Development of iSpring Suite-Based Learning Media Using Dual Coding Theory for Arabic Vocabulary

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ABSTRACT

Backgrounds: Mastery of Arabic vocabulary is essential for language proficiency; however, instruction in Islamic senior high schools remains dominated by memorisation and drill methods, resulting in low retention and limited integration of cognitively grounded digital media.
Objectives: This study aims to analyse students' needs in Arabic vocabulary learning, examine the feasibility of iSpring-based learning media grounded in Dual Coding Theory, and test its effectiveness in improving vocabulary mastery.
Methods: The study employed a Research and Development (R&D) approach using the ADDIE model, combined with a one-group pre-test–post-test design. Data were collected through observations, interviews, questionnaires, and vocabulary tests, and analysed using a mixed-methods approach.
Results: The results indicate that students require interactive digital media integrating visual and audio elements. The developed iSpring-based media was categorised as highly feasible based on expert validation. The effectiveness test involving 26 students (n = 26) revealed a statistically significant improvement in vocabulary mastery, as reflected by the increase in mean scores from pre-test (M = 68.85) to post-test (M = 77.31), $t(25) = 7.04$, $p < 0.001$, with a large effect size (Cohen's $d = 1.38$).
Conclusions: The findings demonstrate that the media is effective in enhancing students' vocabulary mastery and engagement.

Keywords: Arabic Vocabulary, ADDIE Model, Research and Development, AI.

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INTRODUCTION

Arabic language learning in Islamic senior high schools continues to face fundamental challenges, particularly in students' low mastery of Arabic vocabulary. Vocabulary plays a crucial role as the foundation for developing language skills, as it directly influences learners' ability to understand spoken discourse, express ideas orally, and interpret as well as produce written texts (Ayu et al., 2022). When vocabulary mastery is inadequate, students tend to have difficulty understanding the meaning of speech, expressing ideas orally, and interpreting and producing written texts. The impact of this condition can be seen in the weakness of students' istimā', kalām, qirā'ah, and kitābah skills. Empirically, Arabic vocabulary learning at Islamic Senior High School is still dominated by memorisation, drill, and direct translation approaches, which treat vocabulary as lexical units separate from the context of their meaning (Alauddin et al., 2025). These approaches tend to be mechanistic, resulting in superficial vocabulary mastery that is easily forgotten.

The problem becomes even more complex when faced with the characteristics of Generation Z students, who are more responsive to visual and audio stimuli. On the other hand, technology-based educational transformation requires the use of digital media that is not only instrumental but also pedagogically designed to support meaningful learning (Sihombing et al., 2024). However, in the context of Arabic language learning in Islamic Senior High Schools, the use of digital media is still relatively limited and has not been systematically directed towards improving Arabic vocabulary mastery. As a result, low vocabulary retention and weak understanding of Arabic vocabulary meanings remain recurring problems (Damayanti et al., 2023).

In recent years, the rapid development of artificial intelligence (AI) has significantly influenced educational practices by enabling adaptive learning environments, personalised feedback, and intelligent content delivery (Zawacki-Richter et al., 2019). AI-supported learning systems facilitate multimodal representations by integrating text, audio, and visual elements in a dynamic and interactive manner. Such capabilities are particularly relevant for vocabulary learning, as they allow learners to build richer semantic associations through multiple channels. Furthermore, recent studies indicate that AI-enhanced learning environments can improve student engagement and learning outcomes through context-aware and interactive features (Ma & Chen, 2025). Therefore, integrating AI-informed perspectives into the design of digital learning media becomes increasingly important to ensure alignment with current technological and pedagogical advancements.

Previous studies highlight the importance of using digital media that align with learner characteristics and cognitive processes. Ramadhani & Shofa (2025) emphasise the need for adaptive approaches in vocabulary learning that respond to technological developments, demonstrate that visual and audio-based media can strengthen vocabulary retention through visualisation, gamification, and immediate feedback. Similarly, the use of animated video-based learning media has been shown to enhance student engagement and improve the quality of the learning process by integrating visual and auditory elements simultaneously (Listiawan & Radiyah, 2024). These findings suggest that effective vocabulary learning requires media that are not only engaging but also cognitively structured.

A number of studies show that language learning is more effective when it involves more than one channel of information representation (Zhan & Cheng, 2025). From a theoretical perspective, Dual Coding Theory (DCT) provides a strong foundation for designing such learning media. DCT posits that information is processed through two interconnected cognitive systems verbal and nonverbal so

that the integration of text, audio, and visual representations can enhance comprehension and memory retention (Paivio, 2014). This theoretical framework aligns with the principles of multimodal learning and is highly relevant in the context of digital and AI-supported educational environments. In addition, interactive multimedia-based learning has been reported to increase student motivation and engagement, further supporting the integration of cognitive theory into instructional design (Kifron et al., 2024).

One of the widely used tools for developing interactive learning media is iSpring Suite, which enables the integration of text, audio, visuals, video, and interactive quizzes into a unified platform. Research by Ainiyah et al., (2024) indicates that iSpring-based media can improve the quality of Arabic language learning. However, such studies generally focus on technological implementation without explicitly grounding the media design in cognitive theory. On the other hand, studies by Damayanti et al., (2023) confirm the effectiveness of Dual Coding Theory in vocabulary learning supported by digital media, yet these studies are still limited to non-Arabic language contexts.

Despite these advancements, there remains a significant research gap in the systematic development of Arabic vocabulary learning media that explicitly integrates Dual Coding Theory within an interactive digital platform. Existing studies tend to examine either the technological aspect of media development or the theoretical application of cognitive principles in isolation, rather than combining both within a coherent instructional design. Moreover, research focusing on such integration in the context of Islamic senior high schools is still limited (Luo, 2022).

Addressing this gap, this study proposes a novel approach by developing iSpring-based learning media grounded in Dual Coding Theory using a Research and Development (R&D) framework with the ADDIE model (Branch, 2009). The novelty of this study lies in the systematic integration of cognitive theory and interactive digital media to optimise both verbal and nonverbal information processing in Arabic vocabulary learning. This approach not only contributes to the theoretical enrichment of Dual Coding Theory in the context of Arabic language education but also provides practical implications in the form of an effective and pedagogically grounded learning media design.

Therefore, this study aims to develop and evaluate iSpring-based learning media grounded in Dual Coding Theory to improve Arabic vocabulary mastery among Islamic senior high school students. Specifically, the objectives of this study are: (1) to analyse students' needs in Arabic vocabulary learning, (2) to examine the feasibility of the developed media based on expert validation and student responses, and (3) to test its effectiveness in improving students' vocabulary mastery.

METHODS

Study Design and Participants

This study employed a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to develop iSpring-based learning media grounded in Dual Coding Theory (DCT) for Arabic vocabulary learning. The ADDIE model was selected due to its systematic and iterative structure, allowing continuous refinement of the product through formative evaluation at each stage (Molenda, 2015).

To evaluate the developed product, this study employed a quantitative R&D design with descriptive feasibility evaluation and effectiveness testing. The effectiveness of the media was examined using a one-group pretest–posttest design

(within-subject design), which is widely used in educational research to measure learning gains before and after an intervention (Campbell et al., 1963).

The intervention consisted of structured classroom instruction using iSpring-based media integrating Arabic text, audio pronunciation, visual representations, and interactive quizzes. All participants received the same treatment, and learning outcomes were measured before and after the intervention to determine its effectiveness. The research subjects were 26 tenth-grade students (n = 26) at Wahid Hasyim Balung Jember Islamic Senior High School who regularly attended Arabic language classes during the current second semester of the 2025/2026 academic year. The sampling technique used cluster sampling, as the research population was organised into intact classroom groups with relatively homogeneous characteristics (Sugiyono, 2010). The participants were aged approximately 15-16 years old, consisting of 11 male and 15 female students.

Ethical approval statement

Since the study involved underage participants, ethical procedures were strictly followed. This study received ethical approval from Wahid Hasyim Balung Jember Islamic Senior High School with approval number B-14648/In.20/3.a/PP.009/01/2026. Written informed consent was obtained from parents or legal guardians, and assent was obtained from all participating students. Participation was voluntary, and all participants were informed of their right to withdraw at any time without academic consequences. All procedures were conducted in accordance with the ethical standards of Declaration of Helsinki and that participants signed a consent form (Clarke et al., 2001).

Research Instruments

The research instruments consisted of: (1) an expert validation questionnaire, using a 1–5 Likert scale, to assess the feasibility of the material content, media design, technical aspects, and integration of the Dual Coding Theory principles; (2) a student response questionnaire, using a 1–5 Likert scale, to measure the level of interest, ease of use, and perceived benefits of the learning media; (3) Learning outcome tests in the form of pre-tests and post-tests of Arabic vocabulary compiled based on Arabic vocabulary learning achievement indicators. The expert validation questionnaire was used to assess the feasibility of the media in terms of content, design, and the integration of Dual Coding Theory principles, while the student response questionnaire measured learners' engagement, ease of use, and perceived benefits of the media. The vocabulary test was designed to evaluate students' learning outcomes before and after the intervention. And all instruments were reviewed by experts prior to implementation (Arikunto, 1998).

This study involved three validators consisting of an Arabic language expert, a learning media expert from KH. Achmad Siddiq State Islamic University in Jember, and an Arabic teacher as a practitioner. Their involvement aimed to ensure the validity of the content, the appropriateness of the media design, and its applicability in the context of Arabic language learning at Islamic Senior High Schools (McKenney & Reeves, 2018). The selection of validators was based on their academic qualifications and professional experience in Arabic language education and learning media development.

Construct validity was examined using corrected item–total correlation with a minimum criterion of $r \geq 0.30$, with correlation values ranging from 0.64 to 0.92. Reliability was tested using Cronbach's Alpha, yielding $\alpha = 0.90$ for the expert validation instrument, $\alpha = 0.93$ for the student response questionnaire, and $\alpha = 0.88$ for the vocabulary test, all of which met the acceptable threshold of $\alpha \geq 0.70$.

Development and Implementation Procedures

The research procedure followed the five stages of the ADDIE model, which was adapted to the development of iSpring media based on Dual Coding Theory. In the analysis stage, a needs analysis was conducted through observation and interviews with Arabic teachers to identify student characteristics, vocabulary learning problems, and media needs. The design stage includes the design of the learning flow, the compilation of vocabulary material, and the design of media displays that integrate Arabic text, audio pronunciation, and illustrative visuals in accordance with the principles of Dual Coding Theory. This is in line with Hasanah et al., (2023), who state that learning media can combine text, images, audio, video, and animation. The results of the design stage show that the iSpring learning media based on Dual Coding Theory was successfully developed in accordance with the design that had been prepared. The modification of the ADDIE model in this study focused on embedding Dual Coding Theory principles during the design and development stages, particularly through the integration of synchronized Arabic text, audio, and visual elements.

The development stage was carried out by developing media using iSpring Suite software, followed by validation by subject matter experts, media experts, and practising teachers. The development stage involved creating iSpring-based media and conducting validation by experts and practitioner teachers. The implementation stage was conducted over three meetings, each lasting approximately 135 minutes. Each session followed a structured sequence: (1) introduction of learning objectives, (2) presentation of vocabulary using integrated text, audio, and visuals, (3) guided practice with contextual examples, (4) interactive exercises using iSpring (e.g., matching, multiple choice, and immediate feedback), and (5) review and reinforcement. All sessions were delivered using the same media to ensure consistency of treatment. The evaluation stage was carried out formatively and summatively to assess the feasibility, student response, and effectiveness of the media based on the results of pre-tests and post-tests. A summary of the development stages and research activities is presented in Table 1.

Table 1 The ADDIE Model and Research Activities

Stage	Main Activities	Outputs Produced
Analysis	Analysis of needs, student characteristics, curriculum, and problems in learning Arabic vocabulary	Media requirements specifications
Design	Designing objectives, materials, and DCT-based media layout	Media design
Development	iSpring media creation, audio, visual, video and interactive quiz integration, and expert validation	Validated media
Implementation	3 sessions (135 minutes each) using structured learning activities	Student response data and learning outcomes
Evaluation	Pretest–posttest analysis and media revision	Media effectiveness

Data Analysis Techniques

Data analysis was conducted using IBM SPSS Statistics version 25. The effectiveness of the learning media was analysed using a paired sample t-test to determine significant differences between pre-test and post-test scores, with a significance level of $\alpha = 0.05$ (Fraenkel, et al., 2012). The results revealed a statistically significant difference between pre-test ($M = 68.85$) and post-test ($M = 77.31$) scores, $t(25) = 7.04$, $p < 0.001$. In addition to statistical significance, the effect

size (Cohen's d) was calculated to assess the magnitude of the treatment effect, yielding d = 1.38, indicating a large effect.

Descriptive quantitative analysis was used to analyse expert validation and student response data by converting scores into percentages. The results were interpreted based on the following feasibility criteria: 81–100% (very feasible), 61–80% (feasible), 41–60% (moderately feasible), 21–40% (less feasible), and 0–20% (not feasible).

RESULTS AND DISCUSSION

Product development in this study refers to a pre-established model as the main reference in developing a systematic framework. At this stage, instructional design is carried out through five main phases, namely analysis, design, development, implementation, and evaluation, which together form a systematic framework for developing teaching materials, as shown in the figure 1.

Figure 1 ADDIE Model Stages

The Need for Arabic Vocabulary Learning Media and Its Implications for Media Design

The results of the needs analysis reveal a clear gap between the learning characteristics of Islamic Senior High School students and the Arabic vocabulary learning practices implemented so far. The majority of students reported difficulties in memorising Arabic vocabulary and a tendency to quickly forget previously learned words. This condition reflects learning practices that are still dominated by drill-based activities using printed textbooks, with limited integration of digital and multimedia-based learning media.

The quantitative results presented in Table 2 show that students' need for visual-audio and digital learning media is in the high to very high category. All respondents (100%) expressed the need for more engaging Arabic learning media, while interest in visual-audio media (95.5%) and digital-based learning (90.9%) also scored very high. These findings suggest that current instructional practices are not aligned with the characteristics of digital-native learners, who tend to process information through multimodal representations.

Table 2 Summary of Analysis of Learning Media Requirements for Arabic Vocabulary for Students

Aspects of Needs	Percentage Agree (%)
Interest in learning Arabic	86.3
Difficulty memorising Arabic vocabulary	59.1
Often forget Arabic vocabulary	95.5
Learning methods lack variety	81.8
Interest in visual-audio media	95.5
Interactive media increases motivation	95.5
Audio pronunciation aids comprehension	90.9
Digital media requirements (mobile phone/laptop)	90.9
The need for more engaging learning media	100.0

From a theoretical perspective, these findings can be explained through Dual Coding Theory, which posits that learning becomes more effective when verbal information is supported by non-verbal representations. The lack of integrated visual and auditory stimuli in conventional instruction leads students to rely heavily on rote memorisation, resulting in rapid forgetting. Therefore, the development of iSpring-based learning media that integrates text, audio, visuals, and interactive elements constitutes a pedagogically relevant response to these identified needs. This finding is consistent with Ramadhani and Shofa (2025), who highlight the importance of multimodal media in strengthening vocabulary retention.

The Suitability of iSpring Media Based on Dual Coding Theory

The feasibility of the developed iSpring media was evaluated through expert validation involving a subject matter expert, a media expert, and a practitioner (Arabic teacher). The results, as presented in Table 3, indicate that the media is categorised as highly feasible across all evaluation aspects.

Table 3 Summary of iSpring Media Validation Results

Validator	Aspects Assessed	Percentage Value	Category
Subject Matter Expert	Content and linguistic appropriateness	95.0%	Highly recommended
Media Expert	Visual appearance, navigation, interactivity	97.3%	Highly recommended
Practising Teacher	Suitability to student characteristics	98.0%	Highly recommended

Although all validation scores fall within the "highly feasible" category, a slight variation is observed among evaluators. The media expert assigned the highest score (97.3%), indicating strong performance in visual design, usability, and interactivity. In contrast, the subject matter expert provided a slightly lower score (95.0%), which can be attributed to stricter evaluation of linguistic accuracy and content depth. This difference suggests that while the media excels in technological and design aspects, refinement in linguistic precision remains an area for continuous improvement.

From a theoretical standpoint, these results confirm that the integration of Dual Coding Theory into media design is not only conceptually appropriate but also practically applicable. The alignment between visual, auditory, and textual elements demonstrates that the media successfully operationalises dual-channel cognitive processing. This finding extends previous studies by not only applying Dual Coding Theory but also embedding it systematically within an interactive digital platform for Arabic vocabulary learning.

The Effectiveness of iSpring Media on Student Responses and Learning Outcomes

The results of the study indicate that the hypothesis stating that iSpring media based on Dual Coding Theory is effective in improving students' Arabic vocabulary mastery is acceptable. Students' responses to the media were very positive. These findings are in line with the results of Tobing & Damanik, (2025) study, which shows that the use of interactive digital platforms in language learning encourages positive attitudes, learning motivation, and active student engagement. Figure 2 shows the aspects of ease of understanding, visual appeal, learning motivation, and audio clarity each received a percentage above 95%.

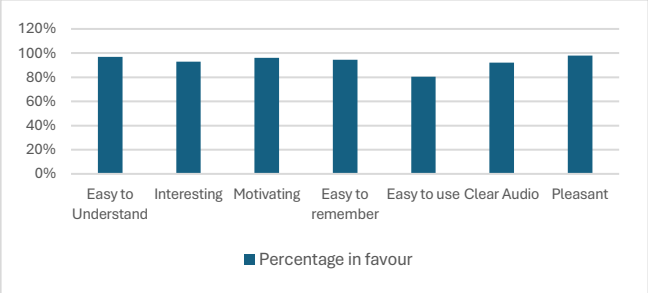

Figure 2 Diagram of Student Response Percentage to iSpring Media

This positive response indicates that the integration of verbal and nonverbal representations helps students build vocabulary associations more effectively. This is in line with Gu, Y., & Johnson, (1996), who emphasise the importance of relevant and user-friendly media design. The effectiveness of the media is also reflected in the students' learning outcomes. A comparison of pre-test and post-test scores in figure 3 shows a shift in the distribution of scores to a higher category after the use of the media.

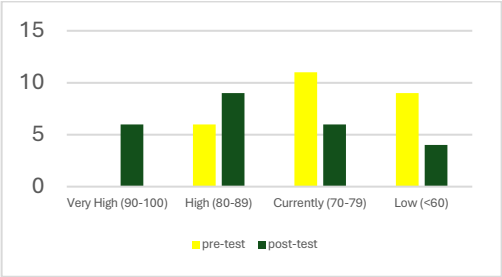

Figure 3 Comparison of Pre-test and Post-test Score Distribution of Students

These results align with Sari, (2023) findings, which show that innovative learning media can significantly improve student learning outcomes compared to conventional learning approaches. In practical terms, iSpring media based on Dual Coding Theory can be an alternative learning medium that is contextual, adaptive, and in line with the characteristics of the digital generation.

The effectiveness of the media was further evaluated through a comparison of pre-test and post-test scores, as presented in Table 4.

Table 4 Descriptive Statistics And Paired Sample T-Test Results (N = 26)

Variable	Mean	SD	T	p	Effect Size (Cohen's d)
Pre-test	68.85	8.87			
Post-test	77.31	11.21	7.04	< 0.001	1.38

The results of the paired sample t-test indicate a statistically significant difference between pre-test and post-test scores (t (25) = 7.04, p < 0.001). Furthermore, the

effect size (Cohen's d = 1.38) falls into the "large" category, demonstrating that the intervention has a substantial practical impact on students' Arabic vocabulary mastery.

This improvement can be explained through the lens of Dual Coding Theory, where the integration of verbal (text and audio) and non-verbal (visual) information enhances cognitive encoding and retrieval processes. By associating vocabulary with multiple representations, students are able to construct stronger mental connections, leading to improved retention and recall. These findings are consistent with Paivio (2023), who emphasises that dual-channel processing significantly enhances long-term vocabulary retention

From a practical perspective, the developed iSpring media provides an adaptive and contextually relevant learning tool that aligns with the characteristics of digital-native learners. The integration of multimedia elements not only improves cognitive outcomes but also enhances students' affective responses to Arabic language learning.

CONCLUSION

Based on the results and discussion of the study, the development of iSpring learning media based on Dual Coding Theory in Arabic vocabulary learning produced three main conclusions. First, Islamic Senior High School students have a highly pressing need for Arabic learning media based on digital technology that integrates interactive visuals and audio to help them understand and remember vocabulary more effectively. This need directly reflects students' preference for learning environments structured around Dual Coding Theory principles.

Secondly, the iSpring media based on Dual Coding Theory was declared highly feasible for use in Arabic vocabulary learning for Grade X at the Islamic Senior High School. Based on expert validation results and positive student responses, the developed media fulfilled the necessary aspects of content feasibility, design, and practicality, enabling its optimal implementation in real classroom settings.

Third, the developed learning media proved to be significantly effective in improving students' learning responses and vocabulary learning outcomes. The improvement indicates that the integration of verbal and nonverbal representations in iSpring media successfully optimizes students' cognitive processing. This finding provides scientific justification that vocabulary learning effectiveness is strongly influenced by how verbal and nonverbal information is cognitively structured within instructional media.

From a scientific perspective, this study provides both conceptual and methodological contributions. Conceptually, it reinforces the application of Dual Coding Theory as a cognitive foundation in Arabic learning media, an area where implementation has been limited. Methodologically, integrating the ADDIE model with Dual Coding Theory produces a systematic, tested, and replicable development procedure. Unlike previous studies that mainly examined the effectiveness of digital media without explicitly grounding the design in a cognitive theory (Sari, 2023), this study advances the field by systematically operationalizing Dual Coding Theory as the core instructional framework in Arabic vocabulary media development. This approach aligns with the principle that structured multimedia presentations significantly reduce cognitive load during language acquisition (Damayanti et al., 2023).

In practical terms, iSpring learning media based on Dual Coding Theory has the potential to be applied more widely in Arabic language learning in various Islamic Senior High Schools and can be developed to support blended learning and online

learning. Further development also allows for the integration of this media into other Arabic language skills as part of technology-based learning innovation.

For future research trajectories, it is highly recommended to implement a control group experimental design (such as a quasi-experimental setup) to establish a stronger causal relationship regarding the media's effectiveness. Furthermore, future studies should incorporate longitudinal vocabulary retention tracking over a period of several months to evaluate the long-term memory impact of Dual Coding Theory-based media. Replicating this study at different educational levels (such as Islamic Junior High Schools or higher education institutions) and exploring its specific application to other Arabic language skills namely *istimā'*, *kalām*, *qirā'ah*, and *kitābah* will significantly strengthen external validity and expand the empirical foundation of instructional media in Arabic language education.

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CONFLICT OF INTEREST

The authors hereby declares that this research is free from conflicts of interest with any party.

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