Rasch Analysis of Students' Motivation in Learning Arabic Instrument (I-SMA) for Malaysian Universities

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Abstract. This study employs Rasch Model analysis to assess the validity and reliability of the I-SMA instrument, aimed at measuring students' motivation in learning Arabic language. Utilizing a cross-sectional survey design, data was gathered from 273 graduating students majoring in Arabic language across eight Malaysian universities. The I-SMA instrument incorporated 20 items derived from three sub-constructs: intrinsic, extrinsic, and holistic, employing a four-point rating scale extending from strongly disagree to strongly agree in the questionnaire. This study presents the examination of each item's quality within the instrument utilizing Winsteps version 5.2. Results indicate that all items on the I-SMA instrument meet Rasch criteria, establishing its reliability and validity as a tool for evaluating Malaysian students' motivation in Arabic language learning, thereby enhancing language education assessment practices.

Keywords: Arabic Language Learning, Motivation Instrument, Malaysian Universities, Educational Assessment, Rasch Measurement Model.

1 Introduction

Arabic language has been integrated into the formal education system across various levels in Malaysia, spanning from primary to higher education. At the tertiary level, Arabic language holds a distinctive status as a mandatory language within the academic framework, serving as a core component of the educational curriculum [1]. Aligned with the objectives outlined in the Malaysian Education Development Plan 2013-2025, the Ministry of Education emphasizes the importance of language acquisition for all students, aiming to enhance the nation's educational landscape [2]. Moreover, proficiency in word-related aspects is essential within language skills, as language serves as a fundamental tool for expressing ideas and thoughts. Effective communication relies on organizing sentences to convey ideas coherently and accurately within the intended context [3].

In the context of Arabic language education in Malaysia, previous research efforts are seen to focus more on the target aspect (what needs to be learned) and the product

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(what is learned) than focusing on the learning process aspect (how an aspect of the language is learned) [4]. Motivation plays a pivotal role in the learning process, as it is closely linked to student autonomy and proficiency in language acquisition. Study [5] further emphasizes the significance of student motivation in determining language mastery and shaping individual learning approaches.

The distinctive nature of Arabic language learning in Malaysia is influenced by local religious and cultural norms, highlighting the interplay between language acquisition and motivational factors [6]. Despite the acknowledgment of religious significance in Arabic language education, there remains a research gap concerning the integration of Islamic principles with Western motivational theories, particularly in the context of Arabic vocabulary acquisition in Malaysia. Western studies predominantly emphasize extrinsic motivators such as rewards and recognition as key drivers for language vocabulary acquisition [7], [8], [9], [10], [11], contrasting with potential Islamic-influenced motivational factors. This lack of exploration extends to holistic perspectives on motivation within the Malaysian Arabic language learning context.

Hence, given the dearth of prior research integrating holistic or Islamic elements with Western motivational theory regarding Arabic vocabulary acquisition in Malaysia, the researcher has devised a questionnaire instrument, namely the Motivation of Malaysian Students towards Learning Arabic (i-SMA), for Arabic students in public universities. However, prior to its utilization, it is imperative for the researcher to as-certain the instrument's validity and reliability. Subsequently, an analysis will be con-ducted using the Rasch model approach to evaluate the validity and reliability of the i-SMA instrument.

2 Research Method

2.1 Research Instrument

This evaluation instrument comprises two segments: Section A encompasses demographic data of participants, including gender, university affiliation, Arabic language proficiency level, and weekly study hours dedicated to Arabic. In contrast, Section B consists of inquiries regarding the motivation of Malaysian students in studying Arabic, comprising 20 items sourced from prior research and categorized into intrinsic, extrinsic, and holistic sub-constructs. Specifically, there are 8 items categorized under the intrinsic sub-construct, 8 items under the extrinsic sub-construct, and 4 items pertaining to the holistic sub-construct. Intrinsic and extrinsic items are derived from studies [12] and [13], respectively, while items for the holistic construct are drawn from the instrument developed by [14].

The intrinsic dimension gauges internal factors like interest, curiosity, and thirst for knowledge, impacting student satisfaction with their learning endeavours. Conversely, the extrinsic facet assesses external motivators, such as academic performance and social status derived from peer comparison. Finally, the holistic component evaluates students' inclination towards deepening their religious comprehension, encompassing understanding of prayer recitations, Quranic verses, and hadith literature.

This instrument employs a 4-point scale encompassing "strongly disagree," "disagree," "agree," and "strongly agree," to represent agreement, deliberately excluding a neutral option to prevent respondents from selecting a middle ground [15]. This decision is based on the suggestion by [16], who argues that a neutral scale frequently leads to problems, advocating instead for a 4-point scale to delineate levels of agreement.

Content Validity of Research Instrument. The instrument underwent a content validity assessment by a panel of five experts, comprising senior lecturers from various academic institutions specializing in Arabic linguistics and questionnaire construction. However, feedback was obtained from only four of the panel members, who were selected based on their expertise in Arabic language education and questionnaire design. The experts were tasked with reviewing and providing insights on the questionnaire format, content, and linguistic structure.

The expert panel unanimously confirmed the instruments' capability in measuring the intended content aspects, although attention was given to certain areas for improvement. Specifically, recommendations were provided regarding item clarity and construct coherence, leading to subsequent refinements made by the researcher. Davis [17] suggests that to assess the reliability among experts, the Content Validation Index (CVI) was employed, with a threshold of 0.80 considered acceptable for new instruments. Overall, the attained agreement coefficients for all values demonstrate a reasonable level of agreement, surpassing the threshold of 0.80, indicating that all items within the instrument garnered satisfactory agreement from all involved experts

2.2 Respondent and Data Collection

The research adopts a cross-sectional survey design involving 273 graduating students majoring in Arabic language from eight Malaysian universities, including the International Islamic University of Malaysia (UIAM), Universiti Teknologi Mara (UiTM), Universiti Kebangsaan Malaysia (UKM), Universiti Malaya (UM), Universiti Sultan Zainal Abidin (UniSZA), Universiti Putra Malaysia (UPM), Universiti Pendidikan Sultan Idris (UPSI), and Universiti Sains Islam Malaysia (USIM).

Permission was sought from the respective department heads to access the designated classes during specified periods. A series of assessment tools was administered to students via a Google Form, allowing them to respond using either a computer or smartphone to prevent incomplete data. Prior to commencing the test, participants were instructed to read the guidelines and complete the assessment individually with-in a designated timeframe of one hour, without any external assistance. Upon completion, the student's name was displayed on the classroom screen, ensuring that responses corresponded to the actual class attendance.

2.3 Data Analysis

In the context of this study, the Rasch Measurement Model, facilitated by Winsteps version 5.2, has been utilized to augment the assessment of the instrument's validity

beyond the conventional reliance on Cronbach's alpha. This analytical tool assists in scrutinizing the quality and performance of the items under examination, aiming to fortify the instrument's validity with precision and rigor [18].

3 Results

The analysis of the data was conducted utilizing the Rasch measurement model with the support of Winsteps software version 5.2. Item analysis involved several aspects including (i) item polarity detection, (ii) reliability, (iii) item fit detection, (iv) dimensionality uniformity, (v) local independence, (vi) rating scale diagnostics, and (vii) Wright Map.

3.1 Item Polarity

Item polarity analysis (Point Measure Correlation-PTMEA CORR) or item parallelism, assesses the consistency of item directionality within a construct. A positive index across all items suggests coherence in their alignment, while a negative index necessitates further scrutiny of the data to ascertain potential improvements or item exclusions.

For I-SMA, the point measure correlation ranges from a minimum value of (.40) to a maximum PTMEA CORR value of (.77), indicating positive alignment among items and the construct being measured, as negative values are absent. This statistical consistency underscores the coherence and directional uniformity of the items, emphasizing the importance of PTMEA CORR analysis in ensuring item parallelism and construct validity.

3.2 Reliability

The reliability of item and respondent elucidates the congruence level of items with the Rasch measurement model and assesses the separation index of both items and respondents, thereby indicating the discerned number of difficulty strata among items and individual abilities within the surveyed cohort. Following the functional examination, the person separation value obtained for I-SMA is 2.71 with a reliability coefficient of 0.88, while the separation and reliability values for items are 5.93 and 0.97, respectively. These findings indicate that the trustworthiness of the I-SMA instrument is very good and effective with a high level of consistency [19] in assessing the motivation level of Malaysian students towards learning Arabic, supported by robust person and item reliability indices nearing 1.00 and separation indices surpassing the threshold of 2.00, as suggested by [20]. Table 1 provides a summary of person, while Table 2 presents a summary of items.

Table 1. Summary of Person.

	Total Score	Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	64.6	20.0	2.05	0.45	1.07	-0.1	0.99	-0.3
S.D.	8.4	0.0	1.53	0.11	0.73	2.2	0.70	2.2
Max.	79.0	20.0	5.97	1.05	3.93	5.9	4.01	6.6
Min.	39.0	20.0	-1.63	0.33	0.11	-4.3	0.10	-4.3
Real RMSE	0.53	True SD	1.44	Separation	2.71	Person Reliability		0.88
Model RMSE	0.46	True SD	1.46	Separation	3.16	Person Reliability		0.91
S.E. of Person Mean = 0.09								

Table 2. Summary of Item.

	Total Score	Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	883.5	273.0	0.00	0.00	0.98	-0.6	0.99	-0.3
S.D.	59.2	0.0	0.75	0.01	0.40	4.2	0.48	4.2
Max.	951.0	273.0	2.02	0.13	2.05	9.9	2.34	9.9
Min.	709.0	273.0	-0.95	0.10	0.53	-6.1	0.48	-5.1
Real RMSE	0.12	True SD	0.74	Separation	5.93	Item Reliability		0.97
Model RMSE	0.12	True SD	0.74	Separation	6.26	Item Reliability		0.98
S.E. of Item Mean = 0.17								

3.3 Item Fit

To identify potential outliers or discrepancies in measuring the construct, it is essential to assess the mean square outfit index value (MNSQ), where MNSQ infit reflects conformity of response patterns to the intended measurement, while MNSQ outfit indicates the absence of significant measurement issues, relatively easier to address compared to MNSQ infit. Thus, emphasis should be placed on evaluating the MNSQ outfit index initially to assess item appropriateness (Item Fit) in construct measurement, aiming for a productive item fit range typically between 0.5 to 1.5, with deviations often indicated by high z-Std values exceeding the accepted range of $-2.0 < ZStd < +2.0$, as suggested by [21].

Four items in I-SMA, namely C2.3, C2.4, C2.5, and C2.8, exhibit values beyond the accepted range for MNSQ outfit and ZSTD as indicated in Table 3. Nonetheless, the PTMEA CORR values for these items remain within the acceptable range. Consequently, these items are being considered for refinement and retention. According to Boone et al. [21], identifying items lacking consistency involves evaluating three primary criteria: MNSQ, ZSTD, and PTMEA CORR. Retention consideration should be given to items meeting at least one of these criteria [22]. This perspective is reinforced by [23], asserting that an item is deemed inappropriate only if it falls outside the suitability range for all three criteria.

Table 3. Item Misfit.

Item	Measure	Outfit MNSQ	Outfit ZSTD	PTMEA CORR
C2.3	1.25	2.00	9.9	0.40
C2.4	2.02	2.34	8.9	0.41
C2.5	0.66	1.54	5.1	0.52
C2.8	-0.82	0.48	-5.1	0.77

3.4 Dimensionality

Ensuring dimensional uniformity is crucial for an instrument's effectiveness in measuring a single construct clearly and unambiguously [18]. Instruments exhibiting ambiguity or confusion among respondents require careful review and refinement to ensure the instrument's objective of precise measurement is met. Rasch analysis employing Residual Principal Component Analysis (PCA) is capable of assessing the instrument's unidimensionality with an acceptable level of item noise.

Researcher [20] outlines that the optimal variance value should exceed 60%. However, each construct demonstrated in the raw variance has met the instrument's uniformity requirement of at least 20%. As depicted in Table 4, the I-SMA construct stands at 43.5%, meeting the minimum threshold established by [24] of 40%. Moreover, the unexplained variance value in contrast 1 residual PCA is notably low at 9.7%, indicating effective control and remaining well below the upper limit of 15%.

Table 4. Unidimensionality.

Element	Eigen value	Observation		Expected value
Total raw variance in observations	35.4	100.0%		100.0%
Raw variance explained by measures	15.4	43.5%		45.4%
Raw variance explained by persons	8.5	24.1%		25.1%
Raw variance explained by items	6.9	19.4%		20.2%
Raw unexplained variance (total)	20.0	56.5%	100.0%	54.6%
Unexplained variance in 1st contrast	3.4	9.7%	17.2%	
Unexplained variance in 2nd contrast	2.5	7.0%	12.5%	
Unexplained variance in 3rd contrast	1.6	4.4%	7.8%	
Unexplained variance in 4th contrast	1.5	4.2%	7.4%	
Unexplained variance in 5th contrast	1.3	3.6%	6.4%	

3.5 Local Independence

The Standardized Residual Correlation test is conducted to detect potential confusion or overlap among pairs of items within the instrument, ensuring its clarity and alignment with the research objectives. When two items register a correlation value exceeding 0.7, it indicates significant overlap in characteristics, necessitating the retention of only one item for measurement. For the I-SMA, all ten pairs of items demonstrate standardized residual correlations falling within the acceptable range for local independence,

spanning from -0.33 to 0.59, indicating the absence of inter-item relationships and the absence of any item pairs causing confusion among respondents.

3.6 Rating Scale Diagnostic

Scale calibration is an essential component of measurement systems, ensuring data validity. An effective scale should establish categories aligned with increasing responses. If minimal category distinctions are indiscernible and fail to demonstrate increments, neighbouring categories should be combined (if the difference < 1.4). Conversely, scales exceeding a threshold value of 5 necessitate segregation.

The results derived from Table 5 reveal that there are no differences exceeding a threshold of 5 or falling below 1.4 in the Andrich Threshold segment. Consequently, the scales assigned and employed for each construct are deemed suitable, obviating the need for segregation or amalgamation. Moreover, the Observed Average section illustrates a standard response trend, with a consistent progression from negative to positive values for the I-SMA construct. This validation of scale determination affirms the appropriateness of the selected scales for each construct, ensuring the likelihood of uniformly distributed responses across the designated scales. Figure 1 depicts a graphical representation of the answer choice categories, delineating a suggested pattern wherein each category intersects with one another.

Table 5. Diagnostic Rating Scale.

Category	Threshold	Observed		Observed average	Infit MNSQ	Outfit MNSQ
		Count	%			
Strongly disagree	None	126	2	-0.07	1.68	1.97
Disagree	-2.07	558	10	0.28	1.12	1.19
Agree	-0.67	2675	49	1.46	0.85	0.74
Strongly agree	2.74	2101	38	3.47	0.91	0.90

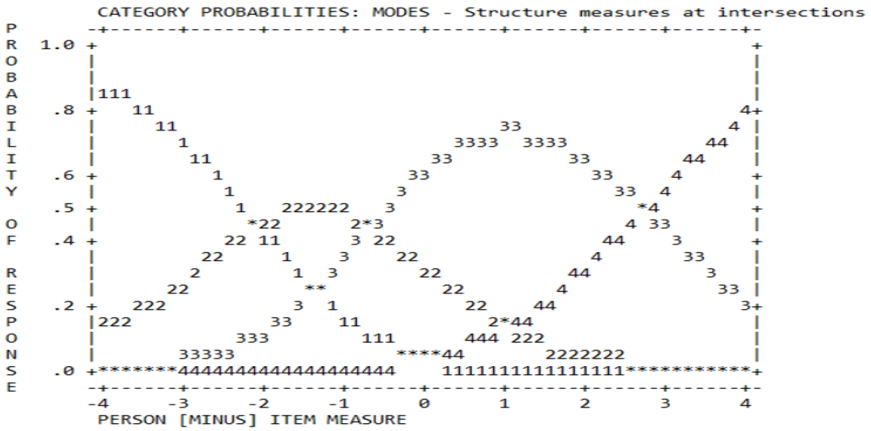

Fig. 1. Category response curve.

3.7 Wright Map

For the Wright Map as shown in the Figure 2, the easiest item to endorse in the I-SMA is C2.7 (because I try to understand the language of the Quran) within the holistic category. Conversely, the most difficult item to endorse is C2.4 (to show that I am a good student in vocabulary knowledge) in the extrinsic category. Person means for all constructs surpass Item means. Thus, on average, a majority of respondents favoured most items.

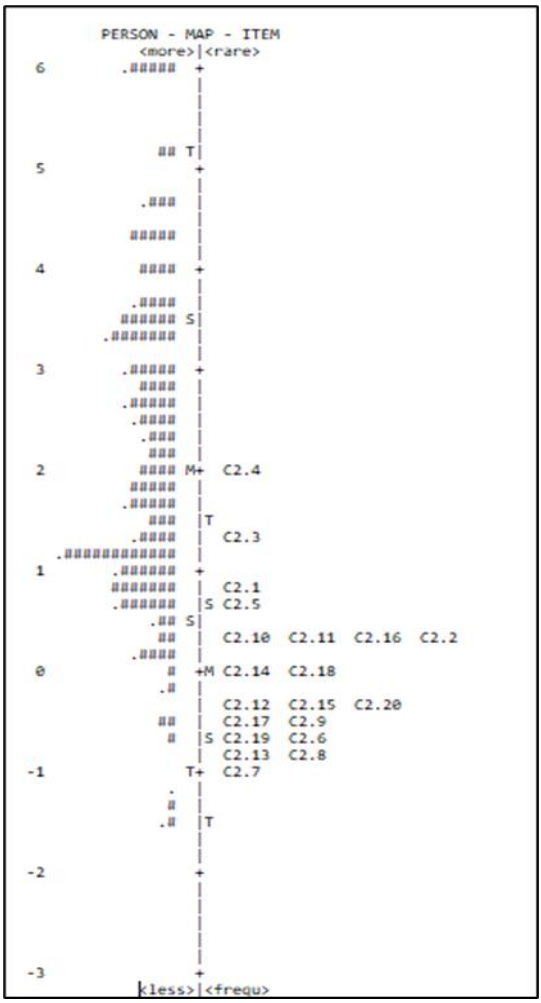

Fig. 2. Wright Map of I-SMA.

4 Discussion

The evaluation of instrument validity and reliability is an essential procedure to ensure the accuracy of each item in measuring the intended objectives of the assessment. Thus, this study employs the Rasch Measurement Model approach to assess and validate an instrument designed to measure students' motivation towards learning the Arabic language at the higher education level. The collected data undergo analysis using Winsteps software version 5.2 and are evaluated against five criteria outlined in the results section.

In the context of the I-SMA, consisting of 20 items, achieving reliability values exceeding 0.80 and item and individual separations surpassing 2.00 signifies robust consistency in the questions utilized in the assessment. The elevated reliability implies that the scale or instrument consistently measures students' motivation in learning Arabic, while the substantial separation values indicate the instrument's capacity to effectively differentiate among students with varying motivation levels. Consequently, based on these metrics, it can be inferred that the I-SMA serves as a reliable measurement tool adept at discerning differences in motivation levels among students in the pursuit of learning Arabic.

In the domain of assessment and measurement, the presence of unfit items often arises due to unforeseen response patterns. Within the I-SMA framework, items C2.3, C2.4, and C2.5 are deemed unsuitable (misfit) as their logit MNSQ values exceed 1.5 logits, alongside ZSTD values falling beyond the range of +2.0. Elevated MNSQ values indicate an excessive level of uncertainty in these items, potentially undermining both the data integrity and the measurement system's reliability [25]. Consequently, the identification of these unfit items signals a lack of consistency with other items, warranting further investigation to elucidate the causes of their inadequacy. Moreover, within this investigation, an additional item recognized as overfitting, labelled as item C2.8, demonstrates an outfit MNSQ value of < 0.5, indicating a close alignment of students' responses with the model's expectations, reflecting minimal variation. However, this outcome does not offer adequate insights into students' abilities.

The origin of item misfit might also arise from ambiguity or unclear wording within the item, as suggested by [26], indicating that factors such as vague item definitions should be explored and, if possible, restored. Consequently, all four items from the I-SMA that fell outside the acceptable range of item fit were reassessed and still met the criteria outlined by [21], which entail satisfying at least one of the following three criteria: PTMEA CORR, MNSQ, and ZSTD. It was observed that all of these items achieved acceptable PTMEA CORR values. Nevertheless, these items underwent revision based on expert recommendations and were retained within the I-SMA.

Finally, the findings from the dimensionality and local independence analyses of the I-SMA demonstrate adherence to standard criteria, affirming the absence of inconsistencies or confusions across its 20 items. This underscores the instrument's robust validity and reliability in measuring the targeted construct. Additionally, the assessment of rating scale diagnostic indicates that the Andrich thresholds are within acceptable limits, obviating the need for merging or segregating response scale categories. As for

the Wright map also reveals favourable outcomes, with person means consistently exceeding item means across all constructs. Consequently, the majority of respondents showed preference for most items on average. These results highlight the strong psychometric properties of the I-SMA, characterized by the coherence and independence of its items. Overall, the instrument exhibits reliability and validity in effectively evaluating the motivation of Malaysian students in learning the Arabic language.

5 Conclusion

In conclusion, the application of the Rasch Measurement Model in assessing the I-SMA for measuring students' motivation towards learning Arabic language at the higher education level demonstrates robust validity and reliability. The instrument's ability to achieve reliability values exceeding 0.80 and substantial item and individual separations signifies consistency and effectiveness in discerning differences in motivation levels among students. Despite the identification of unfit and overfit items, the reassessment and revision processes, guided by established criteria, ensure the instrument's continued adherence to psychometric standards. Moreover, the absence of inconsistencies or confusions across the items, coupled with the adherence of Andrich thresholds within acceptable limits, further solidifies the instrument's strong psychometric properties. Overall, the I-SMA emerges as a reliable and valid tool for evaluating Malaysian students' motivation in learning the Arabic language, contributing to the enhancement of language education assessment practices.

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