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Development of an Arabic Vocabulary Selection Model for Lower Secondary Students using the Fuzzy Delphi Method

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Abstract
The purpose of this project is to utilise the Fuzzy Delphi technique to develop an Arabic vocabulary selection model for Malaysian lower secondary students. The researcher chose five Arabic and educational specialists to assess important vocabulary selection factors. The experts identified five primary domains: instructional value, curriculum relevance, contextual suitability, frequency of use, and challenge level. Every Fuzzy Delphi criterion was met by the model, including the α-cut score (≥ 3.5), agreement (≥ 75%), and threshold value (d < 0.2). This concept can inform the development of more effective Arabic teaching resources.

Keywords: Arabic vocabulary; Fuzzy Delphi Method; lower secondary education; curriculum development

1.0 Introduction

This study aims to get expert approval for developing an Arabic Vocabulary Selection Model for Lower Secondary Students Using the Fuzzy Delphi Method (FDM). Vocabulary mastery is a critical aspect in Arabic language learning, especially at the lower secondary level (Hanifansyah & Mahmudah, 2024). Therefore, this study developed an Arabic Vocabulary Selection Model based on the FDM, using five main criteria: instructional value, curriculum relevance, context suitability, frequency of use, and difficulty level. An expert agreement of 97% was reached, indicating the validity of this model. This model is expected to assist educators in teaching Arabic more effectively.

Clarity of Aim/Purpose of Study:

1. To investigate the effectiveness of the FDM in developing an Arabic vocabulary selection model for lower secondary students.
2. To explore expert consensus on key criteria (instructional value, curriculum relevance, etc.) for Arabic vocabulary selection.
3. To validate a research-based model through systematic expert evaluation, ensuring alignment with pedagogical needs.

Objectives of the study:

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1. To develop an Arabic Vocabulary Selection Model for lower secondary students using the Fuzzy Delphi Method.
2. To validate the model through expert consensus (97% agreement, d < 0.2 threshold).
3. Ensure the model meets key criteria, including instructional value and curriculum relevance.

2.0 Literature Review

Although studying Arabic requires vocabulary knowledge, Malaysian lower secondary schools do not have standardised, contextually relevant word lists (Ramli & Ghani, 2025). Research indicates that results are improved by systematic selection based on educational value, frequency, and difficulty (Milton & Hopwood, 2022). However, arbitrary decisions result from present models' disregard for expert opinion (Hanifansyah & Mahmudah, 2024). This is addressed with the FDM, which synthesises expert input (Syahfutra et al., 2024). Five criteria—instructional value, curriculum alignment, context, frequency, and difficulty—are validated in this study using FDM. By addressing pedagogical and standardisation shortcomings, it provides an organised framework for teaching Arabic vocabulary.

3.0 Methodology

This research applies the Multi-Research Methods approach by Richey and Klein (2014). Researchers in development studies typically employ Design and Development Research, which facilitates the creation of frameworks, models, designs, and other elements that contribute to the primary purpose of each study.

The assessment has two separate areas, with the initial phase requiring the researcher to identify relevant literature to develop the Arabic Vocabulary Selection Model for Lower Secondary Students. Consequently, the researchers move on to Step 2, using the FDM based on the consensus of experts. It is a method employed to bring team members to agreement on what should be developed. For example, experts provide their advice by designing consent evaluation tools for the framework. Until the data is examined, the Arabic Vocabulary Selection Model for Lower Secondary Students is created based on expert agreement.

3.1 Sampling procedure

In this case, sampling is conducted with a clear purpose, gauging experts' opinions on a specific issue. Hasson et al. (2000) stated that using purposeful sampling is the best approach in the FDM (Hasson et al., 2000). Correspondingly, seven specialists participated in this study throughout its duration. Table 1 presents the list of those who have consented to engage in the survey. They were appointed, given the necessary qualifications and experience. At least five to ten professionals are needed if the specialists share the same role. Note that approximately 10 to 15 Delphi experts are involved when there is strong agreement between responses (Adler & Ziglio, 1996).

Table 1. List of experts

Expert	Field of expertise	Institution
7 Religion teacher	Islamic studies	7 Public School

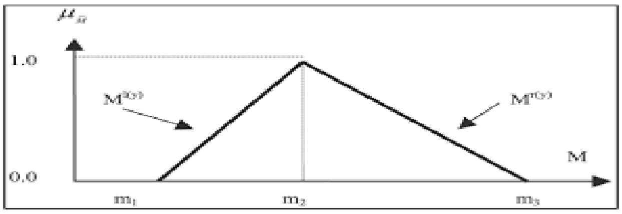
3.2 Expert criteria

Booker and McNamara (2004) delineated experts as individuals who have attained their qualifications, undergone rigorous training, accumulated extensive experience, obtained professional affiliations, and received acknowledgement from their peers through diligent effort and unwavering commitment (Ayyub, 2001). Following the findings of Cantrill et al. (1996), an expert is expressed as someone possessing substantial knowledge and proficiency in a specific domain or sector. The expert selection process constitutes a critical consideration within the framework of Fuzzy Delphi research. Inadequate execution of expert selection, particularly based on insufficient criteria, may raise concerns regarding the legitimacy, validity, and reliability of the study's findings (Mustapha & Darusalam, 2017). According to Kaynak and Macaulay (1984), those conducting the research must have relevant experience or skills related to the issue being examined. Hence, experts selected by the researcher have at least seven years of experience and are relevant to the research context, having been chosen according to strict evaluation standards.

3.3 Fuzzy Delphi step

Table 2. Fuzzy Delphi step

Step	Formulation
1. Expert selection	• This report was compiled with input from 11 separate specialists. Consequently, a group of linguistic experts was assembled to evaluate the importance of each assessment parameter for each factor being studied and to explain any potential issues with the work.
2. Determining the linguistic scale	• The process mainly involves modifying all linguistic terms into triangle (Triangular Fuzzy Number) values. In this method, fuzzy numbers are combined with linguistic variables (Hsieh et al., 2004). A Triangular Fuzzy Number written as (m1, m2, m3) represents the values m1, m2 and m3. The smallest value is m1, its rational value is denoted by m2, and the highest is m3. To express these linguistic variables in fuzzy numbers, the Triangular Fuzzy Number is used to create a Fuzzy Scale.

Step	Formulation
	 Fig. 1: Triangular fuzzy number
3. The Determination of Linguistic Variables and Average Responses	• All measurement results need to be converted into Fuzzy Scales once feedback has been obtained from the appointed expert. This process is commonly understood as the validation or recognition of each response (Benitez et al., 2007).
4. Determining the threshold value "d"	• When assessing the level of expert agreement, the threshold value is essential (Thomaidis et al., 2006). The formula below is employed to determine the distances for any fuzzy integer m = (m1, m2, m3) as well as n = (m1, m2, m3): $d(\tilde{m},\tilde{n}) = \sqrt{\frac{1}{3}\left[(m1-n1)^2 + (m2-n2)^2 + (m3-n3)^2\right]}$
5. Identify the α-cut aggregate level of fuzzy assessment	• Each item is provided with a fuzzy number given that an expert consensus is formed (Mustapha & Darusalam, 2017). The method for determining and quantifying fuzzy values is as given by: (1) Amax = 4 (m1 + 2m2 + m3)
6. Defuzzification process	• This methodology employs the equation Amax = (1)⁄4 (a1 + 2am + a3). Should the investigator utilise Average Fuzzy Numbers or average responses, the resultant numerical score will fall within the interval of 0 to 1(Jamil et al., 2013). In this methodology, three distinct formulas are presented: i. A = 1/3 * (m1 + m2 + m3), or; ii. A = 1/4 * (m1 + 2m2 + m3), or; iii. A = 1/6 * (m1 + 4m2 + m3). The α-cut value is the median value between '0' and '1', computed as α-cut = (0 + 1) / 2 = 0.5. When the computed A value is inferior to the α-cut value of 0.5, the corresponding item shall be deemed unacceptable due to a lack of concordance among experts. As posited by Bodjanova (2006), the alpha cut value should surpass 0.5. This assertion is corroborated by Tang and Wu (2010), who maintained that the α-cut value must exceed the threshold of 0.5.
7. Ranking process	• The placement process is executed by defining elements according to defuzzification values based on expert consensus, which identifies the most crucial location for decision-making and assigns the highest priority to the element (Fortemps & Roubens, 1996).

3.4 Instrumentation

The Fuzzy Delphi research instrument was meticulously formulated by the researcher, utilising extant literature pertinent to the subject matter. It is posited that researchers can construct questionnaire items derived from literature, preliminary studies, and experiential insights (Skulmoski et al., 2007). Correspondingly, in formulating inquiries for the FDM, they incorporated scholarly research literature, expert consultations, and focus group methodologies (Mustapha & Darusalam, 2017). Moreover, Okoli and Pawlowski (2004) contended that the inception of item and content development for research should commence with a thorough examination of pertinent literature.

Thus, researchers aggregated the significant ramifications of deceptive news on societal constructs by synthesising published scholarly works. Subsequently, a compendium of expert queries was formulated employing a 7-point Likert scale. The adoption of the 7-point scale was deemed advantageous, as an increased number of response options enhances the precision and validity of the outcomes (Chang et al., 2011). To facilitate the ease of response for professionals engaging with the questionnaire, the researcher modified the Fuzzy value in Table 4 to correspond with a 1–7 scale value, as delineated:

Table 3. Fuzzy scale

Item	Fuzzy number
Strongly disagree	(0.0, 0.0, 0.1)
Disagree	(0.0, 0.1, 0.3)
Somewhat Disagree	(0.1, 0.3, 0.5)
Neutral	(0,3, 0.5, 0.7)
Somewhat agree	(0.5, 0.7, 0.9)
Agree	(0.7, 0.9, 1.0
Strongly agree	(0.9, 1.0, 1.0)

3.5 The List Of the Arabic Vocabulary Selection Model for Lower Secondary Students Using the Fuzzy Delphi Method

Researchers highlighted the critical features of an Arabic Vocabulary Selection Model for Lower Secondary Students. Researchers will then use the FDM to confirm whether the experts agree this factor should be included in the model. To confirm the vocabulary selection criteria, this study employed the FDM with seven Arabic education experts (with ≥7 years of experience). Reliability was established by the **97% consensus** and the **threshold value (d < 0.2)**. Note that a **7-point Likert scale** that was translated to fuzzy numbers was employed by the instruments. Validity was guaranteed by rigorous **defuzzification (α-cut ≥ 0.5)**. Expert homogeneity compensated for the small sample size.

4.0 Findings

Expert opinion will cover some aspects of Arabic Vocabulary Selection for Lower Secondary Students. Seven experts in the specialised field answered the Fuzzy Delphi questions, and the outcomes were built from those responses. This study revealed the following knowledge:

Table 5. The analysis result

Results	ITEM = 7		Threshold value d <=		0.2		
	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Expert 1	0.056	0.127	0.199	0.029	0.068	0.305	0.203
Expert 2	0.056	0.127	0.199	0.029	0.068	0.036	0.203
Expert 3	0.056	0.125	0.054	0.264	0.186	0.305	0.189
Expert 4	0.056	0.127	0.054	0.029	0.186	0.036	0.203
Expert 5	0.336	0.125	0.197	0.029	0.068	0.380	0.189
Expert 6	0.056	0.127	0.054	0.264	0.186	0.247	0.061
Expert 7	0.056	0.265	0.054	0.593	0.366	0.036	0.189

Following data processing, the bold threshold value exceeds the threshold value of 0.2 (> 0.2), as determined in the findings (refer to Table 5). Here, specialists may have different or even conflicting perspectives on issues. An Arabic Vocabulary Selection model generally has an average threshold value (d) below 0.2, 0.05329. Should the average (d) value be less than 0.2, the item reflects strong agreement among experts (Cheng & Lin, 2002). The indicator shows that at least 97% of experts agreed on this item, which surpasses (> 75%) the set quantity of 97%.

This study surpassed the 75% validity level with 97% expert consensus. Strong agreement is indicated by the average threshold value of d=0.053 (d<0.2). The criteria with the highest acceptability were curriculum relevance (d=0.127) and instructional value (d=0.056). Slight differences in contextual appropriateness (d = 0.593) suggest that particular learning settings require modification. These findings support the model's reliability in selecting Arabic vocabulary.

5.0 Discussion

FDM was used in this study to create a validated Arabic vocabulary selection model, which achieved 97% expert consensus with d<0.2 and α-cut≥3.5. It tackles three main problems in line with Vygotsky's (1978) theory: lack of contextualisation, curriculum misalignment, and arbitrary selection (Milton & Hopwood, 2022). Their pedagogical priority is highlighted by the strong agreement on instructional value (d = 0.056) and curriculum relevance (d = 0.127). Although generalisability is limited by the tiny expert panel (n=7), the model offers a valuable foundation that requires additional classroom testing. Furthermore, the approach could influence curricular policy and potentially enhance less-frequently taught language instruction worldwide. Integration with digital technologies in the future could improve implementation while upholding standards based on evidence.

6.0 Conclusion & Recommendations

The study successfully developed an Arabic Vocabulary Selection Model for lower secondary learners using the FDM, incorporating experts' views to ensure the model's validity and relevance. There was strong agreement among experts, as the chosen vocabulary elements scored low on average (d < 0.2), and 97% of the experts agreed that these elements were key vocabulary. Note that experts were carefully assessed using specific standards, and linguistic statements were turned into numbers with fuzzy logic, which made the model more dependable and precise.

With a format that is suitable for its users and thoroughly validated, the model is crucial for teaching Arabic at the lower secondary level. It is intended to help language curriculum creators, textbook makers, and educators make more efficient teaching materials.

At the same time, these studies have their difficulties. Between the use of a small number of participants and the strong emphasis on expert opinions, conducting further empirical studies would help make the findings more convincing.

Future research should consider:-

1. Empirical validation of the model with actual student cohorts to measure its impact on vocabulary acquisition and language proficiency.
2. Cross-contextual studies to adapt and validate the model across different educational settings, including private and international schools.
3. Integration with digital learning tools and mobile applications to evaluate the model's effectiveness in technology-enhanced learning environments.
4. Longitudinal studies to track vocabulary retention and application over time among students using this model.

The use of FDM enabled the study to develop an Arabic vocabulary selection model, which was confirmed by experts. More research is needed on testing in various settings, its application in the classroom, and its integration with technology-based education.

Finally, selecting vocabulary based on expert consensus represents a crucial first step in enhancing Arabic language education. Additional studies can build upon this research to enhance the model's utility for teachers and students.

It is worth noting that this study has several limitations. First, the findings' generalisability can be impacted by the tiny expert panel (n=7). Second, there was no empirical testing of the model in actual classroom environments. Instead, it was validated purely by expert consensus. Third, its immediate applicability to other educational environments or age groups is limited due to its focus on lower secondary students in Malaysia. These constraints highlight the need for broader validation and adaptation in future research.

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Paper Contribution to Related Field of Study
This research provides a straightforward and confirmed method for picking vocabulary in Arabic language education. It ensures that students' needs are met, enhances curriculum development, and creates a model that can be applied to language teaching in various environments.

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