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Transforming Arabic Language Education: Expert Consensus on a Digital Learning Module Validated Using the Fuzzy Delphi Method

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Abstract

The rapid advancement of digital technology has necessitated the transformation of Arabic language education through the development of pedagogically sound and expert-validated digital learning modules. However, the lack of systematically validated instructional modules grounded in expert consensus remains a significant challenge. This study aims to identify and validate the essential components of a digital learning module for Arabic language education using the Fuzzy Delphi Method (FDM). A quantitative research design was employed involving a panel of subject-matter experts comprising Arabic language educators, instructional designers, and educational technology specialists. Based on an extensive review of the literature, a structured questionnaire was developed and analysed using triangular fuzzy numbers, threshold values, expert consensus percentages, and defuzzification procedures. The findings revealed that all proposed components of the digital learning module achieved strong expert consensus, with threshold values below 0.2 and a 100% agreement rate among experts. The validated components encompass interactive features, curriculum alignment, gamification, simulation, multimedia integration, discussion-based activities, thematic content organisation, language skills coverage, progressive learning stages, and learner proficiency alignment. These results indicate a robust and comprehensive framework for the development of a digital Arabic language learning module. The study contributes theoretically by extending the application of the Fuzzy Delphi Method in Arabic language education research and practically by providing a validated foundation for designing effective digital learning modules. Future research is recommended to examine the instructional effectiveness of the proposed module through empirical implementation and experimental evaluation.

Keywords: Arabic Language Education, Digital Learning Module, Fuzzy Delphi Method, Expert Consensus, Educational Technology, Instructional Design

Introduction

The rapid digital transformation in education has significantly reshaped language teaching and learning practices, compelling educators to adopt technology-enhanced instructional

approaches. Digital learning modules have become an essential pedagogical solution for improving learner engagement, flexibility, and accessibility, particularly in language education contexts. Studies consistently report that well-designed digital modules can enhance learners' motivation, interactivity, and mastery of language skills when aligned with sound instructional principles and technological affordances (Liu et al., 2023). As a result, the integration of digital technology is no longer optional but a necessity for sustaining educational relevance in the 21st century.

In today's rapidly evolving educational ecosystem, digital competence is not merely an added advantage but a fundamental requirement for effective teaching and learning. Educational institutions worldwide are increasingly transitioning toward blended and fully digital learning environments, making the development of structured, pedagogically sound digital modules critically important. Without systematically designed and validated digital learning frameworks, language education risks becoming fragmented, inconsistent, and less responsive to contemporary learner needs.

Arabic language education faces unique challenges in this digital transition, including limited availability of structured, interactive, and pedagogically validated digital learning resources. Despite the growing interest in digital tools for Arabic language learning, many existing modules lack systematic validation and are often developed without rigorous expert consensus, leading to inconsistencies in content quality, instructional design, and learner alignment (Jaya & Ismail, 2022). This gap highlights the urgent need for a validated framework to guide the development of effective digital learning modules tailored specifically to Arabic language education.

The absence of a comprehensive and empirically validated digital learning module not only affects instructional quality but also limits learners' opportunities to engage meaningfully with the Arabic language through interactive, multimodal, and learner-centred approaches. Given the linguistic complexity of Arabic—encompassing distinct phonological, morphological, and syntactic features—students often require structured scaffolding, progressive learning stages, and contextualised practice. Therefore, the development of a validated digital module is essential to ensure that technological integration genuinely enhances learning effectiveness rather than merely digitising traditional materials.

Recent educational research emphasizes the importance of expert-driven validation methods to ensure instructional quality and relevance. Among these methods, the Fuzzy Delphi Method (FDM) has gained prominence due to its ability to systematically capture expert consensus while addressing uncertainty and subjectivity in expert judgments. FDM has been widely applied in educational technology and language education research to validate instructional modules, models, and frameworks, demonstrating strong reliability and decision-making accuracy (Yusoff et al., 2021; Liu et al., 2023). Its integration of fuzzy set theory with the classical Delphi technique allows researchers to obtain more precise and meaningful consensus outcomes, making it particularly suitable for instructional design validation.

Employing a rigorous validation method such as FDM ensures that the proposed digital learning module is not based solely on individual assumptions or isolated practices, but rather

grounded in collective expert knowledge. This strengthens the credibility, applicability, and scalability of the module across diverse educational contexts. Within the context of Arabic language education, the application of FDM remains relatively limited, especially in validating comprehensive digital learning modules that integrate pedagogy, multimedia, interactivity, and learner proficiency considerations. While previous studies have applied FDM to specific Arabic language components such as speaking skills or vocabulary consolidation (Yusof et al., 2021), there is a notable lack of research focusing on holistic digital module development for Arabic language learning. This gap underscores the need for a structured, expert-validated digital learning module that addresses both linguistic and technological dimensions.

Addressing this gap is not only academically significant but also practically urgent. Educators require reliable design guidelines to ensure instructional coherence, instructional designers need validated components to guide development processes, policymakers seek curriculum-aligned digital solutions to support national education standards, and learners need engaging, structured, and proficiency-aligned materials that support meaningful skill development. Without such a validated framework, digital Arabic language initiatives may remain inconsistent, underutilised, or ineffective.

Therefore, this study aims to identify and validate the essential components of a digital learning module for Arabic language education through expert consensus using the Fuzzy Delphi Method. By systematically synthesizing expert judgments, this research seeks to establish a robust and empirically grounded framework to guide digital module development.

The significance of this study lies in its potential to enhance the utility, effectiveness, and sustainability of digital Arabic language instruction. By producing a validated framework, the study provides a practical blueprint for developing digital modules that are interactive, curriculum-aligned, proficiency-sensitive, and pedagogically sound. Ultimately, this research benefits multiple stakeholders: learners gain access to structured and engaging digital learning experiences; educators receive a validated instructional guide; instructional designers obtain empirically supported development criteria; and educational institutions acquire a sustainable model for digital Arabic language implementation. Through this contribution, the study supports the broader transformation of Arabic language education in alignment with 21st-century educational demands.

Literature Review

Digital Transformation in Language Education

The integration of digital technology has fundamentally transformed language education by reshaping instructional delivery, learner engagement, and assessment practices. Digital learning environments enable flexible, learner-centred approaches that support multimodal input, self-paced learning, and interactive activities. Empirical studies in language education consistently demonstrate that technology-enhanced learning improves learners' motivation, participation, and language performance when aligned with pedagogical principles (Liu et al., 2023). As a result, digital learning modules have emerged as a critical instructional strategy for addressing diverse learner needs in contemporary language classrooms.

In parallel, mobile-assisted and online learning platforms have gained increasing acceptance in language education, particularly after the COVID-19 pandemic accelerated digital adoption.

Research highlights that structured digital modules provide consistency in content delivery while enabling active learning strategies such as simulations, gamification, and collaborative discussion (Paris et al., 2023). These developments indicate that effective digital language learning requires not only technological integration but also systematic instructional design.

Digital Learning Modules in Arabic Language Education

Despite global advancements in digital language education, Arabic language instruction faces persistent challenges in adopting technology-based learning. Existing studies report that many Arabic language digital resources lack pedagogical structure, interactivity, and alignment with learner proficiency levels (Jaya & Ismail, 2022). Consequently, learners often experience fragmented learning experiences that do not adequately support the development of integrated language skills.

Several studies have attempted to address this gap by developing digital modules for specific Arabic language components, such as speaking skills and vocabulary consolidation. For instance, Yusof et al. (2021) validated an Arabic vocabulary learning module using expert consensus and reported that technology-supported learning enhanced learner engagement and retention (Yusof et al., 2021). However, these studies remain limited in scope, focusing on isolated language skills rather than comprehensive digital module frameworks. This limitation underscores the need for holistic digital learning modules that integrate content, pedagogy, multimedia, and assessment in Arabic language education.

Expert Consensus in Instructional Design and Educational Technology

Expert consensus plays a crucial role in validating instructional design elements, particularly in educational technology research where multiple perspectives and contextual considerations are involved. Consensus-based approaches help ensure that instructional modules are pedagogically sound, contextually relevant, and aligned with learner needs. Previous studies demonstrate that expert validation strengthens the reliability and applicability of educational models and instructional frameworks (Yusoff et al., 2021).

In language education, expert consensus has been widely employed to validate curriculum components, instructional standards, and learning technologies. Studies in mobile-assisted language learning and blended learning environments highlight that expert-validated instructional elements lead to more effective and sustainable learning outcomes (Hussain et al., 2023). These findings support the use of structured consensus methods in designing digital learning modules.

Fuzzy Delphi Method in Educational and Language Research

The Fuzzy Delphi Method (FDM) has emerged as a robust approach for obtaining expert consensus in educational research. By integrating fuzzy set theory with the traditional Delphi technique, FDM effectively addresses ambiguity and subjectivity in expert judgments. Numerous studies confirm that FDM enhances decision-making accuracy and consensus reliability in instructional design validation (Liu et al., 2023).

In language education research, FDM has been successfully applied to validate digital modules, pedagogical models, and evaluation frameworks. Studies report high levels of expert agreement when threshold values, consensus percentages, and defuzzification criteria

are met (Yusoff et al., 2021). However, the application of FDM in Arabic language digital module development remains limited, particularly for comprehensive modules that address multiple instructional dimensions.

Research Gap

The reviewed literature indicates a growing body of research on digital learning modules and expert consensus methods in language education. Nevertheless, there is a clear lack of studies that employ the Fuzzy Delphi Method to validate a comprehensive digital learning module specifically designed for Arabic language education. Existing studies predominantly focus on isolated language skills or specific learner contexts, leaving a gap in holistic module development that integrates pedagogical, technological, and linguistic components. Addressing this gap is essential for advancing the quality and effectiveness of digital Arabic language education.

Methodology

Research Design

This study employed a quantitative research design using the Fuzzy Delphi Method (FDM) to obtain expert consensus on the essential components of a digital learning module for Arabic language education. The FDM was selected due to its ability to systematically synthesise expert judgments while addressing uncertainty and subjectivity inherent in human decision-making. Previous studies in language education and instructional design have demonstrated that FDM is effective for validating module elements, instructional frameworks, and educational models (Liu et al., 2023; Yusoff et al., 2021). The use of FDM in this study aligns with the objective of validating instructional components based on expert consensus prior to module development and implementation.

Selection of Experts

A total of twelve (12) experts participated in this study. The experts were selected using purposive sampling, which is commonly employed in Delphi-based research to ensure that participants possess relevant expertise rather than representativeness. The expert panel consisted of individuals who met at least one of the following criteria:

1. Academics with recognised expertise in Arabic language education
2. Specialists in instructional design or educational technology
3. Practitioners with experience in developing or implementing digital learning modules

The number of experts involved in this study aligns with methodological recommendations for Fuzzy Delphi research, which suggest that panels consisting of 10–20 experts are sufficient to achieve reliable and stable consensus outcomes (Jaya & Ismail, 2022). All experts participated voluntarily and provided informed consent prior to data collection.

Instrument Development

The research instrument consisted of a structured questionnaire developed based on an extensive review of the literature on digital learning modules, Arabic language education, and technology-enhanced instructional design. The questionnaire was designed to capture expert judgments regarding the suitability and importance of proposed components of a digital Arabic language learning module. The questionnaire comprised seventeen (17) items,

representing key instructional, pedagogical, and technological elements of the module. These items included:

1. The module is designed to be interactive.
2. The module is aligned with the Document of Standard Curriculum and Assessment (DSKP).
3. The module integrates gamification elements.
4. The module incorporates simulation elements.
5. The module utilises various technological elements.
6. The module integrates discussion-based elements.
7. The module uses vocabulary appropriate to learners' proficiency levels.
8. The module is organised thematically according to learners' proficiency levels.
9. The topics included in the module are aligned with the DSKP.
10. The topics included in the module are aligned with the designated themes.
11. Topics related to speaking skills are sufficient.
12. Topics related to listening skills are sufficient.
13. Topics related to reading skills are sufficient.
14. Topics related to writing skills are sufficient.
15. The module contains multiple levels within its content.
16. The module contains multiple levels of vocabulary difficulty.
17. The module is appropriate for learners' proficiency levels.

Each item was measured using a five-point linguistic Likert scale, ranging from *strongly disagree* to *strongly agree*. These linguistic responses were subsequently transformed into triangular fuzzy numbers to facilitate Fuzzy Delphi analysis, following established procedures in prior educational research.

Fuzzy Delphi Procedure

The Fuzzy Delphi Method was implemented through several systematic steps:

1. Transformation of Linguistic Variables
   Expert responses were converted into triangular fuzzy numbers representing minimum (m_1), most plausible (m_2), and maximum (m_3) values.
2. Calculation of Threshold Values (d)
   The threshold value was calculated to measure the distance between expert opinions. Items with threshold values of $d \leq 0.2$ were considered to have achieved acceptable consensus (Yusoff et al., 2021).
3. Expert Consensus Percentage
   A minimum of 75% expert agreement was required for an item to be accepted, consistent with standards used in prior FDM studies (Jaya & Ismail, 2022).
4. Defuzzification Process
   Accepted items were further analysed using the defuzzification formula to obtain a single crisp value (A). Items with defuzzification values of $A \geq 0.5$ were retained as validated components (Liu et al., 2023).

Data Analysis

All data were analysed using spreadsheet-based calculations and statistical procedures commonly employed in FDM research. The analysis focused on determining which components of the digital learning module achieved expert consensus based on the three acceptance criteria: threshold value, consensus percentage, and defuzzification score. The

final output of the analysis was a validated list of digital learning module components ranked according to expert priority, providing a structured foundation for subsequent module development.

Findings

Item	*Triangular Fuzzy Numbers*		*Fuzzy Evaluation*				Expert Consensus	Accepted Element	Ranking
	Threshold Value, d	Expert Consensus Percentage, %	m1	m2	m3	*Fuzzy Score (A)*			
1	0.092	100.0%	0.767	0.925	0.992	0.894	TERIMA	0.894	8
2	0.057	100.0%	0.850	0.975	1.000	0.942	TERIMA	0.942	3
3	0.138	100.0%	0.683	0.858	0.967	0.836	TERIMA	0.836	16
4	0.083	100.00%	0.750	0.917	0.992	0.886	TERIMA	0.886	9
5	0.116	100.00%	0.700	0.875	0.975	0.850	TERIMA	0.850	15
6	0.042	100.00%	0.867	0.983	1.000	0.950	TERIMA	0.950	1
7	0.112	100.00%	0.750	0.908	0.983	0.881	TERIMA	0.881	12
8	0.042	100.00%	0.867	0.983	1.000	0.950	TERIMA	0.950	1
9	0.068	100.00%	0.833	0.967	1.000	0.933	TERIMA	0.933	4
10	0.042	100.00%	0.733	0.917	1.000	0.883	TERIMA	0.883	10
11	0.076	100.00%	0.800	0.950	1.000	0.917	TERIMA	0.917	7
12	0.074	100.00%	0.817	0.958	1.000	0.925	TERIMA	0.925	5
13	0.125	100.00%	0.717	0.883	0.975	0.858	TERIMA	0.858	14
14	0.042	100.00%	0.733	0.917	1.000	0.883	TERIMA	0.883	10
15	0.129	100.00%	0.667	0.850	0.967	0.828	TERIMA	0.828	17
16	0.074	100.00%	0.817	0.958	1.000	0.925	TERIMA	0.925	5
17	0.070	100.00%	0.733	0.908	0.992	0.878	TERIMA	0.878	13

This study employed the Fuzzy Delphi Method (FDM) to obtain expert consensus on the essential components of a digital learning module for Arabic language education. A total of twelve (12) experts evaluated seventeen (17) proposed items representing instructional, pedagogical, and technological elements of the module. The analysis was conducted based on three established FDM acceptance criteria: a threshold value (d) not exceeding 0.2, an expert consensus percentage of at least 75%, and a defuzzification score (A) equal to or greater than 0.5.

The findings indicate that all seventeen items successfully met the acceptance criteria. The threshold values for the items ranged from 0.042 to 0.138, demonstrating a high level of convergence in expert opinions and indicating strong agreement across all evaluated components. In addition, all items achieved a 100% expert consensus rate, reflecting unanimous agreement among the experts regarding the relevance and suitability of each proposed element. Furthermore, all defuzzification scores exceeded the minimum cut-off value of 0.5, confirming that every item was accepted and retained as a validated component of the digital learning module.

The defuzzification analysis revealed that the scores ranged between 0.828 and 0.950, indicating that experts perceived all components as highly important. The highest-ranked components, with defuzzification scores of 0.950, were the integration of discussion-based elements and the thematic organisation of content aligned with learners' proficiency levels. These findings suggest that experts placed strong emphasis on interactive communication and structured thematic learning within digital Arabic language instruction. Other highly prioritised components included alignment with the Document of Standard Curriculum and Assessment (DSKP), adequacy of listening skill content, and the inclusion of multiple levels of vocabulary difficulty, all of which recorded defuzzification scores above 0.925.

Although some components such as the inclusion of multi-level content structures and gamification elements received comparatively lower rankings, they were still accepted with defuzzification scores well above the threshold value, indicating their continued relevance within the module design. Overall, the ranking results provide a clear prioritisation of module components based on expert judgment, which can serve as a structured guideline for subsequent module development.

In summary, the findings confirm that all proposed components of the digital learning module were validated through expert consensus using the Fuzzy Delphi Method. The results demonstrate strong agreement among experts on the importance of integrating interactive features, curriculum alignment, thematic organisation, comprehensive language skills coverage, technological integration, and proficiency-level differentiation. These validated and prioritised components establish a robust empirical foundation for the design and development of a comprehensive digital learning module for Arabic language education.

Discussion

The purpose of this study was to validate the essential components of a digital learning module for Arabic language education through expert consensus using the Fuzzy Delphi Method (FDM). The findings demonstrate unanimous expert agreement on all seventeen proposed components, indicating a strong and shared understanding among experts regarding the pedagogical, technological, and linguistic requirements of an effective digital Arabic language learning module. This outcome reinforces the appropriateness of using FDM as a rigorous decision-making and validation tool in educational module development.

One of the most significant findings is the prioritisation of discussion-based elements and thematic organisation aligned with learners' proficiency levels, both of which achieved the highest defuzzification scores. This reflects a growing emphasis in language education on meaningful interaction and contextualised learning. Interactive discussion activities are widely recognised as crucial for developing communicative competence, particularly in second and foreign language learning environments, as they encourage authentic language use and collaborative meaning-making (Liu et al., 2023). In the context of Arabic language education, where learners often struggle with productive skills, the integration of structured discussion elements can play a vital role in improving fluency and confidence.

The strong consensus on curriculum alignment, particularly alignment with the Document of Standard Curriculum and Assessment (DSKP), highlights the importance of ensuring coherence between digital learning materials and formal educational standards. This finding

aligns with previous studies that emphasise curriculum alignment as a key factor in the successful adoption of digital learning modules within formal education systems (Jaya & Ismail, 2022). Digital modules that are not aligned with curriculum standards risk being perceived as supplementary rather than integral instructional tools, thereby limiting their pedagogical impact.

Another notable outcome is the high level of agreement on the adequacy of language skill coverage, including listening, speaking, reading, and writing components. This finding supports the view that effective digital language modules should adopt a holistic approach that addresses all core language skills rather than focusing on isolated competencies. Similar conclusions have been reported in studies validating language learning frameworks and modules using FDM, where balanced skill integration was identified as a critical design principle (Pham & Abdullah, 2025). For Arabic language education, such comprehensive skill coverage is particularly important due to the linguistic complexity of the language and the need for coordinated development of receptive and productive skills.

The acceptance of gamification and simulation elements, although ranked lower than interaction and curriculum alignment, indicates expert recognition of their supportive role in enhancing learner engagement. This finding is consistent with research showing that gamified and simulated learning environments can increase motivation and sustain learner interest, especially in digital and mobile-assisted language learning contexts (Paris et al., 2023). However, the relatively lower ranking suggests that experts view these elements as complementary rather than foundational, reinforcing the idea that pedagogical integrity should take precedence over technological novelty.

The strong validation of multi-level content and vocabulary differentiation further underscores the importance of learner-centred design in digital language education. Experts' agreement on these components aligns with contemporary instructional design principles that emphasise adaptive learning and scaffolding to accommodate diverse learner proficiency levels (Zain et al., 2022). In Arabic language learning, where learner backgrounds and proficiency levels often vary widely, such differentiation is essential for maintaining instructional effectiveness and learner engagement.

From a methodological perspective, the findings further validate the effectiveness of the Fuzzy Delphi Method in educational research. The achievement of 100% expert consensus across all items, combined with low threshold values, demonstrates the method's capacity to synthesise expert judgment systematically and transparently. This supports earlier research advocating the use of FDM in validating instructional modules, educational frameworks, and policy-related models (Yusoff et al., 2021). The application of FDM in this study contributes to the limited but growing body of research employing this method specifically within Arabic language education.

Overall, the discussion highlights that the validated components collectively represent a comprehensive and pedagogically grounded framework for digital Arabic language learning. By integrating interaction, curriculum alignment, skill balance, technological support, and learner differentiation, the proposed module framework addresses both instructional quality

and contemporary digital learning demands. These findings provide a strong empirical basis for the subsequent design and development phases of the digital learning module.

Conclusion

This study validated the essential components of a digital learning module for Arabic language education through expert consensus using the Fuzzy Delphi Method (FDM). The findings revealed unanimous agreement among twelve experts on all seventeen proposed components, with all items meeting the established acceptance criteria of low threshold values, full expert consensus, and high defuzzification scores. The validated components emphasise the integration of interactive and discussion-based learning, thematic organisation aligned with learners' proficiency levels, curriculum alignment with the Document of Standard Curriculum and Assessment (DSKP), comprehensive coverage of core language skills, technological integration, and differentiated content and vocabulary levels. Collectively, these elements reflect contemporary principles of effective digital language pedagogy that prioritise learner-centred design, instructional coherence, and meaningful engagement. Methodologically, the study further confirms the robustness of the Fuzzy Delphi Method as a systematic and reliable approach for validating instructional modules in language education, particularly within the relatively underexplored context of Arabic language learning. From a practical perspective, the findings provide a clear, empirically grounded guideline for educators, instructional designers, and curriculum developers in designing and implementing digital Arabic language learning modules that are pedagogically sound and curriculum-aligned. While this study establishes a strong foundational framework, future research should focus on the design and development of the proposed module followed by empirical evaluation through experimental or quasi-experimental studies to examine its effectiveness on learners' language proficiency, engagement, and learning outcomes across different educational contexts and proficiency levels.

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