Application of Rasch rating scale model in calibrating youth adversities in Malaysia

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Abstract. The traditional statistical summation of Likert scale is based on the a priori assumption that all of the items are of equal difficulty and that the thresholds between steps are of equal distance or equal value. The Rasch Rating Scale Model (RSM) emphasize that not only each item have a difficulty estimate, but the rating scale has a series of thresholds to show the progression of the scale used compared to dichotomous data. In order to check the quality of the adapted items based on Malaysian Youth Challenges and also how functions the RSM in calibrating the adversities among youth. The research aimed to investigate the reliability and separation index of adapted items developed and calibrating the main adversities among youth. A set of items in online survey questionnaires with a four-point Likert scale were administered to 500 youth that categorized into early, mid and end youth from five different zones using convenience sampling technique. The data of the questionnaire were analysed using RSM. The items with -0.09 logit from the data set (second quartile or 50 percent), and above are considering as hard to endorse by youth. The findings revealed that all items have good reliability and separation index. The most dominant challenge for all age categories of youth is the economy and the least dominant is technology. The results exposed the potential of logit on the RSM is useful to help organize the adversities. The logit served to convert the ordinal to the interval type of data. The research was contributed to the applications of modern psychometric theory. This information is valuable to redesign the content of the self-development for youth self-development programs, especially to face adversities in their life.

1. Introduction
The issue of youth development is crucial as Malaysia has a total of 14.7 million youths, 46 percent of its 31.7 million populations based on Department of Statistics Malaysia in 2015 and continuously increasing [1]. This shows that almost half of the population in Malaysia is youth. Youth development is an important issue in national development. Youth are an important asset of the country in which they are the largest contributor to improve the living standards either from the economic, social or political aspects. The Youth Societies and Youth Development Act 2007 (Act 668) define youth as individuals between the ages of 15 to 40 years. However, in 2015, the Malaysia Youth Policy (MYP) changed the youth age limit definition to individuals between the ages of 15 years and before reaching the age of 30 years. In an increasingly competitive global environment, Malaysian youth are faced with various challenges. It is anticipated that youth challenges will multiply in the future if not properly managed [1]. Malaysia Youth Policy [2] had identified four major challenges facing Malaysian youth namely politic, economy, social and technology. One of the vital needs for youth is technology challenges such as social or digital media, and information technology (IT). One of the examples is Massive Open Online Courses (MOOC) application in teaching and learning process for all levels.
While the Malaysian Youth Index (MYI) was built in 2015, item assessment was only demonstrated through reliability of item indices alone without considering psychometric testing of challenge items from MYP. The development of adversities item amongst youth is important to ensure that dominant adversity can be identified for the purpose of empowering youth or specifically by the youth age category. In addition to the general definition of youth in general from 15 to 29, youths are also categorized into three; namely early youth (15-18 years), mid youth (19-24 years), and end youth (25-30 years) [2]. Additionally, the psychometric item testing using modern measurement theory is believed to provide more empirical information than Classical Test Theory (CTT). One of the modern measurement theories is Rasch model. Rasch model has been widely used in various fields, especially in education and psychology of education assessment to measure the level of achievement and cognitive [3]. In a nutshell, this study will focus on assessing the item reliability and calibrating the adversities among youth in Malaysia.

2. Research objectives
   a) To investigate the reliability and separation index of items developed based on Malaysian Youth Challenges using Rasch Model.
   b) To calibrate the main adversities among youth in Malaysia using Rasch Model.
   c) To rank the adversities type based on category of youth from Malaysian Youth Challenges.

3. Literature review

3.1. What is adversity?
Adversity or challenges is connected with distress or problems experienced by a person. Challenge means difficulties, hardships, unlucky, challenge, sources of stress, sadness, misery and distress [4]. Two types of challenges described by Stoltz and Weihenmayer [4]. The first type is internal challenges or inner adversity such as fear, anxiety, depression, loneliness, lack of confidence, health problems, insomnia, uncertainties and others. The second type of challenge is external challenges or outer adversity involves external factors such as economic problems, failure in examinations, computer malfunction, car scratched and natural disasters. For this research context, adversities or challenges among youth are based on Malaysia Youth Challenges.

3.2. Youth major challenges
Malaysia Youth Challenges has outlined four key indicators of the politic, economic, social and technology domain [5]. This indicator is defined operationally in the context of the research. The domains are Political (P1-Political literacy, P2-Political Maturity, P3-Leadership, P4-Global Thinking, P5-Regional and International Relations); Economy (E1-Cost of Living, E2-Entrepreneurship Culture, E3-Skills, E4-Employment, E5-Urban Poor Youth, E6-Remigration, E7-Personal financial); Social (S1-Education, S2-Social problems, S3-Spirituality and Religion, S4-Good Values, S5-Self-identity and Unity, S6-Volunteerism, S7-Mental and Physical Well-being, S8-Family Institution, S9-Human Touch, S10-Community Institution); and Technology (T1-Information and Communication Technology, T2-Social or Digital Media, T3-Innovation and Creativity, T4-Science and Technology).

3.3. Rasch rating scale model
The rating-scale model is an extension of the dichotomous model to the case in which items have more than two response categories (e.g., Likert-type scales). In this research, each item has four response choices (1 = not at all a problem, 2 = minor problem, 3 = moderate problem, 4 = serious problem) it is modeled as having three thresholds. Each item threshold (k) has its own difficulty estimate (F), and this estimate is modeled as the threshold at which a person has a 50/50 likelihood of choosing one category over another [6]. The model is represented in the equation (1).
\[ P_i = \frac{\exp[\beta_n - (\delta_i + \tau_k)]}{1 - \exp[\beta_n - (\delta_i + \tau_k)]} \] 

where, 
\[ P_i = \text{Probability of getting a correct answer for item } i, \ i = 1, 2, \ldots \]
\[ \beta_n = \text{Ability parameter for respondent } n, \ n = 1, 2, \ldots \]
\[ \delta_i = \text{Difficulty parameter of an item } i \]
\[ \tau_k = k^{th} \text{threshold} \]

Item difficulty parameter is defined as the proportion of the number of students who answer incorrectly. Respondent’s ability parameter is calculated based on the ratio of the number of correct items. Modelling of both parameters is conducted through a procedure called calibration, where responses for each item is transformed into equal interval score called ‘measure’ using natural log (ln). The measure for both parameters is defined in logit unit. Many previous researchers are using Rasch for evaluating items for their instrument and also conducted other research that based on Rasch model concept [7–9].

4. Methodology

4.1. Research design

The research used a quantitative approach with survey method study because of its ability to gather data for numerical setting to explain phenomena that are studied. The data was obtained using self-administered online survey because they are less expensive, no cost of copying surveys, and no coding necessary. Thus, the results are ready for statistical analysis almost immediately [10]. Data collection was conducted using an online survey, which required participants to respond to all items before submitting their answers; this prevented the possibility of missing data.

4.2. Sampling

The respondents for this study included 500 youth, consisting of 250 (50%) males and females each. Subjects were chosen from five zones by convenient sampling which 100 respondents represented by South, East, West, North and Borneo. They were selected based on the appropriateness of the sample, their free time, and willingness to involve in this study. The respondents were into range of 15 to 29 years old. The total of 200 (40%) were represented early youth, 150 (30%) represented mid youth and 150 (30%) from end youth. The respondents criteria were as follows: (1) still consider as youth categories (15 to 30 years old); (2) willing to answer the questionnaires; and (3) able to answer items through online. Participation was strictly voluntary and anonymous.

4.3. Instrumentation

The instrument was self-assessed by each youth using Malaysian Youth Challenges model from Ministry of Sports and Youth with four main challenges including (a) Political (Political literacy, Political Maturity, Leadership, Global Thinking, Regional and International Relations), (b) Economy (Cost of Living, Entrepreneurship Culture, Skills, Employment, Urban Poor Youth, remigration and personal financial), (c) Social (Education, Social Problems, Spirituality and Religion, Good Values, Self-identity and Unity, Volunteerism, Mental and Physical Well-being, Family Institution, Human Touch, and Community Institution), (d) Technology (Information and Communication Technology, Social or Digital Media, Innovation and Creativity, and Science and Technology) [1]. The items are coded from item 1 to 10 (politics), item 11 to 24 (economy), item 25 to 44 (social) and item 45 to 52 (technology) with the total number of items is 52.

4.4. Measurement and scoring

The instrument is rated on a four-level Likert scales response system for level of problems, from 1 “not at all a problem”; 2 “minor problem”; 3 “moderate problem”; and 4 “serious problem” [11].
frame for completing the questionnaires is one week. Scales raw scores are calculated by mean score. The mean score obtained then transformed to logit value by Rasch [12]. The lower score of logit indicated that respondents are easy to endorse the items and vice versa.

5. Results and discussions

5.1. Objective 1: To investigate the reliability and separation index of items developed based on Malaysian Youth Challenges.

The items reliability was recorded 0.99 and it is consider excellent [13]. The person (youth) reliability is 0.88. The reliability value that within range 0.81 to 0.90 is consider good [13]. High reliability (of persons or items) means that there is a high probability that persons (or items) estimated with high measures actually do have higher measures than persons (or items) estimated with low measures [14]. The Cronbach’s alpha value recorded a reliability value of 0.89 and this value considered acceptable and fulfill the internal consistency [15]. The item separation index of 8.35 is consider excellent and person separation index is 2.75 and consider as fair [13]. Item separation is used to verify the item hierarchy. High item separation implies that the person sample is large enough to confirm the item difficulty hierarchy (construct validity) of the instrument. Person separation is used to classify people. High person separation with a relevant person sample implies that the instrument may be sensitive enough to distinguish between high and low performers [14].

5.2. Objective 2: To calibrate the main adversities among youth in Malaysia using Rasch Model.

Table 1 show the list of main adversities from 500 youth based on logit from Rasch. The logit on the second quartile or 50% from all adversities were listed based on cutting score of -0.09 logit. The items with -0.09 logit and above are considering as hard to endorse by youth. Table 1 revealed that list of adversities among youth with 26 items including economy (9 items), politic (5 items), social (10 items) and technology (2 items). The top five main adversities were in economy (I’m not good at financial planning), economy (I feel less work opportunities at my place), politic (I don’t have a leader aura), politic (I am immature in managing the country’s political issues prudently), and social (I don’t prefer to participate in mosques or worship houses). Figure 1 revealed the logit average from all items according to types of adversity. It was mentioned that the economy (logit = +2.37) is the most challenged by youth in Malaysia followed by politics (logit = -0.34), social (logit = -0.37), and technology (logit = -1.66). The logit average showed the rank of adversities.

The findings of the youth challenge in managing financial planning were found to be in line with some previous studies [16–18]. This study addresses the status of bankruptcy and the level of financial literacy among middle youth. The least dominant adversities are social (I lack communication with neighbours...
and the community) and economy (I can’t afford to be a skilled manpower in the future). This finding shows that youths think that communication is not a problem for the youth.

Table 1. List of adversities among youth (N=500).

| No | Item statement                                                                 | Types of Adversity | Logit |
|----|-------------------------------------------------------------------------------|--------------------|-------|
| 24 | I'm not good at financial planning                                            | Economy            | 1.50  |
| 22 | I feel less work opportunities at my place                                    | Economy            | 1.20  |
| 5  | I don’t have a leader aura                                                    | Politic            | 1.13  |
| 4  | I am immature in managing the country's political issues prudently             | Politic            | 1.10  |
| 30 | I don’t prefer to participate in mosques or worship houses                     | Social             | 1.00  |
| 35 | I don’t prefer to be involved in voluntary activities                         | Social             | 0.85  |
| 41 | I am not focusing on humanity aspect in the society                           | Social             | 0.69  |
| 39 | I don’t care enough about the relationship between my family                  | Social             | 0.64  |
| 11 | I cannot afford to manage my finances well                                    | Economy            | 0.62  |
| 3  | I am immature in assessing the political issue of the State                   | Politic            | 0.51  |
| 17 | I find it difficult to find the right job                                     | Economy            | 0.55  |
| 33 | I have a difficulty in managing my personal finances everyday                  | Social             | 0.55  |
| 7  | It's hard to think globally about the current political issue of the world    | Politic            | 0.53  |
| 19 | I am unable to cope with the burdensome cost of living                        | Economy            | 0.53  |
| 40 | I don’t care about the situation in my family                                 | Social             | 0.39  |
| 20 | I am unable to face competition to get a job                                  | Economy            | 0.33  |
| 10 | I am hard on expanding strategic relationships with Asian and world partners  | Politic            | 0.30  |
| 23 | I have difficulty managing my personal finances everyday                       | Economy            | 0.24  |
| 38 | I don’t care about the health of my body                                      | Social             | 0.22  |
| 29 | I'm less concerned about the spiritual aspect of life                          | Social             | 0.16  |
| 12 | I can hardly control the debt burden level                                   | Economy            | 0.13  |
| 25 | I'm not good at finding opportunities to pursue studies                       | Social             | 0.13  |
| 47 | I'm easily influenced by false news through social media                      | Technology         | 0.08  |
| 52 | I cannot afford to contribute to science and technology for national development| Technology         | 0.08  |
| 42 | I lack communication with neighbors and the community                          | Social             | -0.01 |
| 15 | I can’t afford to be a skilled manpower in the future                         | Economy            | -0.08 |
5.3. Objective 3: To rank the adversities type based on category of youth from Malaysian Youth Challenges.

Table 2 shows a rank of the adversities type based on three categories of early youth, mid youth and end youth from Malaysian Youth Challenges. For early youth, the economic is the main challenge while the least dominant challenge is technology for all youth age categories.

| Types of adversity | Logit mean |
|--------------------|------------|
|                    | Early | Mid | End |
| Politic            |  -0.17 |  -0.50 |  -0.46 |
| **Economy**        |  **2.66** |  **2.92** |  **1.65** |
| Social             |  -0.34 |  -0.59 |  -0.23 |
| Technology         |  -0.80 |  -1.82 |  -0.94 |

Figure 2 visualized the logit mean of four adversities domain according to the early, mid and end youth. It was clearly shown that economy was the most dominant aspect compared to the technology.

The most dominant challenge in the context of this study is the economy that covers seven major aspects in Malaysian Youth Challenges model such as cost of living, entrepreneurship culture, skills, employment, and urban poor youth. This shows that youth in Malaysia have difficulty in the aspects such as financial management and debt burden, cultivating entrepreneurial culture, becoming skilled manpower, unemployment and marketability, limited work opportunities, competition and cost of living, urbanization problems for employment and management of personal finances. In Malaysia, youths have financial management problems such as bankruptcy. Previous studies have discussed about bankruptcy factors among youths. Youths are likely to become depressed and unable to manage financially well because of the rising cost of living. Malaysia Department of Insolvency statistics from 2005 to 2012 recorded 243,823 people declared bankruptcy. The total of 57 percent comprised of those under age 45. The total of 50 percent of these groups are credit card holders under the age of 30 [17]. Furthermore, previous study showed the evident that more youths are bankrupt because of the burden of serious debt obligations such as credit cards, car loan purchases and personal loans [18-19].

One of the results of the previous study shows that most of the students in UKM have a moderate level of financial literacy. The majority of them are youths who are going to the job market and self-reliant. They will also face a more challenging financial environment in the realm of work. Recent
studies have put emphasis on issues of financial literacy and financial decision making among students at colleges and universities [20]. Youths are faced with the changing economic and financial environment in line with more complex system and financial transformation including education or personal finance loans, and education investments. One study was conducted to examine the reasons or causes of young people in Malaysia owing the findings show that young people have to fulfill their responsibilities to households such as housing, vehicles, small children's education (if married) and also rising cost of living. Hence, most of the young people in Malaysia take a way to indebted to meet the basic needs of life, especially for those who have been married and have a lot of dependence [16]. Youth challenges in the economy for this study are also in line with the growing youth unemployment problem in Malaysia. Unemployment is also one indicator in the Malaysian Youth Challenges.

For the least dominant aspect is technology such as information and communication technology, social or digital media, innovation and creativity, also science and technology. Youth are found to have difficulty adapting to the constraints of research and development or ICT methods, controlling the influence of information disclosure, generating innovation and creativity in various fields, and adapting to the rapid development of knowledge. In Malaysia, the use of gadgets and ICTs is growing rapidly and youth are the ones who are directly involved as the main consumers in Malaysia. This is evident of ICT usage from primary to tertiary education. Additionally, Massive Open Online Courses (MOOC) is an open and free online learning course (online) that widely used among youths in Malaysia. MOOCs Malaysia is the Ministry's prioritization agenda under Leap 9: Globalized Online Learning (Globalized Online Learning) under Malaysia's Education Development Plan 2015-2025 (Higher Education) included improving the quality of education in the vocational college [21].

In addition, youth have also been exposed to e-learning, blended learning, Web 2.0, game based learning such as Kahoot, Quizizz, Quizlet and any other apps. Malaysian education system had also encouraged teacher for using information system, internet, software and computers in the classroom [22]. That's the main reason that technology is not a challenge for youth in Malaysia because most of them are familiar with it.

6. Conclusions
The key finding in this research is to emphasize that economy domain was the most dominant adversity among youth in Malaysia. Previously, adversity arrangements were made using the scoring and ranking system. However, not all researchers are aware about the application of Rasch logit for the same purpose. The comparison of Rasch logit with Likert score was the type of data which logit provided interval type of data and Likert was ordinal. The ordinal just concern about the order matters but not the difference between values, and interval had more ability where the difference between two values is meaningful. With the application of Rasch logit, the type of data to rank the adversities are more beneficial for data improvisation. Suggestions for improvements that can be made are through the help of the youth on prudent financial management to avoid financial burdens. For the context of the study, it is hoped that it can be expanded to different comparisons of settings such as youths in schools and working youth. Further research can be done through the financial management courses to all ages for expose them with the right techniques and awareness of youth savings. The limitation of this study is the existence of youths who are still uncertain of the challenges they faced. Hence, these types of challenges can be multiplied by adapting other challenge models rather than model in Malaysia only. A further study can be done through the study of the relationship between these challenge scores with other variables such as the well-being of life and youth intelligence. In addition, statistical comparisons are relevant for examining profiles on a demographic basis.

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