Therefore, Arabic learning apps should be designed to address these needs through multimedia integration, interactive exercises, and automated evaluation systems. Recent research shows that web-based language learning is able to increase learners' learning motivation and engagement because it provides a more flexible and

interactive learning experience than conventional methods (Rahmah, Asrowi, & Musadad, 2024)

b. System Planning

1) Determining Learning Objectives

The system planning stage begins with determining the learning objectives to be achieved through the application. Learning objectives are the main basis in determining the content of the material, application features, evaluation methods, and digital learning design. Learning objectives must be formulated in a specific, measurable, and appropriate manner with the Arabic language competencies to be developed. In web-based Arabic learning, learning objectives can include improving the mastery of the mufradat, conversational skills, comprehension of Arabic texts, or the skills of writing simple sentences باللغة العربية. Recent research shows that the clarity of learning objectives in the development of digital education applications greatly influences the effectiveness of learning and user learning experiences (Nurulhaifa & Hikmawan, 2026).

2) Defining Application Features

Once the learning objectives are determined, the next step is to determine the features that will be available in the app. The features of the application must be adapted to the needs of the user and the learning objectives so that the application is not too complicated but still effective in supporting Arabic learning. In a web-based Arabic learning application, the features that can be developed include a mufradat menu, audio pronunciation, learning videos, interactive quizzes, discussion forums, conversation exercises, and an automatic scoring system. Recent research shows that the integration of multimedia features and interactivity in language learning applications is able to increase learning motivation and digital learning effectiveness (Syarifah, 2024)

3) Creating Flowcharts and Storyboards

Flowcharts are used to describe the flow of the app's system, while storyboards are used to design the visual appearance of each app's page before the coding process is carried out. Flowcharts help developers understand the flow of application usage in a systematic manner, while storyboards help design the user experience visually. Recent research in UI/UX development of educational applications shows that the use of storyboards and visual planning can improve the quality of application design and simplify the process of developing digital systems (Aulia, Setyadi, & Jundillah, 2024)

c. Application Design

1) UI/UX design

UI (*User Interface*) and UX (*User Experience*) design are important aspects in the development of web-based learning applications because they determine the comfort and user experience when using the application. UI design is concerned with the visual appearance of the application such as colors, icons, buttons, and layouts, while UX is concerned with the convenience and ease of users in interacting with the application system. In Arabic applications, UI/UX design must pay attention to Arabic literacy, visual comfort, and simple navigation so that users do not have difficulties while learning. Recent research shows that good UI/UX design in digital learning applications can improve user satisfaction and learning effectiveness (Sistem, 2024).

2) Application Menu Structure

The app's menu structure should be simple and easy for users to understand for learning navigation to be effective. A good menu structure helps users find material quickly without any confusion. Research on learning app design shows that simple navigation affects user comfort and interaction effectiveness in digital learning (Romadhoni & Dirgahayu, 2024)

3) Material Database Design

The database is used to store all application data such as learning materials, user accounts, audio, video, and evaluation results. Good database design helps applications run faster and more organized. In Arabic applications, databases can store mufradat data, pronunciation audio files, learning videos, and user scores.

7. Challenges and Solutions for the Development of Arabic Learning Media Applications

a. Challenge

1) Technical Limitations

One of the main challenges in the development of web-based Arabic learning media applications is technical limitations which include hardware limitations, low user device specifications, server limitations, and lack of technical capabilities in digital application development. Many educational institutions, especially in certain areas, still have limited technology facilities so that the use of web-based learning applications cannot run optimally. In addition, the development of Arabic applications also requires special technological support such as Arabic letter compatibility, audio pronunciation integration, and interactive multimedia systems that require considerable system capacity. This condition causes the application development process to often face obstacles in system performance, accessibility, and application stability when used by multiple users simultaneously. Recent research shows that the limitations of digital infrastructure and technological devices are still the main obstacles in the implementation of technology-based language learning in various educational institutions (Haq, Akmansyah, Erlina, & Koderi, 2024)

2) Lack of Digital Competence of Teachers

The next challenge is the low digital competence of teachers in developing and using technology-based learning media. Many Arabic teachers are still used to using traditional textbook-based

learning methods and lectures, so they have difficulty integrating digital technology into the learning process. The low ability to use *the Learning Management System* (LMS), multimedia applications, and online learning platforms causes the use of technology in learning Arabic to be not optimal. In addition, some teachers still have difficulties in designing digital learning media that is interactive and in accordance with the needs of students in the digital era. Recent research based on the TPACK (*Technological Pedagogical Content Knowledge*) framework shows that the technological competence of Arabic language teachers is still at the elementary to intermediate level and has not been fully able to integrate technology, pedagogy, and learning content effectively (Sholahudin, Nurbayan, & Ali, 2025)

3) Internet connectivity issues

Internet access constraints are also a big challenge in the development and implementation of web-based Arabic language learning applications. Web-based learning relies heavily on a stable internet connection, while in many areas internet access is still limited or has low speeds. This condition causes students to have difficulty accessing learning videos, interactive audio, and online evaluation features optimally. In addition, the relatively high cost of internet access can also be an obstacle for students from certain economic backgrounds. Recent research shows that the digital *divide* is still the main factor affecting the effectiveness of technology-based learning implementation in the educational environment (Haq et al., 2024)

4) Arabic Design Difficulties

The development of Arabic learning applications also faces challenges in interface design and representation of Arabic texts. Arabic has special characteristics such as *right-to-left* writing, letter shapes that change according to position in words, and Arabic typography needs that are different from Latin letters.

Errors in typography design and layout can cause Arabic text to be difficult to read and confuse users. In addition, the integration of Arabic pronunciation audio and multimedia requires special attention so that learning takes place accurately and communicatively. Recent research shows that the development of Arabic learning media requires a special design approach that pays attention to the linguistic and visual characteristics of Arabic in a digital environment (Jamil & Abdullayev, 2024;

b. Solution

1) Educational Technology Training

One of the main solutions to overcome the challenges of developing web-based Arabic learning applications is through educational technology training for teachers and educators. This training aims to improve teachers' digital competence in using, designing, and developing technology-based learning media. Teachers need to be equipped with skills in the use of LMS, multimedia learning development, digital evaluation design, and technology integration in Arabic language learning. Recent research shows that improving teachers' digital competence through educational technology training is able to increase the effectiveness of digital-based learning and strengthen teachers' pedagogical abilities in the era of digital transformation of education (Hanifah, Binti Adam, Faizin, Miftakhul Jannah, & Hanafi, 2024)

2) Use of Open Source Platforms

The use of *open source* platforms is an effective solution to reduce the cost of developing web-based learning applications. *Open source* platforms allow developers and educational institutions to use digital learning systems without expensive licensing fees so that they are more accessible to schools and madrassas with limited budgets. In addition, *the open source* platform also allows developers to modify the system according to the needs of learning Arabic. Recent research shows

that the use of *Open Educational Resources* and open source platforms can help improve the accessibility of digital learning in educational environments with limited resources (Hosman, Nova, Naji, & Alsaka, 2024)

3) Lightweight Application Design

To overcome the limitations of the internet and user devices, Arabic language learning applications need to be designed with a lightweight and efficient system. The lightweight app design allows apps to remain accessible even if you're using a slow internet connection or low-spec devices. Developers need to optimize the size of images, videos, and audio so that the app is not too heavy when accessed by the user. Recent research shows that lightweight and responsive application design is able to improve the accessibility and effectiveness of the use of web-based learning media in various user technology conditions (Zaini et al., 2025)

4) Collaboration between Teachers and Programmers

Collaboration between Arabic teachers and programmers is an important solution in the development of web-based learning media applications. Teachers have an understanding of learning materials and pedagogical needs of students, while programmers have technical skills in the development of digital application systems. The collaboration between the two allows for the creation of learning applications that are not only technically interesting but also in accordance with the pedagogical goals of learning Arabic. Recent research shows that the development of educational technology that involves multidisciplinary collaboration results in learning media that is more effective and relevant to the needs of users (Jamil & Abdullayev, 2024; Tamphu et al., 2024).

5) Further Revision and Development

The development of a web-based Arabic learning app does not stop after the application is

completed, but must be continued with continuous evaluation and revision. Evaluation is carried out to find out the weaknesses of the application, the needs of new users, and the effectiveness of the resulting learning. Based on the results of the evaluation, developers can update features, improve design, and add learning materials to keep the application relevant to technological developments and the needs of modern Arabic language learning (Fauzi, Al Ayyubi, Nurhikmah, Prayetno, & Al-Ghatnaini, 2025). Recent research shows that *continuous improvement* is essential in maintaining the quality of digital education applications and improving user learning experience (Zaini et al., 2025).

CONCLUSION

The development of web-based Arabic learning media applications is an important innovation in supporting educational transformation in the digital era because it is able to create a more interactive, flexible, and student-centered learning process. The development of such applications must be based on the analysis of user needs, characteristics of Arabic language materials, and clear learning objectives so that the media produced is in accordance with pedagogical needs and modern technological developments. In the development process, it requires careful system planning, responsive and user-friendly interface design, selection of appropriate technologies, and multimedia integration such as audio, video, and interactive evaluations to improve the effectiveness of Arabic learning. In addition, application development also faces various challenges such as technical limitations, low digital competence of teachers, internet access constraints, and the complexity of digital-based Arabic design. Therefore, solutions such as educational technology training, the use of open source platforms, lightweight application development, and collaboration between teachers and programmers are strategic steps in improving the quality of web-based Arabic learning applications. With continuous evaluation and development, web-based Arabic learning media applications are expected to be able to increase learning

motivation, language skills, and the quality of Arabic language learning that is more adaptive to the needs of students in the digital era

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