

Received November 11, 2020, accepted January 4, 2021, date of publication January 8, 2021, date of current version January 25, 2021.

Digital Object Identifier 10.1109/ACCESS.2021.3050311

The Development and Psychometric Assessment of Malaysian Youth Adversity Quotient Instrument (MY-AQi) by Combining Rasch Model and Confirmatory Factor Analysis

MOHD EFFENDI EWAN MOHD MATORE¹, MOHAMMED AFANDI ZAINAL¹, MUHAMAD FIRDAUS MOHD NOH¹, AHMAD ZAMRI KHAIRANI², AND NORDIN ABD RAZAK²

¹Faculty of Education, Universiti Kebangsaan Malaysia (UKM), Bangi 43600, Malaysia

²School of Educational Studies, Universiti Sains Malaysia (USM), Pulau Pinang 11800, Malaysia

Corresponding author: Mohd Effendi Ewan Mohd Matore (effendi@ukm.edu.my)

This work was supported in part by the Ministry of Higher Education (MOHE), Malaysia, and Universiti Kebangsaan Malaysia (UKM) through the Fundamental Research Grant Scheme (FRGS) under Grant FRGS/1/2018/SSI09/UKM/02/1, and in part by the Geran Galakan Penyelidik Muda under Grant GGPM-2017-088.

ABSTRACT Youths are a dominant cluster in Malaysia's population. They need to be resilient as they are the anchor of our country's development. Resilience is often associated with Adversity Quotient (AQ). There are many instruments developed across contexts and countries; however, good validity and reliability in measuring the AQ of youths are still scarce. Therefore, this study seeks to examine whether the items developed for the Malaysian Youth Adversity Quotient Instrument (MY-AQi) in measuring AQ within the context of Malaysian youths managed to manifest good psychometric properties using Rasch analysis. Apart from that, this study aims to measure the construct validity of the MY-AQi items using confirmatory factor analysis (CFA). Four constructs of AQ were established, namely control, ownership, reach, and endurance. A total of 1000 youths were assigned using stratified random sampling from five zones in Malaysia: northern, western, southern, Borneo, and eastern. Analysis from WINSTEPS 3.71 has revealed that 27 items were able to meet Rasch statistical modeling, while CFA has shown that 12 AQ measuring items could function well. The findings of this study demonstrated the strengths of the psychometric aspects by combining Rasch and CFA analysis to prove item quality and construct stability. Future studies should endeavor to develop more items to establish better youth profiles and combine AQ with other appropriate variables, such as achievement and demography. Nevertheless, some limitations can be scrutinized including a report on the more in-depth errors in the analysis conducted.

INDEX TERMS Adversity quotient, AQ, youth, Rasch model, factor analysis, psychometrics.

I. INTRODUCTION

Youth is the most dominant cluster in the overall population of Malaysia. Adversity Quotient (AQ) or the intelligence in facing adversity is an indicator to measure the resilience of individuals in enduring various life challenges that will make them succeed in life. Based on the literature review, many cases of misbehavior, discipline, suicide, depression, and vandalism cases were reportedly involving youths. Even

The associate editor coordinating the review of this manuscript and approving it for publication was Laxmisha Rai¹.

though Malaysia is seen as rich with various self-development and resilience programs, such cases keep rising and do not show any signs of abatement. The philosophy of education nurtured in Malaysian educational institutions that is our education system is more focused on Intellectual Quotient (IQ) and cognitive accomplishment, in tandem with Emotional Quotient (EQ) and Spiritual Quotient (SQ). Thus, many intelligences were born such as Multiple Intelligences (MI) and others. Thus, it is alarming when the combination of all intelligence types is not strong enough for an individual to possess resilient intelligence.

TABLE 1. AQ constructs and indicators in the context of youths.

Constructs	Indicators
Control	1. The ability of youths to feel that they are capable of handling and responding to challenges in a controlled way. 2. The ability of youths to feel positive. 3. The ability of youths to rise after confronting challenges or failures.
Ownership	4. The ability of youths to explain the cause of the challenges confronted. 5. The ability of youths to acknowledge the consequences of a challenge.
Reach	6. The ability of youths to ensure that the challenges confronted will not influence the other aspects of their life. 7. The ability of youths to limit the challenges from being influenced by other problems in their life. 8. The ability of youths to strive quickly in solving the challenges confronted.
Endurance	9. The ability of youths to anticipate the duration of challenges in their life. 10. The ability of youths to anticipate the duration of the cause of challenges in their life. 11. The ability of youths to seek solutions to the challenges.

In Malaysia, the challenges are more demanding and encompassing a variety of challenges, such as financial, personal, social, spiritual, work-related problems, studies, and others. If the youths could not properly manage all of these challenges, then to what extent could they become survivors in facing their future? While the relevant parties have taken many proactive steps to solidify resilience among youths in Malaysia, there is inadequate and unclear empirical evidence on the extent to which the programmes have succeeded in developing a resilient youth. Previous studies demonstrating the effort to ascertain youths with low AQ are vague because AQ instruments among youths that were developed in the local context are very limited. In fact, the existing AQ instrument only focuses on certain contexts and countries regarding the issues in the psychometric aspect of item testing and their causes. This article was different from the previous studies in the literature because of the efforts to produce AQ alternative measurement instruments among Malaysian youth or Malaysian Youth Adversity Quotient Instrument (MY-AQi).

Psychometric issues concerning AQ measurement has been raised by many researchers, such as [1] who doubted the validity and reliability of the original instrument AQ, which is unclear and has insufficient information on psychometric testing. Apart from that, the aspect of challenges was raised as well. The same issue regarding unidimensionality was mentioned by [2]. As the AQ instrument was used in Malaysia, the adaptation issue of translation from other countries' instruments makes the application limited. Past researchers have constructed AQ instruments; however, they were limited to challenges within their contexts only [3]–[5]. Thus, a new AQ item testing within the context of Malaysian youth is a necessity to ensure that the items have good validity and reliability. The succeeding part of this article will be providing the strong empirical evidence on the MY-AQi especially from the Rasch model perspectives. Otherwise,

this article also helps the readers to understand the flow and process of this instrument was developed.

II. LITERATURE REVIEW

Adversity Quotient (AQ) refers to the extent of an individual's ability to confront and surmount challenges, problems, or adversities and transform them into opportunities to succeed in life [6]. Several views from previous researchers are in tandem with [6] who concluded that AQ refers to the ability to (i) confront problems; (ii) persist; (iii) solve problems; and (iv) change challenges into an opportunity to succeed. The four main constructs stated are Control, Ownership, Reach, and Endurance.

The "Control" construct is the extent to which an individual realises that he or she can manage a challenging situation [6]. The "Ownership" construct is related to the cause of a challenge, particularly the extent to which an individual identifies the causes of the challenge, who causes the challenge, and the extent to which the individual acknowledges the causes and the consequences of confronting challenges [6], [7].

The third construct is "Reach", which measures the extent to which an individual can contain the challenge that is affecting him or her. In other words, the term is well-defined as the ability of an individual to ensure that the adversities confronted will not affect the other parts of his or her essential being, such as health problems, academic performance, and others [6], [7].

Meanwhile, the "Endurance" construct measures the duration of the effect of a challenge, which refers to the extent to which an individual could withstand the challenge and how long the cause of the challenge will last [6], [7]. In conclusion, AQ emphasises an individual's ability to handle, manage, and rejuvenate professionalism and endurance in confronting life challenges.

A. PREVIOUS RESEARCHES

The development of AQ researches has encompassed numerous countries and contexts. Nevertheless, not many researchers in Malaysia have studied AQ-related topics, especially in the context of youths. Globally, comparisons on the research pattern have been demonstrated in several countries by several researchers, such as the AQ study among elite female athletes in Canada [8] and studies involving university students in the Netherlands [9] and African American in the US high schools [10]. However, all of these studies in the education context are only focused on employment, and the difference only exists in terms of respondents and contexts, where the analyses of ideas remain in the scope of endurance.

Recent studies on AQ have been conducted in the last three years from 2018 to 2020. In fact, the research field has expanded not only across the fields of education but also in other contexts of career. Such a difference demonstrates that AQ has expanded the AQ theory, which was initially for work organisation context and further to the education context. The context expansion proves that AQ knowledge has indirectly demonstrated the potential of AQ. As such, many researchers have placed their trust in the adaptability of AQ with other fields. Most AQ researches in 2020 have shown the expansion pattern of AQ on pedagogy in mathematics education [11]–[13]. The author's research emphasises more on students with the endurance and pedagogical aspects such as Problem Based Learning (PBL) and Experiential Learning in facing challenges and solving mathematical questions.

The situation is different from research on entrepreneurship education that emphasises the role of personality, AQ, and creativity in enhancing entrepreneurship interest [14], parents' economics status, AQ, and self-efficacy towards entrepreneurship interest [15]. The tendency is supported by earlier research by [16] that exhibits 92 percent of score changes in the tendency of entrepreneurship students that can be explained by AQ. In fact, a study by [17] has proven the existence of a positive relationship between AQ and the performance of entrepreneurs in the era of IR 4.0. AQ research continues to expand into the linguistics field, where [18] argued about the relationship between students' AQ and academic achievement in the English language subject.

Nonetheless, research in Malaysia conceptually explores the potential of AQ towards academic performances among students in the technical field [19]. Moreover, to establish AQ among teachers, [20] studied the impact of training programmes on AQ enhancement among the trainee teachers of the Master of Education programme between those who were trained formally and those who were not. Variations in the research context have made the expansion of the AQ knowledge corpus dynamic.

Comparisons by previous researchers revealed that AQ studies have received attention from researchers across countries, such as Canada [8], Netherlands [9], the USA [10], China [21]–[22], India [23]–[25], Thailand [26], Iran [27], the Philippines [28], and Kenya [29]. However, AQ studies

in Malaysia are still limited, especially those that involve youths. AQ research is perceived as too focused on the context of education. Nevertheless, it cannot be denied that there are efforts to expand AQ knowledge in the last three years [30]–[32]. Besides, the psychometric assessment for AQ items was only conducted by [5] through AQ item construction among polytechnic students.

The lack of studies in Malaysia regarding youths' AQ has created a research gap for AQ knowledge development as it is yet to be emphasised by Malaysian researchers. Even though AQ knowledge development is being conducted, the limitation of AQ measurement in the aspect of youths needs more attention from researchers.

III. THEORIES

Adversity Quotient (AQ) by [6] involves seven theories, which are Helplessness Theory by [33], Locus of Control Theory by [34], Self-efficacy Theory by [35], Endurance Theory by [36], Resilience Theory by [37], Optimism Theory by [38], and Attribution Theory by [39]. This theory was selected because the conditions of AQ require an individual to be able to manage life in facing challenges [40]. AQ is built based on four main constructs, namely Control, Ownership, Reach, and Endurance (CORE). These constructs are also known as CORE model, which is built from the seven theories as mentioned.

Based on the sex differences, some studies show inconsistent findings in which female respondents were found to have higher AQ than males including the studies that are not in the context of education. In addition, there are also studies that empirically found that the AQ of male students is higher than female students. These inconclusive results drive further study for Malaysian youth. However, this study does not focus on the AQ level but the deep focuses are on the quality of items that are not biased towards any sex group.

The AQ also related to coping style. Some people may be familiar with their environment as being in struggle with their activities and objectives. Transformations in individual characteristics such as personality and coping style are the most imperative determinants of an individual's response to challenging situations. The different coping styles also function for different personality types. The psychological quality is a vital role particularly the coping ability against adversity or resilience (bouncing back to normal) in difficulty. This inability of coping to any hardship will affect their life and their future development. This will also affect whether they can become the qualified builders and trustworthy successors for the cause of society.

The novelty of AQ is due to the different challenges for each individual and context. As the individual challenges are different, the AQ measurement becomes unique and could not be applied to the same challenge in a different context. AQ studies, which remain unvaried, have caused limitations in terms of measurement and only a few operational definitions could be acquired. Moreover, the definitions are questionable. Apart from that, the AQ theory is potentially

close to predicting success and performance. In terms of this research context, the AQ theory is used through the operational definitions specified for Malaysian youths apart from emphasising the psychometric aspect and the item testing empirically without associating with individual achievement.

IV. METHODOLOGY

A. RESEARCH DESIGN

A questionnaire survey was used in the study through a quantitative approach and the questionnaire was managed online to the consented youths. The questionnaire survey was used because it is suitable for a large sample with a wide area coverage [41].

B. ITEM DEVELOPMENT

The AQ questionnaire was developed using four constructs as mentioned earlier. The items and validity constructions for the four constructs have been explained and proven by [42] through EFA analysis. In this study, 39 items were initiated in the first phase (Rasch) and followed by the second phase (CFA). Thus, the study began from EFA, followed by Rasch and CFA. The adversities for the item development were based on the Malaysian Youths' Challenges framework, which has drawn four important constructs such as political, economic, social, and technology as suggested by [43] based on the Malaysian Youth Index or MYI.

C. SAMPLING

A total of 500 youths was involved in the first study for item testing using Rasch analysis. Mixed sampling techniques of stratified random and convenience samplings were used in the study encompassing three youth categories from five zones in Malaysia (North, West, East, South, and Borneo). The strata for this study are sex, youth category, and zone types. The youth samples were divided into the early youth group from 15 to 18 years old, followed by the middle youth group from 19 to 24 years old, and the late group from 25 to 30 years old as stipulated by the Youth and Sports Ministry of Malaysia [44]. Convenience sampling was then used for the pilot study. In fact, the youths were given an option to participate in the study or otherwise. [45] explained that the stratified technique is meticulous in selection, especially in quantitative research due to its ability to generalise the findings. The technique was applied to ensure that youth has an equal opportunity to be chosen as respondents. Their demographic profile is shown in Table 2.

The sample complied with [52]'s recommendation that a total sample of 500 respondents is adequate and credible for Rasch analysis. In the second phase, another batch of 500 youths was selected for item testing using CFA. The samples are different for both phases. CFA supports the EFA finding by applying separate research samples [46]. For a CFA study, the minimum sample recommended is 300 respondents [47], [48] and have stated that a sample

TABLE 2. Demographic characteristics.

Features	Criteria	Whole sample (N=1000)	First phase (N=500)	Second phase (N=500)
Sex	Male	500 (50%)	250 (50%)	250 (50%)
	Female	500 (50%)	250 (50%)	250 (50%)
Youth	Early	400 (40%)	200 (40%)	200 (40%)
	Intermediate	400 (40%)	200 (40%)	200 (40%)
	Late	200 (20%)	100 (20%)	100 (20%)
Zone	North	200 (20%)	100 (20%)	100 (20%)
	East	200 (20%)	100 (20%)	100 (20%)
	West	200 (20%)	100 (20%)	100 (20%)
	South	200 (20%)	100 (20%)	100 (20%)
	Borneo	200 (20%)	100 (20%)	100 (20%)

of 500 respondents is categorised as very good and respondents of more than 1000 are considered excellent.

In fact, the minimum ratio of items with the sample is 1:5 [49]. Hence, the number of items for the first phase of Rasch analysis should be multiplied by five. Initially, the study had 39 items before Rasch analysis was conducted; thus, at least 300 samples were needed for the CFA phase. Therefore, 500 youths were considered adequate for CFA.

D. INSTRUMENTATION

The AQ measurement instrument encompasses four constructs, namely control, ownership, reach, and endurance [6], [40]. A total of 60 AQ items were analysed using Exploratory Factor Analysis (EFA) and the best 39 items were obtained [42], which were further analysed using the Rasch model and subsequently CFA. In Rasch analysis, item sequence began with the control construct (item 1 until 9), ownership (item 10 until 21), reach (item 22 until 30), and endurance (item 31 until 39). For item scaling in the first phase questionnaire using Rasch analysis, a four-point Likert scale was used comprising 1 with "strongly disagree", 2 with "disagree", 3 with "agree", and 4 with "strongly agree". The scale was referred from the agreement level of polytechnic students' AQ measurement, which is the IKBAR instrument by [50]. The scale was retained for the second phase analysis, which is CFA.

E. ADMINISTRATION AND RESEARCH PROCEDURE

The survey was managed through an online medium that was administered around two weeks for the first phase using Rasch analysis and another two weeks for the second phase using CFA. Each respondent filled the questionnaire for approximately 45 minutes to one hour. The analysis consists of two phases. Phase 1 involves the Rasch model through the Winsteps 3.71 software. Subsequently, the data from Phase 2 were tested descriptively and inferentially using different samples through CFA via AMOS 24.0.

V. FINDINGS AND DISCUSSIONS

The research findings discuss two objectives. The first objective aims to determine whether the AQ item measurement has good psychometric properties in the context of Malaysian youths based on Rasch analysis. Rasch testing reports the

TABLE 3. Fit statistics of measurement items.

Item	Score total	Measure	Standard Error	MNSQ		PTMEA	
				<i>Infit</i>	<i>Outfit</i>	Corr.	Exp.
C4	1668	-0.28	0.08	1.13	1.20	0.32	0.40
C5	1673	-0.31	0.08	0.86	0.99	0.35	0.40
C6	1658	-0.22	0.08	0.92	0.90	0.44	0.40
C8	1552	0.38	0.07	1.06	1.05	0.40	0.43
C9	1650	-0.17	0.08	0.95	0.93	0.49	0.40
O1	1632	-0.07	0.08	0.94	0.98	0.39	0.41
O2	1653	-0.19	0.08	0.91	0.94	0.45	0.40
O5	1613	0.04	0.08	1.27	1.22	0.43	0.41
O6	1782	-1.05	0.09	1.04	0.98	0.45	0.35
O9	1736	-0.72	0.08	1.01	1.04	0.40	0.37
O11	1563	0.32	0.07	0.89	0.88	0.44	0.43
O12	1653	-0.19	0.08	0.99	0.97	0.43	0.40
R1	1634	-0.08	0.08	1.02	1.01	0.39	0.41
R2	1703	-0.50	0.08	0.88	0.86	0.50	0.39
R3	1572	0.27	0.07	0.98	0.97	0.39	0.42
R4	1327	1.44	0.06	1.07	1.11	0.34	0.48
R5	1540	0.44	0.07	0.88	0.87	0.42	0.43
R6	1588	0.18	0.07	0.95	0.96	0.47	0.42
R7	1547	0.41	0.07	1.00	0.97	0.47	0.43
R8	1640	-0.11	0.08	0.81	0.81	0.53	0.41
R9	1686	-0.39	0.08	1.12	1.18	0.39	0.39
E1	1652	-0.18	0.08	1.09	1.08	0.40	0.40
E3	1652	-0.18	0.08	1.12	1.12	0.34	0.40
E4	1501	0.64	0.07	1.22	1.23	0.35	0.44
E5	1575	0.26	0.07	1.00	1.01	0.41	0.42
E8	1608	0.07	0.08	0.88	0.89	0.43	0.42
E9	1585	0.20	0.07	1.08	1.09	0.33	0.42

primary assumptions such as item fit, the test of unidimensionality, local independence, reliability index, and separation index. The items were tested using Sex Differential Item Functioning (DIF) to ensure no differential item functioning for different sexes. DIF exists when a tested item functions differently in the two groups compared. Some researchers explained that such a difference occurs when the item is relatively harder for one group than the other group. The aspect also reports the strength of an item through graphic analysis, such as the Wright Map and the Bubble Charts. A scale review was also conducted to examine whether the four-point scale was suitable to be used in the measurement instrument.

Meanwhile, the second objective aims to determine whether the AQ item measurement has good construct validity through CFA. The analyses include absolute fit (Chisq, RMSEA, and GFI), followed by incremental fit (AGFI, CFI, TLI, and NFI), and parsimonious fit (Chisq/df). The findings include Model Chi-Square over the degrees of independence (χ^2/df), Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residual (RMR), Goodness of Fit (GFI), Comparative Fit Index (CFI), Adjusted Goodness

of Fit (AGFI), Normed Fit Index (NFI), and Tucker Lewis Index (TLI).

A. RESEARCH OBJECTIVE 1: TO DETERMINE WHETHER THE AQ ITEM MEASUREMENT HAS GOOD PSYCHOMETRIC PROPERTIES IN THE CONTEXT OF MALAYSIAN YOUTHS BASED ON RASCH ANALYSIS.

1) ITEM FIT

Table 3 depicts the MNSQ values of *infit* and *outfit*, which range from 0.81 to 1.27 logits. The *infit* MNSQ value ranges within 0.81 and 1.27 logits, while the *outfit* MNSQ value ranges within 0.81 and 1.23 logits. This complies with the acceptable range set by [51] that is within 0.77 logits to 1.30 logits. The Rasch model's first assumption is the item fit. This is to ensure that the item is fit with the data [52]. As the Likert scale data that are polytomous, the Mean Square (MNSQ) analysis was used to detect whether any discrepancy exists within the data observed in the Rasch model. The appropriate statistical value that is uniform (Zstd) was discarded because the study has the appropriate MNSQ as recommended by [53].

TABLE 4. Standardised residual variance (Eigenvalue unit).

		Empirical values		Modelled
Total raw variance in observations	34.9	100.0%		100.0%
Raw variance explained by measures	7.9	22.6%		23.0%
Raw variance explained by persons	2.8	8.1%		8.2%
Raw variance explained by items	5.1	14.5%		14.7%
Raw unexplained variance (total)	27.0	77.4%	100.0%	77.0%
Unexplained variance in 1st contrast	2.5	7.0%	9.1%	

Nevertheless, not all Z_{std} values reported were between the ranges of ± 2.0 as recommended by [54]. However, if the MNSQ value acceptance was applied, the Z_{std} values could be disregarded [53]. The Z_{std} reporting will be explained further in the Bubble Chart section in Figure 1. Standard error values were found to be in the range of 0.06 to 0.08.

The S.E. values show the accuracy element in the calculation [55], [56]. In fact, the error range recorded was below 0.25, which is considered excellent [51]. For the PTMEA value, the values were between 0.32 and 0.50 logits. The values corresponded with the values suggested by [57], who recommended that the PTMEA value should be positive and above 0.30. The PTMEA values showed that the items indeed contributed to the AQ measurement in the research context by succeeding in discriminating or differentiating the AQ capability of Malaysian youths.

2) UNIDIMENSIONALITY

Unidimensionality refers to the ability of each item in the instrument to measure with a single ability [52]. To ensure that the items are unidimensional, the Principal Component Analysis of Residual (PCA) was used. As such, the items must be on one dimension at a time and measures the same trait [58]. The PCA procedure represented a 22.6 percent of the raw variance explained by AQ measurement, close to the model expectation of 23.0 percent as mentioned in Table 4. The result has almost fulfilled the instruments' uniformity of at least 20 percent [59]. Disturbance level measure or variance that is not explained in the first contrast recorded 7.0 percent and is categorised as good [51]. Variance ratio explained by item measurement (14.5%) with the first principal component variance (7.0%) of 2.07 almost exceeds a minimum ratio of three [60].

The Eigenvalue shows 2.5; however, the value that is less than three shows an unclear clear existence of a second dimension [61]. Some AQ item testing was also found to be unidimensional through Rasch analysis.

3) LOCAL INDEPENDENCE

Table 5 depicts ten item matching constructs with the residual correlation standard value between 0.23 and -0.20 . This correlation value range is suggested to be less than 0.30 [62], [63]. Hence, this means that the items are not correlated significantly to other items in the same construct. Even

though a correlation exists, the strength is in the accepted range. Item fit that can be improved is item (R7-E5) because item correlation exists in different constructs with the same perspective. Item fit (C8-E5), (O6-R4), (R5-E9), and (C9-E5) with a negative correlation strength showed an opposing perspective with different constructs in the study. Apart from the assumptions of item fit, unidimensionality, and local independence, this study also reported AQ item strength through graphic analysis, such as Wright Map in Chart 1 and Bubble Charts in Figure 2.

TABLE 5. Item local independence.

Correlation	Item number – construct	
0.23	E4 – endurance	E5 - endurance
0.22	C8 – control	C9 - control
0.21	E3 - endurance	E9 - endurance
0.21	R7 – reach	E5 - endurance
0.20	C6 - control	C9 - control
-0.32	C8 - control	E5 - endurance
-0.25	O6 - ownership	R4 - reach
-0.23	R5 – reach	E9 - endurance

4) WRIGHT MAP

Wright item-person map displays the item difficulty distribution of the instrument that coordinates with the students' ability distribution along the logits scale on a measurement continuum. This continuum is visually located from the least difficult to the most difficult items [54]. The instrument calibration process involves two stages; the first stage is the estimation of the item difficulty parameter and the second stage is the estimation of the individual ability parameter. The first and second stages were performed repeatedly until a specification of stable parameter estimation was acquired. The calibration process showed that the item parameter (item difficulty) and individual parameter in the instrument (ability) were estimated so that they can be in a single scale frame of reference.

Based on Figure 1, the maximum value of item difficulty is $+1.44$ logits and followed by the minimum value recorded as -1.05 logits. The logits value for the control construct is between -0.31 and 0.38 logits, followed by the ownership construct (-1.05 to 0.04 logits), the reach construct

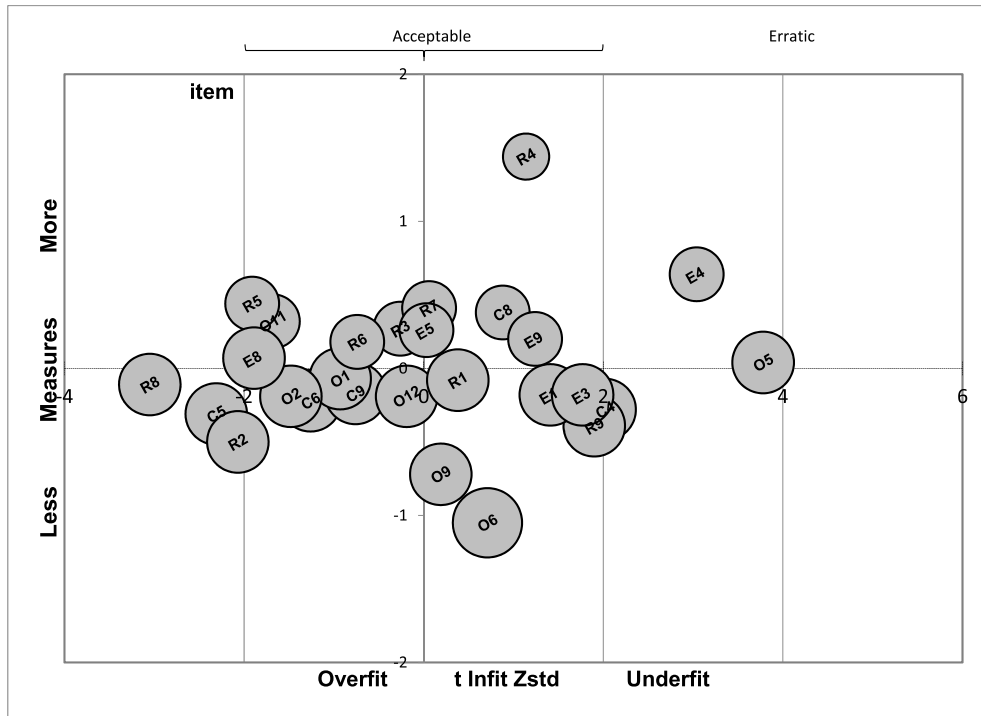


FIGURE 1. Bubble chart.

TABLE 6. Fit statistics for items that do not fit.

Item No.	Total score	Logits	S. E	MNSQ	
				Infit	ZSTD
O5	1613	0.04	0.08	1.27	3.80
E4	1501	0.64	0.07	1.22	3.00
R2	1703	-0.50	0.08	0.88	-2.10
C5	1673	-0.31	0.08	0.86	-2.30
R8	1640	-0.11	0.08	0.81	-3.00

TABLE 7. Statistical summary for individual.

	Raw Score	Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	87.3	27.0	1.59	0.33	1.01	-0.20	1.01	-0.2
Standard Deviation	7.4	0.0	0.85	0.06	0.52	1.90	0.52	1.9
Max	107.0	27.0	5.51	1.02	3.07	4.80	3.08	4.9
Min	65.0	27.0	-0.38	0.26	0.06	-6.10	0.06	-6.1
Real RMSE	0.37	True S.D	0.76	Separation	2.06	Person Reliability		0.81
Model RMSE	0.34	True S.D	0.78	Separation	2.28	Person Reliability		0.84

Person Raw Score-To-Measure Correlation = .98

Cronbach’s Alpha (KR-20) Person Raw Score Reliability = .82

(−0.50 to 1.44 logits), and the endurance construct (−0.18 to 0.64 logits). The values of difficulty measurement separation fulfil the distribution range within ±3.00 logits to be considered acceptable as mentioned by [64]–[66]. The item R4 was recorded as the toughest item to be recognised by the respondents, whereas O6 is the easiest item to be endorsed. From 27 items, all 12 items identified were higher than the mean of logit item (0.00), while the remaining 15 items were lower than the mean. This shows that 44.4 percent of the items

were categorised as difficult and the other 55.6 percent of the items were easy. Based on the logit value between individual and item, the mean of individual ability (1.59 logits) was higher than the mean of item difficulty (0.00 logits). This demonstrates that AQ items, on the whole, are easier for the youths in Malaysia because individual ability is higher than item difficulty.

The findings clearly passed through the range of individual ability that recorded +5.89 logits, whereas item difficulty

TABLE 12.2 Adversity Quotient GGPM ZOU585WS.TXT Apr 6 16:44 2020
 INPUT: 500 STUDENT 39 item REPORTED: 500 STUDENT 27 item 4 CATS WINSTEPS 3.71.0.1

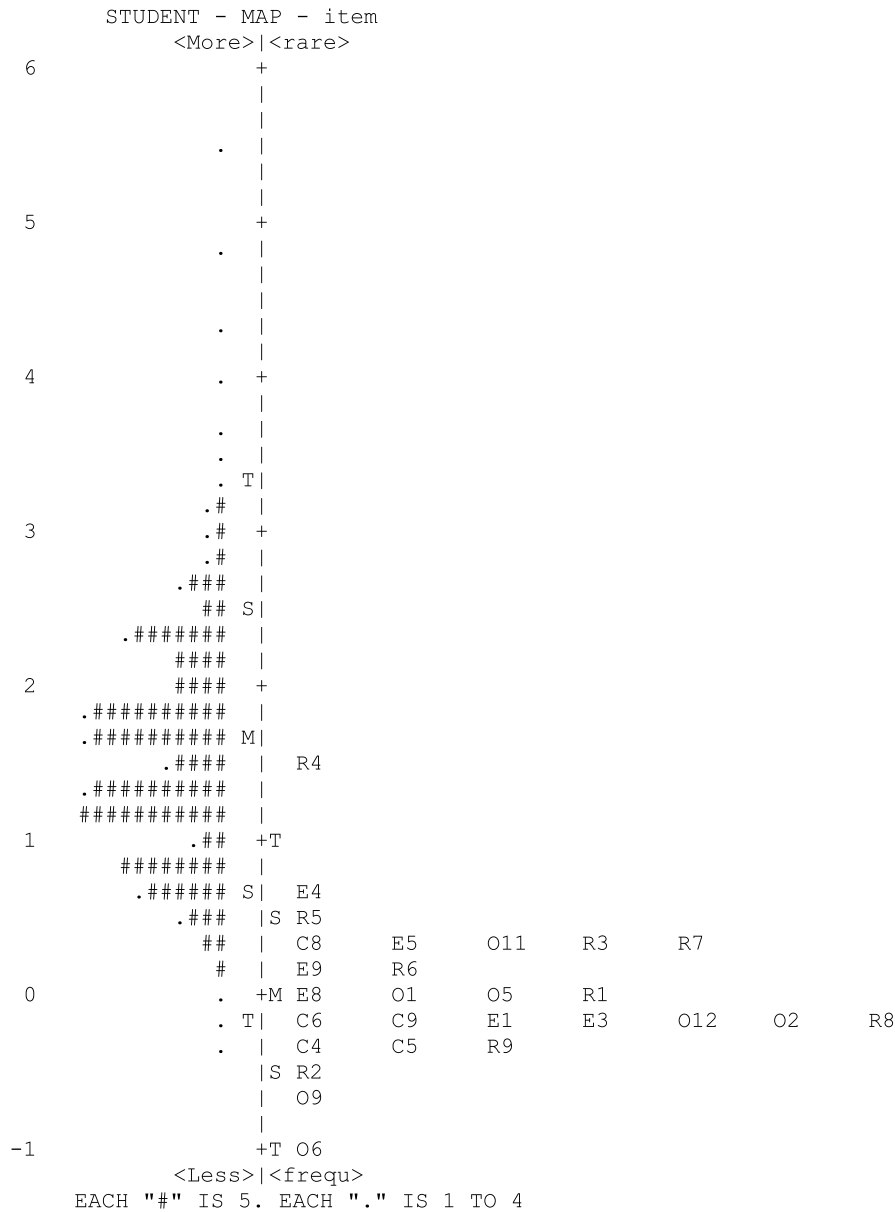


FIGURE 2. Wright item-person map.

was +2.49 logits. For the individual logit, the maximum individual ability was +5.51 logits and the minimum value was -0.38 logits. 491 from 500 students were higher than the mean of logit item (0.00), while the remaining 9 students were lower than the mean. This means that 98.2 percent of the youths were able to answer all AQ items well, whereas the other 1.8 percent were categorised as having difficulty in answering the AQ items. Items O5 and E4 could be perceived as too good to be true and items R2, C5, and R8 could be classified as erratic or unpredictable. The Z_{std} value provides implication to the measurement as explained by [67]

that items O5 and E4 have a standardised value (≥ 3) and categorised as much unpredicted if the items fit the model perfectly. Thus, they probably did not. Items R2, C5, and R8 have a value of ≤ -2 and the data are categorised as too predictable. Table 6 depicts the value of item compatibility for the five items.

5) RELIABILITY AND SEPARATION INDEX

The reliability index, specifically for individual ability was 0.81 and it is considered good and enough within the range of 0.81 to 0.90 as suggested by [51]. The findings showed

TABLE 8. Statistical summary for item.

	Raw Score	Count	Measure	Model Error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	1616.4	500.0	0.00	0.08	1.00	0.0	1.01	0.1
Standard Deviation	83.8	0.0	0.46	0.00	0.11	1.7	0.11	1.7
Max	1782.0	500.0	1.44	0.09	1.27	3.8	1.23	3.2
Min	1327.0	500.0	-1.05	0.06	0.81	-3.0	0.81	-3.1
Real RMSE	0.08	True S.D	0.45	Separation	5.84	Item Reliability		0.97
Model RMSE	0.08	True S.D	0.45	Separation	5.97	Item Reliability		0.97

UMean = 0.000 UScale = 1.000

Item Raw Score-To-Measure Correlation = -0.99

TABLE 9. Mean category of measurement: The observed average.

Category		Observed		Obsvd avrge	Sample expected	MNSQ		Structure calibration	Category measurement
label	score	count	%			infit	outfit		
1	1	163	1	0.56	0.23	1.17	1.27	NONE	(-2.89)
2	2	1355	10	0.82	0.82	1.00	1.02	- 1.59	-1.11
3	3	7158	53	1.38	1.41	0.93	0.94	- 0.55	0.87
4	4	4824	36	2.16	2.13	0.99	0.99	2.14	(3.29)

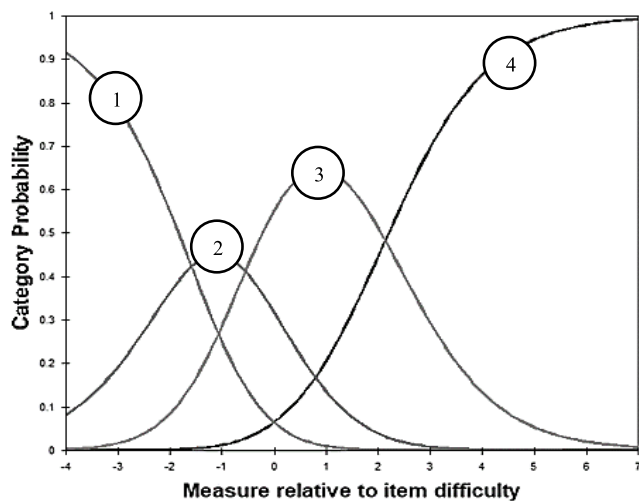


FIGURE 3. The threshold for scale review.

that the item separation index is enough to acquire a good reliability value. The reliability value for item difficulty was 0.97 and considered excellent [51] with an acceptable value of 0.82 per Cronbach’s alpha. The reliability value was better with the AQ original instrument of Adversity Quotient Profile (AQP) that recorded a value of 0.91 [68]. Tables 7 and 8 show a statistical summary for individual and item.

The findings illustrated that a value of 2.06 was recorded for the person separation index. Further, a value of 5.84 was also recorded for item separation. These findings described that individual ability and item difficulty have scattered well and item location on logits scale has a high reliability. The measurement quality is considered good because it exceeds two [54]. The values given in Tables 7 and 8 only refer to the

separation index or known as G, which refers to the actual standard deviation per mean measurement error. G is more conservative for separation index than H, which is also known as strata. Strata, H can be explained through the equation $(4 * G + 1) / 3$. Determining whether to use the value of H or G is based on sample separation. If outliers on the sample of individual or item follow a normal distribution, G is used. However, if outliers on the sample of the individual or item do not adhere to a normal distribution, H is used.

As the research did not consider normality, the use of strata or H is more appropriate. Nevertheless, past researchers tended to use separation than H in classroom teaching. Yet, this study found that both values did not consider normality. The findings showed that the value of strata, H for the individual parameter was 3.08, whereas the strata value for the item parameter was 8.12. This means that individual ability can be categorised into three levels of ability and item difficulty can be categorised into eight levels of difficulty.

6) SCALE REVIEW

There are six criteria required to determine whether or not the current scale can be maintained [60]. The first criterion was met: there were more than 10 observations. The value portrays that the higher the frequency for a category, the better the expectation for a score’s accuracy. The second criterion was also fulfilled as shown in Figure 3, where the curve shape for each category formed a peak and did not cover each other. The findings demonstrated that each category showed a peak, but only the peak for category two was slightly hidden. The third criterion is that the value of mean measurement for each category must increase with the category scale. The findings showed a uniform increase in the measurement value for each scale. For example, Table 9 depicts the measurement value of 0.56 logits for category one, 0.82 logits for category two,

TABLE 10. Mean category of measurement: The measurement structure.

Category label	Structure		Structure to measure			50% CUM PROBABLY	Coherence		RMSR	ESTIM DISCR
	Measure	S.E	At Cat	----Zone----			M->C	C->M		
1	NONE		(-2.89)	-INF	-2.09		0%	0%	1.8756	
2	-1.59	.08	-1.11	-2.09	-0.23	-1.84	45%	10%	1.0065	0.91
3	-0.55	.03	0.87	-0.23	2.30	-0.37	60%	87%	0.3221	0.99
4	2.14	.02	3.29	2.30	+INF	2.20	69%	41%	0.6493	1.06

TABLE 11. Revision scale check.

Scale	Gaps calculation	Range of acceptance	Decision
S ₁₋₂	0.00 – (-1.59) = 1.59	(1.0 < x < 5.0)	Accepted
S ₂₋₃	- 0.55 – (-1.59) = 1.04	(1.0 < x < 5.0)	Accepted
S ₃₋₄	2.14 – (-0.55) = 2.69	(1.0 < x < 5.0)	Accepted

1.38 logits for category three, and 2.16 logits for category four. The consistent increase shows a normal and uniform response pattern.

The fourth criterion is that the MNSQ outfit value must be less than two logits. The MNSQ outfit value for AQ ranged from 0.81 to 1.22, which is less than two. A score of more than two logits indicates a disturbance level for an unexplained variance. The fifth criterion is that the restriction threshold must increase in tandem with the rating scale category. The findings in Table 10 portrayed that the threshold value increase is orderly (-1.59, -.55, and 2.14) and can be seen in the measurement structure. The tendency of the respondents to select a uniform scale indicates that the findings did not experience any step disordering issue, which is a low probability for a category to be chosen. The sixth criterion is that the restriction category must be more than one and less than five for the four-point Likert scale [69], [70]. The values for the whole scale as shown in Table 11 were found to be more than one and less than five to be maintained on one scale.

In this study, the difference is more than one and there is no need to combine or separate the scale. Scale combination can be made if the difference is less than one, while scale inclusion can be made if the difference is more than five. As such, this scale is appropriate because the difference is more than one and less than five.

7) SEX DIFFERENTIAL ITEM FUNCTIONING (GDIF)

DIF seeks to determine whether test scores are affected by different sources of variation in different samples. The DIF contrast findings in Table 12 portrayed that the value was between -0.31 and 0.15, whereas the t value was within -1.83 to 1.85 logits. The value obtained is in tandem with the value of +0.5 to -0.5 logits determined for DIF contrast for the Likert scale and the t value between -2 and +2 [54], [71]. Apart from that, each item did not contain DIF because the probability was more than 0.05 [72]. A total of 27 items remained after the deletion process for item fit,

unidimensionality, and local independence. Items that passed this GDIF analysis indicated that this MY-AQi item meets the element of fairness in AQ testing. By analyzing DIF, the study identifies all 27 items that did not show signs of inequity when a group of youth of different ability levels of the same sex being compared.

B. RESEARCH OBJECTIVE 2: TO DETERMINE WHETHER THE AQ ITEM MEASUREMENT HAS A GOOD CONSTRUCT VALIDITY THROUGH CONFIRMATORY FACTOR ANALYSIS (CFA)

The 27 items from Rasch analysis were subsequently analysed with an aim to fulfil the aspect of construct validity using CFA, which is a comprehensive method for evaluating construct validation. CFA is relevant in this study because the Rasch model is only limited to test unidimensionality. CFA is a technique of structural equation model used to evaluate the goodness of fit between models that are hypothesised with the sample data. Responses from another 500 youths who are different from the youths in the Rasch analysis were analysed for CFA. There are three categories in the structural equation model to test model goodness and fit, which are classified by [73] as absolute fit (RMSEA, Chisq, and GFI), incremental fit (CFI, AGFI, NFI, and TLI), and parsimonious fit (Chisq/df).

The general model of the goodness of fit uses six criteria: Model Chi-Square over the degrees of independence (χ^2/df), Goodness of Fit (GFI), Adjusted Goodness of Fit (AGFI), Comparative Fit Index (CFI), and Tucker Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) [46]. Apart from that, the factor loading and standardised coefficient, β are also reported. [74] explained that at least three matching indices must be obeyed with one index for each model category mentioned above. In research, at least one matching index from each category will be reported based on literature corroboration and the validity of each construct must be evaluated prior to the validity test of the overall model. Additionally, instrument validity can

TABLE 12. The list of 27 independent items for youth aq.

No item	Total score	Logits	DIF Contrast	t	Prob
C4	1668	-0.28	0.06	0.38	0.7006
C5	1673	-0.31	0.07	0.47	0.6408
C6	1658	-0.22	0.13	0.84	0.3989
C8	1552	0.38	0.00	0.00	1.0000
C9	1650	-0.17	-0.13	-0.87	0.3872
O1	1632	-0.07	0.00	0.00	1.0000
O2	1653	-0.19	0.14	0.92	0.3597
O5	1613	0.04	0.00	0.00	1.0000
O6	1782	-1.05	-0.31	-1.76	0.0783
O9	1736	-0.72	0.07	0.44	0.6580
O11	1563	0.32	-0.14	-0.93	0.3539
O12	1653	-0.19	0.00	0.00	1.0000
R1	1634	-0.08	-0.11	-0.71	0.4781
R2	1703	-0.50	0.13	0.81	0.4161
R3	1572	0.27	-0.23	-1.59	0.1119
R4	1327	1.44	-0.08	-0.65	0.5134
R5	1540	0.44	-0.08	-0.56	0.5735
R6	1588	0.18	-0.22	-1.45	0.1470
R7	1547	0.41	0.12	0.82	0.4143
R8	1640	-0.11	0.15	0.98	0.3274
R9	1686	-0.39	0.14	0.87	0.3824
E1	1652	-0.18	0.13	0.84	0.4022
E3	1652	-0.18	0.13	0.84	0.4022
E4	1501	0.64	0.00	0.00	1.0000
E5	1575	0.26	-0.07	-0.49	0.6267
E8	1608	0.07	0.14	0.95	0.3437
E9	1585	0.20	0.06	0.41	0.6852

TABLE 13. The skewness and kurtosis analysis for data normality.

	Control	Ownership	Reach	Endurance	Overall
Valid	500	500	500	500	500
Missing	0	0	0	0	0
Skewness	-.240	-.062	-.250	-.277	-.161
S.E of Skewness	.109	.109	.109	.109	.109
Kurtosis	-.277	-.262	.091	-.172	.021
S.E of Kurtosis	.218	.218	.218	.218	.218
Skewness, Z _{score}	2.201	0.569	2.294	2.541	1.477
Kurtosis, Z _{score}	1.271	1.202	0.417	0.789	0.096

be divided into three: construct, convergent, and discriminant validity. This study focuses on the reporting for χ^2/df , RMSEA, GFI, AGFI, TLI, NFI, CFI, and RMR.

1) NORMALITY ANALYSIS

One of the requirements for conducting CFA is the data must be normally distributed. As this research has 500 individuals as the sample for the CFA test, empirical normality tests such as Kolmogorov-Smirnov (KS) and Shapiro Wilk (SW) could not be applied because these tests are not appropriate for a sample of more than 300 [75]. [76] explained that skewness and kurtosis tests are recommended for a suitable normality test either for a small sample or a big sample. Following

the justifications of more than 200 respondents as mentioned by [77], the tests applicable are skewness and kurtosis. Table 13 shows that the findings for Z_{skewness} (-1.477) and Z_{kurtosis} (0.096) were normally distributed because the values were in the range of ± 2.58 [77]. Therefore, the fulfilment of normality assumptions has allowed the research data to be continued using CFA.

2) FINDINGS OF CFA MODEL

Table 14 shows the validity of the AQ constructs that is aimed at exhibiting the extent of the model fit suggested compared to the analysed data. The findings revealed that the model fits CFA. The result of χ^2/df was recorded at 2.722

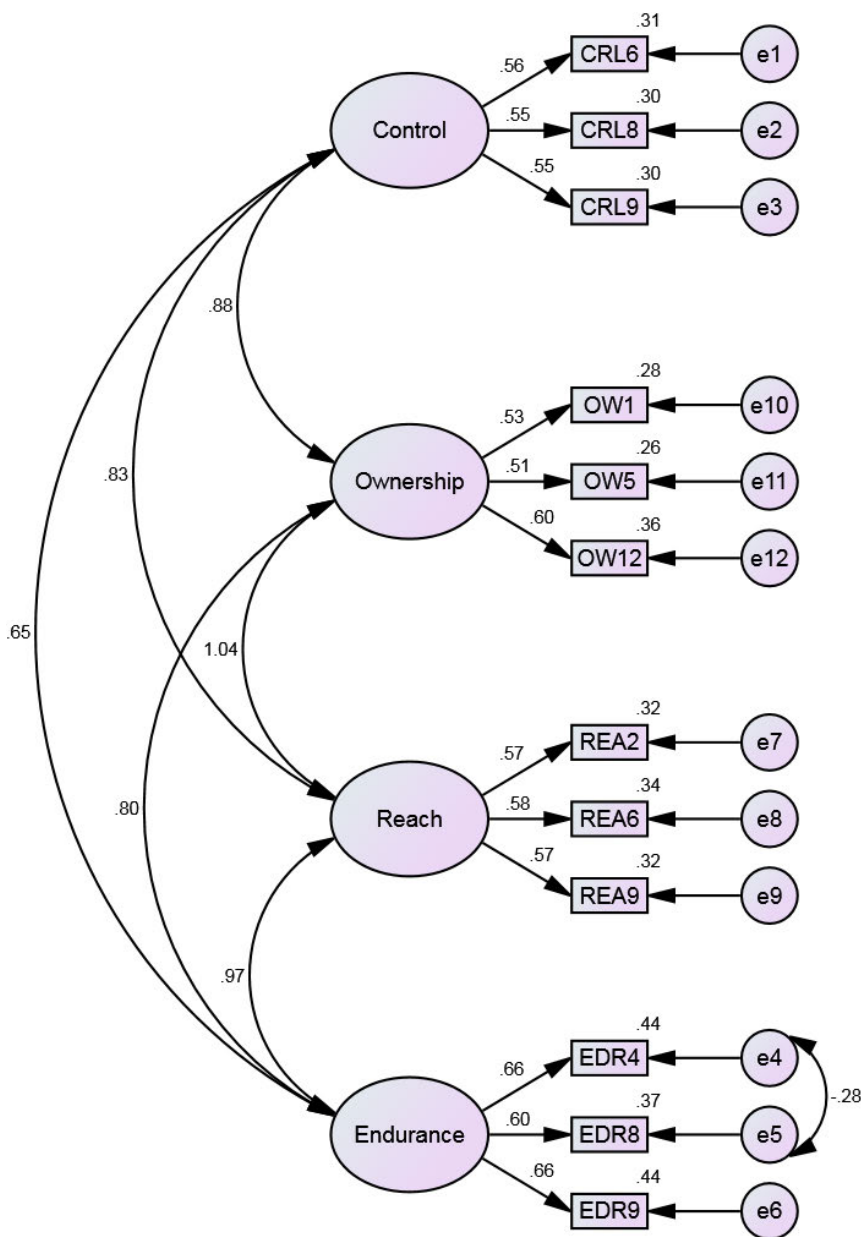


FIGURE 4. Measurement Model for Malaysian Youths' Adversity Quotient (AQ).

($\chi^2 = 127.931, p < 0.05, df = 47$). Apart from that, other fit indices recorded the respective values: RMSEA = 0.059, CFI = 0.940, GFI = 0.958, RMR = 0.030, and AGFI = 0.930. All factor loading values were in the range of 0.51 to 0.66 and standardised coefficient was in the range of 0.26 to 0.44. Thus, all of the fit values were accepted. The factor loading values also satisfied the recommendation by [78] who mentioned that for a newly constructed item, the factor loading must achieve 0.50 or higher. Therefore, the findings of the newly constructed AQ have satisfied the acceptance range. [79] and [49] also suggested that a factor loading value of 0.45 to 0.55 ranges from moderate to good.

The model shown in Figure 4 has met the criterion that the factor should have at least three items [80]. In the context

of this study, there was a minimum of three items for each factor. If the items are too many, other implications arise. For example, as more items are obtained for each factor, the tendency for the factor to be replicated is higher [81], [82]. Thus, the measurement model was found to fulfil all aspects of validity, reliability, and unidimensionality. The final items were shown in **Appendix**.

VI. FUTURE IMPLICATIONS AND LIMITATIONS

There are several significant implications from the research findings for future endeavours. The important practical implication is that the items selected from this study can be used as an alternative for self-evaluation and peer evaluation sessions for improvement purposes. The Malaysian youth ministry

TABLE 14. Summary of the fitness index.

Name of Indices	Findings	Acceptance ranges	Results	Literature sources
χ^2/df	2.722	$1.0 \leq \chi^2/df \leq 3.0$	Satisfactory	[83]
RMSEA	.059	$RMSEA \leq 0.08$	Satisfactory	[84]
GFI	.958	More than 0.95	Satisfactory	[85]
AGFI	.930	More than 0.90	Satisfactory	[85]
TLI	.915	More than 0.90	Satisfactory	[86]
NFI	.909	More than 0.90	Satisfactory	[85]
RMR	.030	Less than 0.08	Satisfactory	[87]
CFI	.940	More than 0.90	Satisfactory	[85]

TABLE 15. The final items of MY-AQi.

Code	Items
C6	Indicate your agreement, whether you are able to respond to the following adversity in a controlled manner. <i>I find it hard to look for a job that suits me.</i>
C8	Indicate your agreement, whether you are able to respond to the following adversity in a controlled manner. <i>I do not care about my body health.</i>
C9	Indicate your agreement, whether you are able to respond to the following adversity in a controlled manner. <i>I am afraid of failing tests.</i>
O1	Indicate your agreement, whether you are able to explain the reasons or causes of the following adversity. <i>I feel that there are not many job opportunities in my own place.</i>
O5	Indicate your agreement, whether you are able to explain the reasons or causes of the following adversity. <i>I am unable to become a skilled workforce in the future.</i>
O12	Indicate your agreement, whether you are able to acknowledge the impact of the following adversity. <i>I barely take care of the good relationships among family members.</i>
R2	Indicate your agreement, whether you are able to ensure that the following adversity does not affect the other aspects of your life. <i>I am not mature in assessing the country's political issues.</i>
R6	Indicate your agreement, whether you are able to limit the following adversity from being influenced by other problems in your life. <i>I am not good at finding opportunities to pursue my studies.</i>
R9	Indicate your agreement, whether you are able to limit the following adversity from being influenced by other problems in your life. <i>I am not able to contribute to the science and technology field for national development.</i>
E4	Indicate your agreement, whether you are able to anticipate how long the cause of the following adversity will end in your living environment. <i>I am worried about the test score positions.</i>
E8	Indicate your agreement, whether you are able to anticipate how long the cause of the following adversity will end in your living environment. <i>I barely emphasize the spiritual aspect of life.</i>
E9	Indicate your agreement, whether you are able to anticipate how long the cause of the following adversity will end in your living environment. <i>I do not have the characteristics of a leader.</i>

NOTE : C = CONTROL, O = OWNERSHIP, R = REACH, E = ENDURANCE

and society will be able to identify which construct to be empowered for their self-development. Secondly, the implication involves the methodological aspect. Several past researchers had supported the applications of different measurement theories to evaluate their items. The combination of different theories in this study using Rasch analysis and

CFA makes the findings more interesting and dynamic. One possible implication of this is to encourage researchers to generate new items based on the contexts of different challenges and respondents. Thirdly, this instrument is based on specific challenges and not all respondents will confront similar challenges in their life. Further, we can also relate

this concern to exploring more types of adversities rather than using only one model of youths. Thus, a qualitative approach using interviews will help future researchers form a new construct of adversities considerably. Finally, the limitation of this study is that the adversity framework is only limited to the adversity model developed by the Malaysian Youths' Challenges framework. This framework has drawn only four important constructs such as politics, economic, social, and technology. It can be seeming as a limitation as there is no generic parameter matching for all cases of adversities. Hence, we can explore more adversities by using a qualitative approach to obtain wider perspectives on the types of adversities. Secondly, the strategies to enhance the quality of analysis might involve the analysis of multidimensional Rasch as a confirmatory approach to investigate the componential structure of related constructs and demonstrate the true association among constructs.

VII. CONCLUSION

This paper aims to determine whether the constructed AQ item measurement has good psychometric properties in the context of Malaysian youths based on the Rasch and CFA techniques. This study has shown that twelve items were found to fulfil psychometric properties with good validity and reliability. The findings of this study support the idea that a combination of the Rasch model that is useful for assessing the MY-AQ_i items and construct validity using CFA will result in the scale's dimensionality structure in higher-order. These findings enhance our understanding of the diversity of AQ measurement for youths in the local context, which covers the conceptualisation and operationalisation of AQ as well. It would be interesting to assess the AQ pattern by investigating the profiling of AQ through the demographic factor. This will further benefit stakeholders to improve the youths by promoting better life and well-being. Further research might also assist in increasing MY-AQ_i application in future studies on educational psychometrics. Besides, to promote AQ awareness and understanding, the MY-AQ_i instrument can be used by teachers, students, and decision-makers. Although the focus of the current study is on the AQ item measurement, the same method can be applied to investigate criterion validity by highlighting the correlation score between MY-AQ_i with any other established AQ assessment scales.

APPENDIX

See Table 15.

ACKNOWLEDGMENT

The authors would like to thank the anonymous reviewers for their valuable comments and suggestions, which helped them improve the content, quality, and presentation of this article. They would also like to honor and give high appreciation to the Ministry of Higher Education (MOHE), Malaysia, Faculty of Education, Universiti Kebangsaan Malaysia (UKM), and the School of Educational Studies, Universiti Sains Malaysia (USM).

REFERENCES

- [1] P. A. Angelopoulos, S. J. R. J. Houde, M. M. Thompson, D. R. McCreary, A.-R. Blais, and L. Pasto, "Canadian forces training and mental preparation for adversity: Empirical review of Stoltz 'adversity quotient (AQ) training for optimal response to adversity' A review of the AQ literature and supporting studies," Defence R&D Canada, Toronto, ON, Canada, Tech. Rep. TR 2002-147, 2002.
- [2] E. L. Thi, "Adversity quotient in predicting job performance viewed through the perspective of the big five," M.S. thesis, Psikologiske Inst., Univ. Oslo, Oslo, Norway, 2007.
- [3] L. Bingquan and C. Can-Rui, "The reliability and validity of the adversity quotient scale in Chinese students," *Chin. Ment. Heal. J.*, vol. 22, no. 8, pp. 605–607, 2008.
- [4] L. Bingquan, C. Weisheng, Z. Xudong, and Z. Wenxiu, "The compilation of the adversity quotient scale for college students," *Psychol. Behav. Sci.*, vol. 8, no. 1, pp. 9–14, 2019.
- [5] M. Effendi and A. Z. Khairani, "Psychometric assessment on adversity quotient instrument (IKBAR) among polytechnic students using Rasch model," in *Proc. Int. Conf. Edu. Technol. (EET)*, 2015, pp. 52–57.
- [6] P. G. Stoltz, *Adversity Quotient: Turning Obstacles Into Opportunities*. Hoboken, NJ, USA: Wiley, 1997.
- [7] P. G. Stoltz and E. Weihenmayer, *The Adversity Advantage: Turning Everyday Struggles into Everyday Greatness*, 2nd ed. New York, NY, USA: Fireside, 2010.
- [8] K. A. Tamminen, N. L. Holt, and K. C. Neely, "Exploring adversity and the potential for growth among elite female athletes," *Psychol. Sport Exerc.*, vol. 14, no. 1, pp. 28–36, Jan. 2013.
- [9] E. T. Higgins, J. Marguc, and A. A. Scholer, "Value from adversity: How we deal with adversity matters," *J. Experim. Social Psychol.*, vol. 48, no. 4, pp. 965–967, Jul. 2012.
- [10] A. Rife, "Creating success from adversity: Sumner high school and African American community identity," *J. Philos. Hist. Educ.*, vol. 60, no. 1, pp. 251–257, 2010.
- [11] M. Hulaikah and I. Degeng, I., "The effect of experiential learning and adversity quotient on problem solving ability," *Int. J. Instr.*, vol. 13, no. 1, pp. 869–884, 2020.
- [12] M. Naimnule and M. Asikin, "Mathematics problem solving ability in terms of adversity quotient in problem based learning model with peer feedback," *Unnes J. Math. Educ. Res.*, vol. 10, no. 2, pp. 222–228, 2020.
- [13] C. W. Suryaningrum, Purwanto, Subanji, H. Susanto, Y. D. W. K. Ningtyas, and M. Irfan, "Semiotic reasoning emerges in constructing properties of a rectangle: A study of adversity quotient," *J. Math. Educ.*, vol. 11, no. 1, pp. 95–110, 2020.
- [14] B. Setyaji, H. Yanto, and D. Prihandono, "The role of personality, adversity intelligence and creativity in increasing entrepreneurial interest through student involvement in entrepreneurship lectures," *J. Econ. Educ.*, vol. 9, no. 1, pp. 30–39, 2020.
- [15] S. A. A. Siregar and Marwan, "The effect of parents socioeconomic status, adversity quotient, and self-efficacy, on students' entrepreneurship," *Adv. Econ., Bus. Manage. Res.*, vol. 124, Feb. 2018, pp. 582–589.
- [16] I. N. Latifah and T. Yuniarsih, "Effect of adversity quotient on entrepreneurial intention," in *Proc. 9th Int. Conf. Special Educ. Southeast Asia Region (ICSAR)*, 2019, p. 357.
- [17] C. W. Wolor, A. Pratama, S. Aditya, F. N. Fadillah, and D. Purwana, "Adversity quotient in improving millennial generation salespeople's performance in the industrial revolution 4.0," *Humanit. Soc. Sci. Rev.*, vol. 8, no. 1, pp. 220–226, 2020.
- [18] F. Kuhon, "A study on students' adversity quotient and Academic performance in english subject," *J. Adv. English Stud.*, vol. 3, no. 1, pp. 24–29, 2020.
- [19] M. E. E. M. Matore, N. A. Rahman, H. Idris, A. Z. Khairani, and N. M. Al Hapiz, "Is adversity quotient (AQ) able to predict the academic performance of polytechnic students," *J. Crit. Rev.*, vol. 7, no. 3, pp. 393–398, 2020.
- [20] R. Biswas, "Impact of B.Ed. Internship programme on the adversity quotient (AQ) level of the B.Ed. Teacher trainees in West Bengal," *Stud. Indian Place Names*, vol. 40, no. 56, pp. 249–271, 2020.
- [21] J. Lin, "Review on students' adversity quotient in China," *Adv. Psychol.*, vol. 8, no. 7, pp. 964–969, 2018.
- [22] Y. Tian and X. Fan, "Adversity quotients, environmental variables and career adaptability in student nurses," *J. Vocat. Behav.*, vol. 85, no. 3, pp. 251–257, 2014.
- [23] R. Dorji and K. Singh, "Role of adversity quotient in learning," *Int. J. Educ.*, vol. 11, no. 46229, pp. 119–125, 2019.

- [24] S. Kundan and P. Sabina, "Impact of adversity quotient on learning Behaviour among secondary school students," *Indian J. Public Heal. Res. Dev.*, vol. 9, no. 12, pp. 1773–1779, 2019.
- [25] N. Rathee and S. Sharma, "Adversity quotient among high school students in relation to demographic variables," *Int. J. Humanit. Soc. Sci. Invent.*, vol. 7, no. 5, pp. 33–36, 2018.
- [26] M. Chunin and C. Petchprayoon, "Adversity quotient and resiliency predicting career success of teachers in secondary schools," *Assoc. Priv. High. Educ. Inst. Thail. Under Patronage Her R. Highness Princess Maha Chakri Siridhorn*, vol. 7, no. 2, pp. 49–62, 2018.
- [27] A. Mehdad, A. Vali Nezhad, and M. S. Hosseini, "Prediction of cyber bullying through components of adversity quotient," *Int. J. Psychol.*, vol. 12, no. 1, pp. 30–49, Mar. 2018.
- [28] A. D. Yazon and K. Ang-manai, "Adversity quotient, emotional quotient and Academic performance of filipino student- parents," *People Int. J. Soc. Sci.*, vol. 4, no. 3, pp. 1253–1264, 2019.
- [29] M. Mwivanda and P. M. Kingi, "Teachers' adversity quotient dimension of control and students Academic performance in secondary schools in Kenya," *J. Educ. Train.*, vol. 6, no. 1, p. 83, 2019.
- [30] A. Zamri Khai and S. Mohammad S, "Relationship between adversity quotient and academic well-being among Malaysian undergraduates," *Asian J. Sci. Res.*, vol. 11, no. 1, pp. 51–55, Dec. 2017.
- [31] M. E. E. M. Matore and A. Z. Khairani, "Relationship between adversity quotient (AQ) with student academic achievement," *Glob. J. Al Thaqafah, Special Issue (MAY)*, pp. 63–78, May 2019.
- [32] M. E. E. M. Matore, "Structural equation model (SEM) in assimilating EQ, SQ and AQ for mechanical students' context," in *Proc. Mech. Eng. Res. Malacca, Malaysia: Univ. Teknikal Malaysia Melaka (UTeM)*, Aug. 2019, pp. 230–231.
- [33] D. S. Hiroto and M. E. Seligman, "Generality of learned helplessness in man.," *J. Personality Social Psychol.*, vol. 31, no. 2, pp. 311–327, Feb. 1975.
- [34] J. B. Rotter, "Generalized expectations for internal versus external control of reinforcement," *Psychol. Monogr. Gen. Appl.*, vol. 1, no. 80, pp. 1–27, 1966.
- [35] A. Bandura, *Social Learning Theory*. Upper Saddle River, NJ, USA: Prentice-Hall, 1977.
- [36] S. C. Kobasa, "Stressful life events, personality, and health: An inquiry into hardiness.," *J. Personality Social Psychol.*, vol. 37, no. 1, pp. 1–11, 1979.
- [37] H. Grotberg, "A guide to promoting resilience in children: Strengthening the human spirit," Bernard van Leer Found., The Hague, The Netherlands, Tech. Rep. 8, 1995.
- [38] M. E. P. Seligman, *Helplessness: On Depression, Development and Death*. San Francisco, CA, USA: W.H. Freeman, 1975.
- [39] B. Weiner, "An attributional interpretation of expectancy—Value theory," in *Cognitive Views of Human Motivation*. New York, NY, USA: Academic, 1974.
- [40] P. G. Stoltz, *Adversity Quotient: Mengubah Hambatan Menjadi Peluang*, 7th ed. Jakarta, Indonesia: PT Grasindo, 2007.
- [41] J. W. Creswell and J. D. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. Newbury Park, CA, USA: Sage, 2018.
- [42] M. E. E. M. Matore, A. Z. Khairani, and R. Adnan, "Exploratory factor analysis (EFA) for adversity quotient (AQ) instrument among youth," *J. Crit. Rev.*, vol. 6, no. 6, pp. 234–242, 2019.
- [43] W. M. Yusof et al., *Indeks Belia Malaysia 2015 (IBM'15): Mengukur Kesejahteraan Hidup Belia Malaysia*. Putrajaya, Malaysia: Institute for Youth Research Malaysia (IYRES), 2015.
- [44] *Dasar Belia Malaysia*, Ministry of Youth and Sports, Kuala Lumpur, Malaysia, 2015.
- [45] J. W. Creswell, *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*, 6th ed. Boston, MA, USA: Pearson, 2018.
- [46] M. F. Ahmad, *Application of Structural Equation Modelling (SEM) in Quantitative Research*, 1st ed. Batu Pahat, Malaysia: Penerbit UTHM, 2017.
- [47] A. G. Yong and S. Pearce, "A beginner's guide to factor analysis: Focusing on exploratory factor analysis an," *Tutor. Quantum Methods Psychol.*, vol. 9, no. 2, pp. 79–94, 2013.
- [48] B. Williams, A. Onsmann, and T. Brown, "Exploratory factor analysis: A five-step guide for novices," *Australas. J. Paramedicine*, vol. 8, no. 3, pp. 42–50, Aug. 2010.
- [49] A. L. Comrey and H. B. Lee, *A First Course in Factor Analysis*, 2nd ed. Hillsdale, NJ, USA: Lawrence Erlbaum Associates, 1992.
- [50] M. Effendi, E. M. Matore, and A. Z. Khairani, "Correlation between adversity quotient (AQ) with IQ, EQ and SQ among polytechnic students using Rasch model," *Indian J. Sci. Technol.*, vol. 9, no. 47, pp. 1–8, 2016.
- [51] J. W. P. Fisher, "Rating scale instrument quality criteria," *Rasch Meas. Trans.*, vol. 21, no. 1, p. 1095, 2007.
- [52] B. D. Wright and G. N. Masters, *Rating Scale Analysis Rasch Measurement*. Chicago, IL, USA: MESA Press, 1982.
- [53] J. M. Linacre, *A User's Guide to WINSTEPS: Rasch Model Computer Programs*, vol. 312. Chicago, IL, USA: MESA Press, 2005.
- [54] T. G. Bond and C. M. Fox, *Applying the Rasch Model: Fundamental Measurement in the Human Sciences*. Evanston, IL, USA: Routledge, 2015.
- [55] J. M. Linacre, "Standard errors: Means, measures, origins and anchor values," *Rasch Meas. Trans.*, vol. 19, no. 3, p. 1030, 2005.
- [56] B. D. Wright, "Which standard error? Item-specific or general? Ideal or real," *Rasch Meas. Trans.*, vol. 9, no. 2, p. 436, 1995.
- [57] M. Wu and R. Adams, *Applying the Rasch Model to Psycho-Social Measurement: A Practical Approach*. Melbourne, VIC, Australia: Educational Measurement Solutions, 2007.
- [58] A. A. Aziz, M. S. Masodi, and A. Zaharim, *Asas Model Pengukuran Rasch: Pembentukan Skala Dan Struktur Pengukuran*, 3rd ed. Bangi, Malaysia: Penerbit UKM, 2017.
- [59] M. D. Reckase, "Unifactor latent trait models applied to multifactor tests: Results and implications," *J. Educ. Statist.*, vol. 4, no. 3, pp. 207–230, Sep. 1979.
- [60] J. M. Linacre, *A User's Guide to WINSTEPS: Rasch Model Computer Programs*. Chicago, IL, USA: MESA Press, 2012.
- [61] J. M. Linacre, *A User's Guide to WINSTEPS: Rasch Model Computer Programs*. Chicago, IL, USA: MESA Press, 2009.
- [62] M. Balsamo, G. Giampaglia, and A. Saggino, "Building a new Rasch-based self-report inventory of depression.," *Neuropsychiatr. Dis. Treat.*, vol. 10, pp. 65–153, Jan. 2014.
- [63] C. J. Gibbons, R. J. Mills, E. W. Thornton, J. Ealing, J. D. Mitchell, P. J. Shaw, K. Talbot, A. Tennant, and C. A. Young, "Rasch analysis of the hospital anxiety and depression scale (hads) for use in motor neurone disease," *Health Qual. Life Outcomes*, vol. 9, no. 1, p. 82, 2011.
- [64] C. Hill and E. Koekemoer, "The development of the MACE work-family enrichment instrument," *SA J. Ind. Psychol.*, vol. 39, no. 2, pp. 1–16, 2013.
- [65] J. M. Linacre, "Sample size and item calibration (or person measure) stability," *Rasch Meas. Trans.*, vol. 7, no. 4, p. 328, 1994.
- [66] D. Andrich and I. Styles, *Final Report on the Psychometric Analysis of the Early Development Instrument (EDI) Using the Rasch Model: A Technical Paper Commissioned for the Development of the Australian Early Development Instrument (AEDI)*. Perth, WA, Australia: Murdoch Univ., 2004.
- [67] J. M. Linacre, "What do Infit and outfit, mean-square and standardized mean," *Rasch Meas. Trans.*, vol. 16, no. 2, p. 878, 2002.
- [68] J. Grandy, "Psychometric properties and analysis of the AQ profile: Online version 8.1," Peak Learn. Inc., San Luis Obispo, CA, USA, Tech. Rep. 1, 2009.
- [69] G. Rasch, "On general laws and the meaning of measurement in psychology," in *Proc. 4th Berkeley Symp. Math. Statist. Probab.*, 1961, pp. 321–334.
- [70] G. Rasch, *Probabilistic Models for Some Intelligence and Attainment Test*. Chicago, IL, USA: The Univ. Chicago Press, 1980.
- [71] J. S. Lai and D. T. Eton, "Clinically meaningful gaps," *Rasch Meas. Trans.*, vol. 15, no. 4, p. 850, 2002.
- [72] B. Sumintono and W. Widhiarso, *Aplikasi Model Rasch Untuk Penelitian Ilmu—Ilmu Sosial, Edisi Revi*. Cimahi, Indonesia: Trim Komunikata Publishing House, 2014.
- [73] Z. Awang, *Structural Equation Modeling Using AMOS Graphic*, 2nd ed. Shah Alam, Malaysia: UiTM Press, 2013.
- [74] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, 7th ed. Upper Saddle River, NJ, USA: Prentice-Hall, 2010.
- [75] H.-Y. Kim, "Statistical notes for clinical researchers: Assessing normal distribution (1)," *Restorative Dentistry. Endodontics*, vol. 37, no. 4, pp. 245–248, Nov. 2012.

- [76] H.-Y. Kim, "Statistical notes for clinical researchers: Assessing normal distribution (2) using skewness and kurtosis," *Restorative Dentistry. Endodontics*, vol. 38, no. 1, pp. 4–52, Feb. 2013.
- [77] A. Field, *Discovering Statistics Using SPSS*. London, U.K.: SAGE Publications, 2009.
- [78] Z. Awang, *A Handbook on SEM for Academicians and Practitioners*, 1st ed. Bandar Baru Bangi, Malaysia: MPWS Rich Resources, 2014.
- [79] B. G. Tabachnick and L. S. Fidell, *Using Multivariate Statistics*, 5th ed. Boston, MA, USA: Pearson, 2008.
- [80] J. Raubenhaimer, "An item selection procedure to maximise scale reliability and validity," *SA J. Ind. Psychol.*, vol. 30, no. 4, pp. 59–64, Oct. 2004.
- [81] T. D. Little, U. Lindenberger, and J. R. Nesselroade, "On selecting indicators for multivariate measurement and modeling with latent variables: When 'good' indicators are bad and 'bad' indicators are good.," *Psychol. Methods*, vol. 4, no. 2, pp. 192–211, Jun. 1999.
- [82] W. F. Velicer and J. L. Fava, "Effects of variable and subject sampling on factor pattern recovery," *Psychol. Methods*, vol. 3, no. 2, pp. 231–251, 1998.
- [83] E. G. Carmines and J. P. McIver, "Analyzing models with unobserved variables," in *Social Measurement: Current Issues*, G. W. Bohrnstedt and E. F. Borgatta, Eds. Beverly Hills, CA, USA: SAGE, 1981.
- [84] M. W. Browne and R. Cudeck, "Alternative ways of assessing model Fit," in *Testing Structural Equation Models*, K. A. Bollen and J. S. Long, Eds. Newbury Park, CA, USA: SAGE, 1993, pp. 136–162.
- [85] B. M. Byrne, *Structural Equation Modeling With LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming*. Trenton, NJ, USA: Lawrence Erlbaum Associates Publishers, 1998.
- [86] P. M. Bentler and D. G. Bonett, "Significance tests and goodness of fit in the analysis of covariance structures.," *Psychol. Bull.*, vol. 88, no. 3, pp. 588–606, 1980.
- [87] R. B. Kline, *Principle and Practices of Structural Equation Modelling*, vol. 20, no. 1, 3rd ed. New York, NY, USA: The Guilford Press, 2011.



MOHD EFFENDI EWAN MOHD MATORE received the bachelor's degree in mechanical engineering (manufacturing) and the master's degree in technical vocational and education training (TVET) from Universiti Tun Hussein Onn Malaysia (UTHM), Johore, in 2005 and 2007, respectively, and the Ph.D. degree in psychometrics and evaluation from Universiti Sains Malaysia (USM), in 2015. He is currently a Senior Lecturer of psychometric and educational measurement with Universiti Kebangsaan Malaysia (UKM). He is also holding the position of an Assistant Dean (Quality Assurance and Strategy) with the Faculty of Education, UKM. He has published more than 60 academic articles as a main author or coauthor. He is also the Principal Investigator in the research areas of measurement and evaluation, instrument development, and items psychometric assessment. His research interests include intelligence assessment and psychometrical analysis.



MOHAMMED AFANDI ZAINAL received the bachelor's degree in education in primary mathematics from the University of Hertfordshire, U.K., in 2009. He is currently pursuing the master's degree in the measurement and evaluation program with the Faculty of Education, Universiti Kebangsaan Malaysia (UKM). He has published more than five academic articles as a main author or coauthor. His research interests include education measurement, pedagogy in mathematics, transformational leadership, teachers' self-efficacy, and teachers' innovative behavior.



MUHAMAD FIRDAUS MOHD NOH received the bachelor's degree in teaching English as a second language from the Queensland University of Technology, Australia, in 2012. He is currently pursuing the master's degree in educational measurement and evaluation with Universiti Kebangsaan Malaysia (UKM). He is also an English Teacher with the Sekolah Rendah Agama Bersepadu Segamat, Ministry of Education, Malaysia. His research interests include language testing and multi-rater assessment analysis.



AHMAD ZAMRI KHAIRANI received the bachelor's degree in educational study and the master's degree in education from Universiti Sains Malaysia (USM), and the Ph.D. degree in psychometric and educational testing from International Islamic University Malaysia (IIUM). He is currently a Senior Lecturer with the School of Educational Studies, USM. His research interests include educational measurement, mathematics education, and teacher education.



NORDIN ABD RAZAK received the bachelor's and master's degrees in education from Universiti Sains Malaysia (USM), and the Ph.D. degree from Flinders University, Adelaide. He is currently an Honorary Lecturer with the School of Educational Studies, USM. His research interests include scale development and educational measurement, secondary data analysis of international large-scale assessment (ILSA), data analysis techniques and statistics, and social psychology of education.

...