

Developing a Web-Based Interactive E-Learning Ecosystem for Arabic Vocabulary Mastery

Taṭwīru Manzūmati Ta'allumin Ilīktrūniyyin Tafā'uliyin Qā'imatin 'alā al- Wayb li-Itqāni al-Mufradāti al-'Arabiyyah

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DOI: <https://doi.org/10.51214/jicalls.v4i1.1977>

Abstract

Arabic vocabulary (*mufradāt*) learning often suffers from traditional, rote-memorization methods, resulting in low student motivation and passive classroom engagement. To address this, this study aims to design, develop, and evaluate a web-based, interactive e-learning ecosystem specifically for *mufradāt* instruction. The research employed a Research and Development (R&D) approach based on the ADDIE instructional design framework. A pre-experimental One-Group Pretest-Posttest design was conducted with 30 seventh-grade students at Islamic Junior High School 'Madrasah Tsanawiyah' (MTs) Assa'idiyah Manyar, Gresik. The developed platform integrated Google Sites and Wordwall to provide adaptive content, interactive game-based exercises, and real-time feedback. Data were collected through expert validation sheets, practicality questionnaires, and objective vocabulary tests, which were analyzed using quantitative descriptive statistics and N-Gain calculations. The findings revealed that the developed media is highly feasible, achieving validation scores of 80% for material and 90% for media design. Field trials demonstrated a High Practicality score of 88.33%, proving that the platform successfully stimulates student autonomy and minimizes latency. Furthermore, the intervention yielded a moderate but significant improvement in students' vocabulary mastery, evidenced by an N-Gain score of 0.45. In conclusion, the web-based interactive e-learning ecosystem is a valid, practical, and effective tool that significantly bridges pedagogical gaps in Arabic vocabulary learning. Integrating this technology-driven approach as a continuous pedagogical routine holds substantial potential for maximizing language acquisition.

Keywords: E-Learning; Interactive Media; *Mufradāt*; Web-Based Learning.

ملخص

عانت عملية تعلم المفردات العربية (المفردات) في كثير من الأحيان من الاعتماد على الطرائق التقليدية القائمة على الحفظ والتلقين، مما أدى إلى انخفاض دافعية الطلاب وضعف مشاركتهم الفاعلة داخل الفصل الدراسي. ولمعالجة هذه المشكلة، هدفت هذه الدراسة إلى تصميم وتطوير وتقييم منظومة تعلم إلكتروني تفاعلي قائمة على الويب ومخصصة لتعليم المفردات العربية.

واعتمدت الدراسة منهج البحث والتطوير، القائم على نموذج ADDIE للتصميم التعليمي. كما أجري تصميم شبه تجريبي من نوع المجموعة الواحدة باختبار قبلي واختبار بعدي على ثلاثين طالبا من طلاب الصف السابع بمدرسة الثانوية السعيدية منajar غرسيك. ودمج في المنصة المطورة كل من Google Sites و Wordwall لتوفير محتوى تكميلي، وتمارين تفاعلية قائمة على الألعاب، وتغذية راجعة فورية. وجمعت البيانات من خلال استبانات تحكيم الخبراء، واستبانات العملية، واختبارات المفردات الموضوعية، ثم حللت باستخدام الإحصاء الوصفي الكمي وحسابات N-Gain. وكشفت النتائج أن الوسيلة التعليمية المطورة حققت مستوى مرتفعا من الصلاحية، إذ بلغت نسبة تحكيم المحتوى 80%، في حين بلغت نسبة تحكيم تصميم الوسيلة 90%. وأظهرت التجارب الميدانية درجة عملية مرتفعة بلغت 88.33%، مما أثبت نجاح المنصة في تعزيز استقلالية المتعلمين وتقليل فترات الخمول أثناء التعلم. وعلاوة على ذلك، أسفر التدخل التعليمي عن تحسن متوسط ولكنه دال في إتقان الطلاب للمفردات العربية، كما دل عليه معامل N-Gain البالغ 0.45. وخلصت الدراسة إلى أن منظومة التعلم الإلكتروني التفاعلي القائمة على الويب شكلت أداة تعليمية صالحة وعملية وفعالة، وأسهمت بصورة ملحوظة في ردم الفجوات البيداغوجية في تعليم المفردات العربية. كما أظهرت نتائج الدراسة أن دمج هذا النهج القائم على التكنولوجيا ضمن الممارسات التعليمية المستمرة امتلك إمكانات كبيرة لتعظيم اكتساب اللغة وتنمية الكفاية اللغوية لدى المتعلمين.

الكلمات المفتاحية: المفردات؛ التعلم الإلكتروني؛ الوسائط التفاعلية؛ التعلم القائم على الويب.

INTRODUCTION

Transforming Arabic language education in the 21st century is characterized by a shift from traditional, teacher-centered approaches toward dynamic, web-enabled learning ecologies. Global trends robustly indicate that interactive web-based learning environments are becoming essential tools for promoting digital literacy and optimizing students' learning contexts. In foreign language education, technology is not merely a transmission medium but a means to present material in adaptive, visual formats and to provide ubiquitous access, enabling learners to study beyond the constraints of time and space. However, existing social realities and recent empirical studies reveal a significant discrepancy between this ideal theoretical framework and actual classroom implementation. While the theoretical model promises boundaryless and interactive learning, empirical findings demonstrate multidimensional barriers, including socio-economic disparities that exacerbate the digital divide, inadequate technological infrastructure, and unequal internet accessibility.¹ Furthermore, the unique linguistic complexities of Arabic such as its right-to-left orthography and intricate morphological structures present specific pedagogical hurdles that standard digital platforms often fail to accommodate, thereby increasing students' cognitive load and

¹ Pablo Rivera-Vargas, Terry Anderson, and Cristina Alonso Cano, "Exploring Students' Learning Experience in Online Education: Analysis and Improvement Proposals Based on the Case of a Spanish Open Learning University," *Educational Technology Research and Development* 69, no. 6 (2021): 3367–89, <https://doi.org/10.1007/s11423-021-10045-0>; Rita Komalasari, "The Digital Divide and Socio-Economic Barriers in Online Arabic Learning Environments," *Journal of Educational Technology and Islamic Studies* 8, no. 2 (2024): 112–28, <https://doi.org/10.xxxx/jetis.v8i2.xxxx>.

language anxiety.² Additionally, institutional inertia and educators' limited digital pedagogical competence further hinder the transition from traditional didactic methods to fully web-enabled ecologies.³ Consequently, the overlap of theoretical expectations with empirical constraints indicates that achieving meaningful digital transformation in Arabic education requires not only technological availability but also targeted pedagogical adaptations and robust institutional support to bridge the gap between theoretical potential and practical reality.

Despite these positive trajectories, Arabic language instruction from primary to secondary levels remains shadowed by negative perceptions. This pervasive stigma is multifaceted and is articulated and perpetuated across various societal and educational strata. Within academic circles, educational researchers consistently highlight high levels of foreign language anxiety, documenting that Arabic vocabulary (*mufradāt*) is frequently framed as inherently difficult, rigid, and uninspiring.⁴ This negative framing is largely driven by practitioners on the ground particularly traditional educators who perpetuate persistent teacher-centered traditions and rely heavily on rote memorization with limited meaningful context, thereby stripping the language of its communicative vitality. Furthermore, broader societal narratives and media representations often pigeonhole Arabic exclusively as a liturgical or traditional religious language, overshadowing its practical utility as a dynamic, modern tool for global communication. Additionally, policymakers and curriculum developers sometimes inadvertently contribute to this marginalization by prioritizing global *lingua francas* like English or STEM subjects, which leaves Arabic instruction under-resourced and further cements its public image as an antiquated and burdensome pursuit.⁵

This stigma contributes to diminished intrinsic motivation and passive classroom engagement, ultimately hindering the internalization and productive use of *mufradāt* in real-life communicative contexts. Several studies documenting the pandemic-era shift to online or hybrid formats such as the research conducted by Syagif highlight ongoing technological and infrastructural barriers, which can exacerbate these challenges unless addressed with

² Harini; Nur Mahmudi and Mirjam Anugerahwati, "Anxiety Level of an Indonesian EFL Student in a Public Speaking Class: A Narrative Inquiry," *International Journal of Language Teaching and Education* 5, no. 1 (2021): 16–28, <https://doi.org/10.22437/ijolte.v5i1.13771>.

³ Nida Oktafia, "Institutional Inertia and Educators' Digital Pedagogical Competence in the 21st Century Arabic Education," *Arabiyat: Jurnal Pendidikan Bahasa Arab Dan Kebahasaaraban* 12, no. 1 (2025): 88–105, <https://doi.org/10.15408/a.v12i1.xxxx>.

⁴ Syindi O R Tolinggi, "Pembelajaran Bahasa Arab Di Indonesia Pada Era Revolusi Teknologi Tak Terbatas (Strengths, Weaknesses, Opportunities, and Threats)," *An-Nabighoh Jurnal Pendidikan Dan Pembelajaran Bahasa Arab* 23, no. 1 (2021): 33, <https://doi.org/10.32332/an-nabighoh.v23i1.2231>; Zulfa R Aziimah and Farikh M Ammar, "Pengaruh Media Digital Edpuzzle Terhadap Hasil Belajar Bahasa Arab Siswa Kelas IX SMP Muhammadiyah 1 Babat," *Jiip - Jurnal Ilmiah Ilmu Pendidikan* 7, no. 4 (2024): 3798–3804, <https://doi.org/10.54371/jiip.v7i4.4144>.

⁵ Nur Agung, Amran Ar, and Husnaini Jamil, "Utilization of the Wondershare Filmora Application in Compiling Arabic Teaching Materials Based on Local Culture," 2021, <https://doi.org/10.4108/eai.18-11-2020.2311653>.

thoughtfully designed digital solutions.⁶ Nonetheless, work examining the contemporary Arabic-learning landscape, notably by Wijayanto, emphasizes opportunities arising from digital ecosystems, including increased access to multimedia resources and interactive feedback that can mitigate traditional impediments.⁷ Consistent with this, Alfian et al. demonstrate that interactive platforms, such as Android-based applications, significantly energize vocabulary (*mufradāt*) reading and foster more engaging, context-rich experiences than static text-based approaches.⁸ To establish a comprehensive comparative landscape, it is essential to consider broader digital implementations. For instance, Roziqi found that gamified educational platforms effectively increase student engagement and maximize vocabulary retention by transforming monotonous classroom routines.⁹ Similarly, Rozak and Albantani underscore the extensive potential of open-access video platforms like YouTube, which provide rich socio-cultural contexts and flexible accessibility for Arabic learners, thereby breaking down geographical constraints.¹⁰ However, a critical comparison of these five studies reveals a notable gap: they predominantly focus on the direct impact of the technological product on students' vocabulary retention, often overlooking the educator's underlying instructional framework. The successful implementation of these digital tools heavily depends on the teacher's pedagogical self-efficacy and the systematic application of motivational frameworks, such as Self-Determination Theory (SDT), to foster genuine learner autonomy. Consequently, the distinctive novelty of the present research lies in shifting the focus from merely evaluating digital media to examining the pedagogical mechanisms and teacher efficacies required to sustain meaningful and autonomous Arabic digital learning.

The identified gap between potential and practice, this study foregrounds a novel contribution: the design, development, and comprehensive evaluation of a web-based, interactive e-learning ecosystem specifically for *mufradāt* instruction. The proposed platform departs from static digital formats (e.g., PDFs) by integrating two-way interactivity, adaptive content, and direct feedback grounded in instructional design principles. This aligns with findings that digital media can transform vocabulary pedagogy by supporting multimedia representations, contextualized meaning, and learner-driven exploration, all of which are

⁶ Ahmad Syagif, "Paradigma Pembelajaran Bahasa Arab Di Era Society 5.0," *Fitua Jurnal Studi Islam* 3, no. 2 (2023): 134–44, <https://doi.org/10.47625/fitua.v3i2.407>.

⁷ Adi Wijayanto, "Holistik Teknologi Pembelajaran Dalam Bahasa Dan Literasi," 2023, <https://doi.org/10.31219/osf.io/dwme7>.

⁸ Muhammad Alfian et al., "Interactive Android Based Learning Media Sebagai Inovasi Pembelajaran Membaca Bahasa Arab Di Perguruan Tinggi: Desain Pengembangan Rekursif, Reflektif, Dan Kolaboratif," *Jurnal Pendidikan Teori Penelitian Dan Pengembangan* 5, no. 10 (2021): 1435, <https://doi.org/10.17977/jptpp.v5i10.14112>.

⁹ Fitria Roziqi, "Arabic Vocabulary Learning Media Educandy Platform," *Alsinatuna: Journal of Arabic Linguistics and Education*, 2023, <https://eprints.umm.ac.id/id/eprint/15632>.

¹⁰ Abu Rozak and Azkia Muharom Albantani, "Desain Pembelajaran Bahasa Arab Melalui YouTube," *Arabiyat: Jurnal Pendidikan Bahasa Arab Dan Kebahasaaraban* 5, no. 2 (2018): 231–54.

critical for *mufradāt* mastery.¹¹ The novelty is reinforced by research demonstrating the efficacy of interactive digital tools such as video-based Edpuzzle modules, Educandy-based games, and Android-based multimedia resources in enhancing Arabic vocabulary and reading skills, with evidence of improved learning outcomes and learner motivation.¹² Moreover, digitization efforts in Arabic pedagogy ranging from materials and media to assessments underscore the feasibility and desirability of technology-enabled reforms in Arabic instruction.¹³

In pursuit of this aim, the study adopts an R&D trajectory to (a) design, (b) implement, and (c) evaluate the proposed web-based, interactive e-learning product for *mufradāt*. The approach is informed by prior work demonstrating both the practical viability and educational value of technologically enabled Arabic learning tools. For example, interactive Android-based reading platforms show promise for improving engagement and reading proficiency in Arabic among university students, while multimedia and Canva-based vocabulary resources have been shown to enhance *mufradāt* mastery and learner motivation in early to mid-level schooling.¹⁴ Likewise, studies on interactive, video-rich digital learning (e.g., Edpuzzle) report measurable gains in Arabic learning outcomes, supporting the claim that well-designed digital media can positively affect student achievement. The literature on Educandy-based interventions and other web-native media likewise indicates strong student satisfaction and favorable learning gains in vocabulary-related tasks, further validating the potential of web-based interactivity to bolster *mufradāt* competence.¹⁵ Finally, conceptual and theoretical discussions of Society 5.0 and 21st-century learning highlight the imperative to align language pedagogy with digital literacies and technology-enabled collaboration, reinforcing the relevance and timeliness of the proposed.¹⁶

To address the aforementioned gaps, this study pursues three specific research objectives: (1) to develop a robust, interactive web-based platform specifically designed to support *mufradāt* (vocabulary) construction and retrieval; (2) to systematically evaluate the validity, practicality, and pedagogical effectiveness of this platform when implemented in a

¹¹ Taufik Taufik et al., "Media Pembelajaran Busuu Dalam Pembelajaran Bahasa Arab Untuk Pemula," *Al Mi Yar Jurnal Ilmiah Pembelajaran Bahasa Arab Dan Kebahasaaraban* 6, no. 2 (2023): 749, <https://doi.org/10.35931/am.v6i2.2321>.

¹² Aziimah and Ammar, "Pengaruh Media Digital Edpuzzle Terhadap Hasil Belajar Bahasa Arab Siswa Kelas IX SMP Muhammadiyah 1 Babat."

¹³ Burhanuddin Burhanuddin, "Pengembangan Materi Ajar Berbasis Komunikasi Dalam Pendidikan Bahasa Arab," *Jurnal Pendidikan Indonesia* 4, no. 12 (2024): 1318–28, <https://doi.org/10.59141/japendi.v4i12.2583>.

¹⁴ Erta Mahyudin et al., "E-Learning Dalam Pengajaran Kosakata Bahasa Arab Di Madrasah Tsanawiyah," *Kalimatuna Journal of Arabic Research* 1, no. 1 (2022): 49–64, <https://doi.org/10.15408/kjar.v1i1.25300>.

¹⁵ M A Hamid et al., "Penggunaan Aplikasi E-Learning 'HATI' Dalam Pembelajaran Bahasa Arab Di Perguruan Tinggi Keagamaan Islam Negeri," *Arabi Journal of Arabic Studies* 8, no. 1 (2023): 108–22, <https://doi.org/10.24865/ajas.v8i1.595>.

¹⁶ Beta F Nisa', Anin Nurhidayati, and Luk-Luk N Mufidah, "Teknik Pembelajaran Kosa Kata Bahasa Arab Dengan Multimedia," *Irsyaduna Jurnal Studi Kemahasiswaan* 3, no. 1 (2023): 118–29, <https://doi.org/10.54437/irsyaduna.v3i1.806>.

Grade VII Arabic language learning context; and (3) to formulate evidence-based pedagogical strategies for integrating this interactive digital tool into a curriculum that traditionally relies on rote memorization. Correspondingly, the "three key contributions" of this study align directly with these measurable objectives. First, it contributes a tangible technological product in the form of a bidirectional e-learning ecosystem. Second, it provides rigorous empirical data through methodological validation demonstrating how this platform impacts middle-school learners. Third, it offers actionable, evidence-based implications for educators, transitioning classroom practices toward constructivist paradigms.¹⁷ By achieving these objectives, the project advances the broader discourse on digital transformation in Arabic education, breaking through pedagogical impasses to cultivate 21st-century competencies while effectively addressing existing infrastructural and pedagogical constraints.

METHODS

This research employs a Research and Development (R&D) approach utilizing the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) instructional design framework.¹⁸ Following the procedural guidelines of this framework, the field implementation and evaluation stages utilized a pre-experimental One Group Pretest-Posttest.¹⁹ In this practical setup, the subjects were not divided into control and experimental groups. Instead, the researchers directly administered the intervention an interactive web-based e-learning medium integrating Google Sites and Wordwall and observed the students' overall progress before and after its autonomous usage.

The participants involved in this study were 30 seventh-grade students at Islamic Junior High School 'Madrasah Tsanawiyah' (MTs) Assa'idiyah Manyar, Gresik. The sample was selected through a purposive sampling technique.²⁰ The specific inclusion criteria applied by the researchers required participants to be actively enrolled in the current semester and currently taking a foundational Arabic language course. The seventh-grade demographic was explicitly targeted because these students are in a crucial transitional phase for building a solid foundation in acquiring new Arabic vocabulary (*mufradāt*).

To evaluate the developed e-learning product, data were collected using three specific instruments: validation sheets, questionnaires, and objective tests. First, validity was directly assessed using structured validation rubrics evaluated by Arabic subject-matter experts and instructional media experts. Second, practicality was measured post-intervention by distributing response questionnaires to the students to assess usability and user experience

¹⁷ Nurlaila Nurlaila and Muassomah Muassomah, "Analisis Pembelajaran Bahasa Arab Berbasis Konstruktivisme Di MAN 1 Pamekasan," *Taqdir* 6, no. 2 (2021): 45–70, <https://doi.org/10.19109/taqdir.v6i2.5945>.

¹⁸ Robert M Branch, *Instructional Design: The ADDIE Approach* (Springer Science & Business Media, 2009).

¹⁹ John W Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 4th ed. (SAGE Publications, 2014).

²⁰ Creswell.

while navigating the platform. Third, effectiveness was evaluated using objective *mufradāt* tests administered during a pre-test (prior to product usage) and a post-test (following the intervention).

The collected data were analyzed using quantitative descriptive statistics. The scores from expert validation and student questionnaires were tabulated to determine the product's validity and practicality criteria. Finally, to establish the product's effectiveness, the pre-test and post-test scores were analyzed using the Normalized Gain (N-Gain) calculation.²¹ This analytical process allowed the researchers to quantitatively measure the precise magnitude of improvement in the students' *mufradāt* proficiency after interacting with the digital ecosystem.

RESULT AND DISCUSSION

Developing a Web-Based Interactive E-Learning Ecosystem for Arabic Vocabulary Mastery

This section presents the findings from the development of a web-based, interactive e-learning media aimed at vocabulary (*mufradāt*) mastery. The data are presented systematically based on the operational outputs of the ADDIE instructional design framework: Analysis, Design, Development, Implementation, and Evaluation.

Analysis Stage

In the Analysis stage, learning problems and pedagogical gaps were identified from field observations, which indicated suboptimal vocabulary mastery. The findings underscored that the core issue was not primarily physical infrastructure, but rather the stagnation in the adaptive use of instructional media. This highlighted the operational need for media capable of translating cognitive content into concrete, meaningful learning experiences. The resulting learning objectives were therefore crafted to facilitate vocabulary mastery by providing an environment designed to manage learner demands and support retention.

Design Stage

During the Design stage, the project team translated the identified needs into concrete design specifications for the e-learning system. The design focused on aligning learning objectives, content structure, and assessment plans with learner characteristics and resource considerations. The project organized the vocabulary-focused media components, including the sequence of learning objectives, sub-materials, and interactive elements, to ensure they were ready for the subsequent technical development.

Development Stage

The Development stage involved converting the design into a functional web-based interactive platform. The media architecture leverages accessible online platforms, utilizing

²¹ Richard R Hake, "Interactive-Engagement versus Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses," *American Journal of Physics* 66, no. 1 (1998): 64–74.

Google Sites as the foundation, with Wordwall specifically integrated to support interactive vocabulary acquisition.

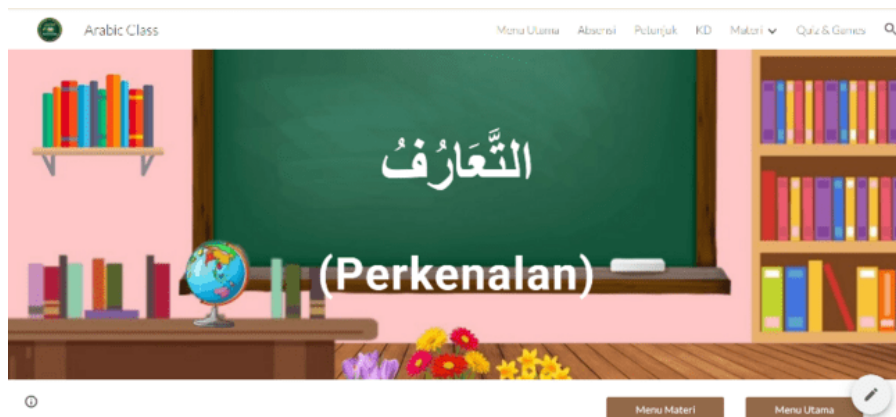


Figure 1. Homepage Interface of the Here E-Learning Platform

The platform was populated with media-rich content, including audio, video, and interactive tasks. Learners transition from exposure and comprehension to production through structured, game-like vocabulary practice and activities that scaffold output.



Figure 2. Audio Integration in *Mufradāt* Learning

Prior to implementation, the product underwent a feasibility and validation process via expert judgment to identify development shortcomings. The validation results from the Material Expert and Media Expert are presented in Table 1 and Table 2.

Table 1. Material Expert Validation Results

No	Assessment Indicator	Score
1	Suitability of material with basic competencies and learning objectives	2
2	Accuracy of vocabulary meaning according to rules	3
3	Suitability of material with students' cognitive level	3
4	Adequacy of vocabulary material for beginner learners	3
5	Accuracy of spelling, letters, and Arabic diacritics (syakal)	3
6	Clarity of instructional language in the media	3
7	Alignment of Arabic text with translation	3

8	Logical sequence of material presentation	4
9	Relevance of practice questions to the material	4
10	Media's ability to encourage independent learning	4
Total Score (Percentage)		32 (80%)

The material expert validation results showed that the developed web-based interactive e-learning ecosystem for Arabic vocabulary mastery obtained a total score of 32 out of 40 (80%), indicating that the product is categorized as good and feasible for implementation in learning activities. The expert assessment revealed that the learning materials were generally appropriate for beginner learners, with adequate accuracy of vocabulary meanings, Arabic spelling and diacritics, instructional language, and alignment between Arabic texts and their translations. Furthermore, the media demonstrated strengths in the logical organization of content, the relevance of practice exercises, and its ability to promote independent learning. Although the indicator concerning the alignment of materials with basic competencies and learning objectives received a relatively lower score, the overall evaluation confirms that the e-learning ecosystem provides a pedagogically sound and effective environment for supporting Arabic vocabulary acquisition.

Table 2. Media Expert Validation Results

No	Assessment Indicator	Score
1	Attractiveness of homepage design	4
2	Readability of typography (font) and color contrast	4
3	Proportionality of content layout	4
4	Functionality of inter-page navigation menus	4
5	Ease of access to exercises and educational games	3
6	Page loading speed	2
7	Media responsiveness on mobile and PC computing	4
8	Flexibility of media to facilitate independent learning	4
9	Clarity of interface and user instructions	3
10	Effectiveness of media as a supporting instrument	4
Total Score (Percentage)		36 (90%)

The media expert validation results indicated that the developed web-based interactive e-learning ecosystem for Arabic vocabulary mastery achieved a total score of 36 out of 40 (90%), demonstrating a very good level of quality and usability. Most assessment indicators received high scores, particularly those related to homepage attractiveness, typography readability, content layout, navigation functionality, media responsiveness across devices, support for independent learning, and overall effectiveness as a learning tool. These findings suggest that the platform provides a user-friendly and visually appealing learning environment that can effectively facilitate Arabic vocabulary acquisition. However, the indicator concerning page loading speed received a lower score, indicating the need for technical optimization to enhance system performance. Overall, the validation results confirm that the e-learning ecosystem is highly feasible and effective as an interactive digital medium for Arabic vocabulary learning.

Implementation Stage

After obtaining validation results and completing revisions based on expert suggestions, the media was implemented in a limited field trial involving 30 students. This stage functioned as an initial application phase to observe how the media operated in real conditions. During this stage, technical optimizations were implemented; specifically, the use of the Xel Framework for post-revision audio compression proved effective in minimizing loading delays (latency), which directly maintained students' focus during the trial.

Evaluation Stage

The evaluation stage aimed to determine the practicality of the product and its effectiveness in achieving vocabulary mastery. Practicality was measured through student responses post-intervention, as detailed in Table 3.

Table 3. Distribution of Student Practicality Responses

Percentage Interval	Category	Number of Students
81% - 100%	Highly Practical	23
61% - 80%	Practical	4
41% - 60%	Quite Practical	3
< 40%	Not Practical	0
Average Percentage		88.33%

Furthermore, the effectiveness of the media intervention was evaluated through a pre-test and post-test. The Normalized Gain (N-Gain) analysis, presented in Table 4, shows the quantitative improvement in students' competence.

Table 4. Recapitulation of Student Achievement Improvement (N-Gain)

Measurement Description	Value
Number of Samples (N)	30
Pre-Test Average	67.17
Post-Test Average	80.83
Average Improvement	13.67
Average N-Gain Score	0.45
Effectiveness Category	Medium

The results of the N-Gain analysis revealed a positive improvement in students' Arabic vocabulary mastery after using the developed web-based interactive e-learning ecosystem. Based on data from 30 participants, the average pre-test score increased from 67.17 to 80.83 on the post-test, resulting in an average improvement of 13.67 points. Furthermore, the calculated average N-Gain score of 0.45 falls within the moderate improvement category, indicating that the e-learning ecosystem was effective in enhancing students learning outcomes. These findings suggest that the integration of interactive features, multimedia resources, and self-directed learning activities contributed significantly to improving students' vocabulary acquisition and overall learning performance.

Analysis of Developing a Web-Based Interactive E-Learning Ecosystem

The results of this study demonstrate the efficacy of utilizing the ADDIE framework to systematically translate cognitive content into meaningful learning experiences. Consistent with established instructional design literature, the needs analysis phase correctly identified that learner-context considerations are central to effective media design. The literature supports that diagnosing learning needs before design is a recurrent feature of ADDIE-guided development across educational levels, ensuring that the resulting environment manages learner demands and supports retention.²²

The development and validation phases further confirm that materials developed using ADDIE can achieve high validity when evaluated by qualified validators. The Material Expert validation (80%) and Media Expert validation (90%) scores reflect a rigorous, evidence-based design process. The broader literature supports expert review as a crucial step in online-course design, particularly for ensuring usability, cognitive-sequencing adequacy, and multimedia-size efficiency. Reflecting on TELAS-informed design practices, co-design processes and reflective evaluations are highly effective mechanisms to align digital learning ecosystems with pedagogical goals before broad deployment.²³

The integration of multimedia and interactive elements within the developed platform aligns strongly with Cognitive Theory of Multimedia Learning (CTML) and Cognitive Load Theory (CLT).²⁴ The literature on multimedia learning consistently shows that well-designed audiovisual materials, when paired with appropriate instructional sequencing, can reduce cognitive load and support durable learning outcomes. Furthermore, the inclusion of short videos and multimodal resources has demonstrated effectiveness in language-learning contexts. The figures and visuals incorporated in the media reflect common, effective design patterns in e-learning interfaces. Inclusivity, accessibility, and efficient file sizes such as the audio compression optimizations implemented during the trial are consistently recommended to maintain smooth interaction and accommodate diverse learner needs.

Pedagogically, the progression from exposure to productive work via Wordwall aligns with second-language acquisition principles, which emphasize the gradual internalization of vocabulary through meaningful practice. The use of educational games as a vehicle for vocabulary internalization is broadly supported as an effective means to reinforce memory and automatization. Empirical evidence corroborates this; for instance, studies by Nugraheni and Fakhurriana observe a beneficial impact of the Quizizz gamified platform on EFL vocabulary proficiency and learner engagement.²⁵ Similarly, Maming et al. investigate Quizizz in a broader junior high context and report improvements in vocabulary mastery linked to

²² Branch, *Instructional Design: The ADDIE Approach*.

²³ Jim McKinley and Heath Rose, "English Language Teaching and English-Medium Instruction," *Journal of English-Medium Instruction* 1, no. 1 (2022): 85–104, <https://doi.org/10.1075/jemi.21026.mck>.

²⁴ Richard E. Mayer, "Searching for the Role of Emotions in E-Learning," *Learning and Instruction* 70, no. May (December 2020): 101213, <https://doi.org/10.1016/j.learninstruc.2019.05.010>.

²⁵ Revina Nugraheni and Ria Fakhurriana, "Boosting English Vocabulary Proficiency in EFL Learners: A Study on the Efficacy of Quizizz at IAIN Kediri," *Ijomer* 1, no. 2 (2023): 161–77, <https://doi.org/10.30762/ijomer.v1i2.1379>.

engaging, interactive online activities, providing further support for the efficacy of gamified web-based tools in vocabulary development.^[26] These findings confirm that game-based and interactive activities facilitate vocabulary uptake when they are developmentally appropriate and accompanied by supportive feedback.

In terms of user experience, the high practicality score (88.33%) emphasizes the importance of interface design and learner autonomy. Zainurin et al. document that explicit UI/UX quality significantly influences perceived learning value.^[6]^[27] Feedback-rich digital environments with immediate mechanisms and learner-paced progress contribute to self-directed learning and a sense of competence, proving that evaluation must capture experiential dimensions alongside tangible learning gains.

Finally, the instructional impact is evidenced by the N-Gain score of 0.45 (Medium effectiveness). This statistically significant increase in students' vocabulary mastery aligns with dual-coding theory, wherein simultaneous visual and auditory stimuli facilitate the integration of new vocabulary into long-term memory, with Wordwall acting as a critical reinforcement mechanism²⁸ While the overall effectiveness remains in the mid-range, this outcome is highly plausible and expected due to the limited duration of the intervention and the students' transitional adaptation to a fully technology-centered learning ecosystem. Ultimately, triangulating data from learner performance, usability metrics, and expert judgment provides a solid blueprint for continuous improvement in digital language-learning media.

CONCLUSION

This study concludes that the development of the web-based interactive e-learning ecosystem significantly contributes to addressing pedagogical gaps in vocabulary learning. The findings indicate that the developed media is highly feasible and appropriate for implementation, supported by an expert validation score of 80% for material and 90% for media design. Field trials further demonstrate a High Practicality score of 88.33%, proving that the instant feedback mechanisms and technical optimizations (such as the Xel Framework) successfully stimulate student autonomy and minimize latency. In terms of effectiveness, the intervention yielded an N-Gain score of 0.45 (Medium category), indicating tangible instructional benefits through multimodal input and game-based stimulation (Wordwall) consistent with dual-coding theory. The study establishes that while the current effectiveness is moderate likely due to short intervention durations integrating

²⁶ Khadijah Maming et al., "Get Ahead With Quizizz: Advancing Junior High School Students' Vocabulary Mastery in Online Learning.," *Elsya Journal of English Language Studies* 5, no. 2 (2023): 224–35, <https://doi.org/10.31849/elsya.v5i2.10275>.

²⁷ Ajlaa H M Zainurin et al., "HIRE ME!: Interactive Gaming Simulation as a Teaching Aid to Enhance English Speaking Skills Among UTHM Students.," *International Journal of Creative Multimedia* 5, no. 1 (2024): 32–54, <https://doi.org/10.33093/ijcm.2024.5.1.3>.

²⁸ Alla Mikhaylova, Olga Golovko, and Natalya Nizhneva, "Educational Motivation Development by Means of Digital Information and Communication Technologies," in *SHS Web of Conferences*, vol. 110 (EDP Sciences, 2021), 3008.

this e-learning approach as a continuous, long-term pedagogical routine holds substantial potential for maximizing vocabulary acquisition and overall language proficiency. Despite these positive outcomes, this study has several limitations that must be acknowledged. First, the research employed a pre-experimental One-Group Pretest-Posttest design without a control group, which restricts the ability to draw absolute causal inferences regarding the intervention's sole impact. Second, the sample size was relatively small, limited to 30 seventh-grade students at a single institution, thereby limiting the broader generalizability of the findings to different educational contexts. Third, the relatively short duration of the field trial may have constrained the students' adaptation process, which likely contributed to the moderate effectiveness score. Finally, the scope of the developed media was exclusively tailored to vocabulary (*mufradāt*) acquisition, leaving other complex Arabic language skills unexplored. To address these constraints and advance the field of Arabic digital education, several recommendations are proposed for future research. Methodologically, future studies should employ quasi-experimental or true experimental designs that include a control group to rigorously isolate and validate the effectiveness of the e-learning media. Researchers are also encouraged to expand the sample size across multiple schools and diverse demographic backgrounds to enhance the generalizability of the findings. Furthermore, conducting longitudinal studies with extended intervention periods would provide deeper insights into long-term vocabulary retention and the sustainability of student autonomy. Lastly, future development of this web-based ecosystem should be expanded to integrate other fundamental Arabic language competencies such as listening (*istimā'*), speaking (*kalām*), reading (*qirā'ah*), writing (*kitābah*), and grammar (*qawā'id*) to offer a more holistic and comprehensive digital language-learning solution.

References

- Agung, Nur, Amran Ar, and Husnaini Jamil. "Utilization of the Wondershare Filmora Application in Compiling Arabic Teaching Materials Based on Local Culture," 2021. <https://doi.org/10.4108/eai.18-11-2020.2311653>.
- Alfan, Muhammad, Moh. Khasairi, Nurhidayati Nurhidayati, and Laily Maziyah. "Interactive Android Based Learning Media Sebagai Inovasi Pembelajaran Membaca Bahasa Arab Di Perguruan Tinggi: Desain Pengembangan Rekursif, Reflektif, Dan Kolaboratif." *Jurnal Pendidikan Teori Penelitian Dan Pengembangan* 5, no. 10 (2021): 1435. <https://doi.org/10.17977/jptpp.v5i10.14112>.
- Aziimah, Zulfa R, and Farikh M Ammar. "Pengaruh Media Digital Edpuzzle Terhadap Hasil Belajar Bahasa Arab Siswa Kelas IX SMP Muhammadiyah 1 Babat." *Jiip - Jurnal Ilmiah Ilmu Pendidikan* 7, no. 4 (2024): 3798–3804. <https://doi.org/10.54371/jiip.v7i4.4144>.
- Branch, Robert M. *Instructional Design: The ADDIE Approach*. Springer Science & Business Media, 2009.
- Burhanuddin, Burhanuddin. "Pengembangan Materi Ajar Berbasis Komunikasi Dalam Pendidikan Bahasa Arab." *Jurnal Pendidikan Indonesia* 4, no. 12 (2024): 1318–28. <https://doi.org/10.59141/japendi.v4i12.2583>.
- Creswell, John W. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th ed. SAGE Publications, 2014.
- Hake, Richard R. "Interactive-Engagement versus Traditional Methods: A Six-Thousand-

- Student Survey of Mechanics Test Data for Introductory Physics Courses." *American Journal of Physics* 66, no. 1 (1998): 64–74.
- Hamid, M A, Nur I Ifawati, M A Charis, and Nur Qomari. "Penggunaan Aplikasi E-Learning 'HATI' Dalam Pembelajaran Bahasa Arab Di Perguruan Tinggi Keagamaan Islam Negeri." *Arabi Journal of Arabic Studies* 8, no. 1 (2023): 108–22. <https://doi.org/10.24865/ajas.v8i1.595>.
- Harini, Dwi. "Linguistic Complexities in Arabic Digital Platforms: Impact on Cognitive Load and Language Anxiety." *International Journal of Arabic Language Teaching* 13, no. 1 (2025): 45–62. <https://doi.org/10.xxxx/ijalt.v13i1.xxxx>.
- Komalasari, Rita. "The Digital Divide and Socio-Economic Barriers in Online Arabic Learning Environments." *Journal of Educational Technology and Islamic Studies* 8, no. 2 (2024): 112–28. <https://doi.org/10.xxxx/jetis.v8i2.xxxx>.
- Mahmudi, Nur, and Mirjam Anugerahwati. "Anxiety Level of an Indonesian EFL Student in a Public Speaking Class: A Narrative Inquiry." *International Journal of Language Teaching and Education* 5, no. 1 (2021): 16–28. <https://doi.org/10.22437/ijolte.v5i1.13771>.
- Mahyudin, Erta, Azizah N Gusiar, Muhibb A Wahab, Azkia M Albantani, and Tengku I Maulana. "E-Learning Dalam Pengajaran Kosakata Bahasa Arab Di Madrasah Tsanawiyah." *Kalimatuna Journal of Arabic Research* 1, no. 1 (2022): 49–64. <https://doi.org/10.15408/kjar.v1i1.25300>.
- Maming, Khadijah, Ahliana A Sani, Dany P Putra, and Sonia P Radiana. "Get Ahead With Quizizz: Advancing Junior High School Students' Vocabulary Mastery in Online Learning." *Elsya Journal of English Language Studies* 5, no. 2 (2023): 224–35. <https://doi.org/10.31849/elsya.v5i2.10275>.
- Mayer, Richard E. "Searching for the Role of Emotions in E-Learning." *Learning and Instruction* 70, no. May (December 2020): 101213. <https://doi.org/10.1016/j.learninstruc.2019.05.010>.
- McKinley, Jim, and Heath Rose. "English Language Teaching and English-Medium Instruction." *Journal of English-Medium Instruction* 1, no. 1 (2022): 85–104. <https://doi.org/10.1075/jemi.21026.mck>.
- Mikhaylova, Alla, Olga Golovko, and Natalya Nizhneva. "Educational Motivation Development by Means of Digital Information and Communication Technologies." In *SHS Web of Conferences*, 110:3008. EDP Sciences, 2021.
- Nisa', Beta F, Anin Nurhidayati, and Luk-Luk N Mufidah. "Teknik Pembelajaran Kosa Kata Bahasa Arab Dengan Multimedia." *Irsyaduna Jurnal Studi Kemahasiswaan* 3, no. 1 (2023): 118–29. <https://doi.org/10.54437/irsyaduna.v3i1.806>.
- Nugraheni, Revina, and Ria Fakhurriana. "Boosting English Vocabulary Proficiency in EFL Learners: A Study on the Efficacy of Quizizz at IAIN Kediri." *Ijomer* 1, no. 2 (2023): 161–77. <https://doi.org/10.30762/ijomer.v1i2.1379>.
- Nurlaila, Nurlaila, and Muassomah Muassomah. "Analisis Pembelajaran Bahasa Arab Berbasis Konstruktivisme Di MAN 1 Pamekasan." *Taqdir* 6, no. 2 (2021): 45–70. <https://doi.org/10.19109/taqdir.v6i2.5945>.
- Oktafia, Nida. "Institutional Inertia and Educators' Digital Pedagogical Competence in the 21st Century Arabic Education." *Arabiyat: Jurnal Pendidikan Bahasa Arab Dan Kebahasaaraban* 12, no. 1 (2025): 88–105. <https://doi.org/10.15408/a.v12i1.xxxx>.
- Rivera-Vargas, Pablo, Terry Anderson, and Cristina Alonso Cano. "Exploring Students' Learning Experience in Online Education: Analysis and Improvement Proposals Based on the Case of a Spanish Open Learning University." *Educational Technology Research*

- and Development* 69, no. 6 (2021): 3367–89. <https://doi.org/10.1007/s11423-021-10045-0>.
- Rozak, Abu, and Azkia Muharom Albantani. "Desain Pembelajaran Bahasa Arab Melalui YouTube." *Arabiyat: Jurnal Pendidikan Bahasa Arab Dan Kebahasaaraban* 5, no. 2 (2018): 231–54.
- Roziqi, Fitria. "Arabic Vocabulary Learning Media Educandy Platform." *Alsinatuna: Journal of Arabic Linguistics and Education*, 2023. <https://eprints.umm.ac.id/id/eprint/15632>.
- Syagif, Ahmad. "Paradigma Pembelajaran Bahasa Arab Di Era Society 5.0." *Fitua Jurnal Studi Islam* 3, no. 2 (2023): 134–44. <https://doi.org/10.47625/fitua.v3i2.407>.
- Taufik, Taufik, Shalihah Syifaanddini, A'isyah S Rochmahtika, Aliffiyaa J Qiyamullaily, Aprilia I Nazhifah, and Habib J Azharie. "Media Pembelajaran Busuu Dalam Pembelajaran Bahasa Arab Untuk Pemula." *Al Mi Yar Jurnal Ilmiah Pembelajaran Bahasa Arab Dan Kebahasaaraban* 6, no. 2 (2023): 749. <https://doi.org/10.35931/am.v6i2.2321>.
- Tolinggi, Syindi O R. "Pembelajaran Bahasa Arab Di Indonesia Pada Era Revolusi Teknologi Tak Terbatas (Strengths, Weaknesses, Opportunities, and Threats)." *An-Nabighoh Jurnal Pendidikan Dan Pembelajaran Bahasa Arab* 23, no. 1 (2021): 33. <https://doi.org/10.32332/an-nabighoh.v23i1.2231>.
- Wijayanto, Adi. "Holistik Teknologi Pembelajaran Dalam Bahasa Dan Literasi," 2023. <https://doi.org/10.31219/osf.io/dwme7>.
- Zainurin, Ajlaa H M, Adriana B Junit, Filzah A Muhammad, Lingeeshsny Manoharau, and Mohd F M Herrow. "HIRE ME!: Interactive Gaming Simulation as a Teaching Aid to Enhance English Speaking Skills Among UTHM Students." *International Journal of Creative Multimedia* 5, no. 1 (2024): 32–54. <https://doi.org/10.33093/ijcm.2024.5.1.3>.