Rasch Measurement Model for Scale Validation of Rowe's Managerial Decision-Making Styles Inventory for University Management Dominance Decision Style

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Abstract: Effective leaders or managers tend to make effective decisions. Measuring one's leadership in terms of decision-making is getting more and more relevant to many organisations since this would predict managers' or leaders' reactions to various working situations and their influence on organisational success. The current study attempts to bring a new perspective on how the Managerial Decision-Making Styles Inventory (DMSI), originally developed by Alan Rowe and Mason in 1987, can be further explored, improved and used by various organisations including academic setting in higher education. The DMSI instrument, which was originally developed using a semantic scale, can no longer be friendly to many researchers or statisticians at the current time. Thus, this research provides a set of new scales for the original instrument by changing and increasing the original scales to six Likert's scales using the Rasch measurement model. From the Rasch outputs, the item separation of 20.47 indicated that all items created a variable that spread about 20 levels. The item's reliability was 1.00, which is considered acceptable and perfect in measurement. The values of the infit MNSQ ranged from 0.77 to 1.87, while the values of the outfit MNWQ ranged from 0.57 to 6.37, respectively. The standardised Residual Variance of managerial decision-making styles was explained by measures of 69.1%, which indicated a strong measurement dimension. With these results, the researchers concluded that the DMSI instrument by Rowe and Mason can be used to measure any organisational managerial decision-making styles. Some implications and recommendations were also provided for the best and most effective decision-making styles and practices.

Keyword: Rasch Measurement Model, Rowe Decision Styles, Rowe Inventory, Scale Validity, University Management, Higher Institutions, Malaysia

1. Introduction

Education institutions, which are meant to provide a friendly, rewarding, and supportive atmosphere for learning, interface with several other features arising from the dynamism of a social system. The strengths, weaknesses, opportunities, and threats therein may be a function of the

institution attributed to the competences, skills, and leadership styles adopted by the management and other members. Basically, the management is solely responsible for the decision-making process, as it is crucial to the organisation's job performance and overall success. For an educational institution like university to remain functional, productive, and relevant to its goals, it must meaningfully establish an organised strategic process for decision-making that applies to all. The success achieved by higher education institutions depends primarily on the ability, capability, and efficacious disposition of the members and their approaches to decision-making.

However, the quality of decision-making is dependent upon the organisation's strategic process, which is determined by several characteristics that come into contact with the university in general. Importantly, the background of universities , personalities of its teachers/lecturers and heads, the values, mission, and vision of the organisation, the disposition of management, university-community relations, government policies, and leadership styles are all important factors that specifically influence the decisions of the organization. Made consciously or unconsciously, decisions shape the operation of an institution, leaving either positive, neutral, or negative consequences. Making good decisions is not easy in today's world. Hence, decision-making can be considered a tool deployed and administered by complex institutions like academic institutions when faced with prevailing opportunities, challenges, threats, and uncertainties (Hammond, 2010). As one of the key factors that define an institution's success, Khetarpal and Srivastava (2000) indicated that various perspectives, such as leaders' personalities, modes of working, interpersonal relationships, and administrative practices, are important to academic staff performance in universities.

Decision-making is an important leadership component in educational management, as its quality is dependent upon the organisation's strategic process and intent. In this regard, effective decision-making is a relevant factor to be considered since it would reveal, to a considerable extent, the flexibility or rigidity of the management. The educational system should be flexible, as bureaucracy in universities might lead academic staff to develop alienation and further create psychological trauma or isolation from the institutions. Although not all members of staff fall into categories of decision-makers, members should have a sense of belonging with the assurance that their efforts and contributions can make a difference when there is an attempt to logically make decisions. For instance, in a study conducted in Malaysian research universities by Amzat and Idris (2012), university staff expressed dissatisfaction with the management for being left out of the decision-making process, while some complained about the rigid management's decision-making styles being exclusively directive and authoritative, which consequently created a sense of hostility among staff. Hence, decision-making styles should be flexible and consultative in their execution so as to inculcate a sense of belonging among staff in the organisations.

2. Literature Review

2.1 Management Styles in Higher Educational Institutions in Malaysia: Impact on Decision-Making

Managers are the bedrock upon which any organisation stands. Their contributions and uncommon ideas are always appropriated when seeking the best ways of dealing with issues and handling organisational challenges and to help them raise their organisation towards an enviable position and attainment of its set goals. This is why they are conceived by Johnson, Nguyen, Groth, Wang, and Ng (2016) as a multiplied man who acts at the juncture of certainty and uncertainty. However, a manager's effectiveness depends on the techniques and skills related to strategic thinking (Cardella, Hernández-Sánchez, and Sánchez-García, 2020). Similarly, the submissions of Nkeiru and Nwinee (2019) and Namiq (2018) are in line with this, as they posit that the increase or decline in performance of any organisation may be attributed to the mode of operation engendered towards the organisation's mission, competencies of the members, direction and magnitude of managerial skills, and strategy of leadership that is used by the managers. In this regard, Namiq (2018) maintains that the style of leadership adopted by any institution determines its members' level of motivation, turnover, and performance.

According to Amzat, Taslikhan, Walters, and Walters (2020), the management styles of managers of educational institutions are an important issue in all nations, especially Malaysia. The country aimed at becoming a regional educational hub, with an emphasis on making significant changes and improvements in the operation and management of higher education institutions. Studies have shown that management styles adopted by any organisation would have a significant effect on its strategic positions, organisational performance, and productivity among employees. Similarly, decision-making is a crucial activity for managers in any organization. The existence of different decision-making styles has been recognised a long time ago to have a significant effect on an organisation's efficiency and effectiveness.

One of the most significant factors that determines the success or failure of any organisation is the decision-making-related area itself. However, several factors can contribute to individuals' decision-making, and this can in turn be a predictor of variables such as job satisfaction: factors like knowledge and experience, individual characteristics and personalities, organisational objectives, environmental and working conditions, nature of tasks assigned or performed, and employee motivation (Thunholm, 2004; Dalal and Brooks, 2013; Hamilton, Shih, and Mohammed, 2016).

For over two decades, the issues of management and decision-making styles have been the utmost concerns on every organisational agenda. Luthans et al. (2008) and Vahedi & Asadi (2014), have examined the relationship between management styles and decision-making styles towards organisational efficiency in the educational sector. Their findings indicated that there was a significant relationship between management styles and decision-making styles and organisational efficiency. Further, Amzat, Taslikhan, Walters, and Walters (2020) indicated in their study that there were significant relationships between management styles and decision-making styles towards organisational success amongst educational managers and leaders in higher educational institutions in Malaysia. Their findings indicated that management styles and decision-making styles tend to influence and contribute to the success or failure of organisations at higher learning institutions.

Considering the fact that individuals' decision-making styles could affect the effectiveness of an organisation, managerial decision-making in relation to areas like organisational performance and outcomes has been commonly investigated among corporate managers and leaders in various private and business organisations as well as educational institutions worldwide. In recent times, there have also been a number of studies being carried out across all levels of education globally. However, empirical research in the area of education emphasises decision-making styles as one of the most important components, which is fundamental to leadership and management processes. Thus, it could be observed that a proficient and productive educational organisation is determined by an effective manager and leader who is also an effective decision-maker.

In the same vein and beyond individual behaviour, external factors that take place around the institution can significantly influence the decision-making styles and roles or responsibilities of education managers at higher educational institutions (Jamian, Sidhu, & Aperapar, 2013). For instance, like other higher institutions, the vice chancellor is regarded as the head of the university, while the deans of colleges are regarded as academic managers who are specifically charged with planning, budgeting, advocating for, and reporting on all activities that centre on faculty/school, all of which are influenced by the academic landscape of the institutions. In this regard, effective decision-making styles serve as the fundamental function since this would reveal implications as to whether academic managers and leaders do have considerable flexibility or rigidity in discharging their decision-making styles.

2.2 Rowe and Boulgarides Decision Styles: Impact on Management and Organisation

For many decades, the managerial decision-making styles of managers and leaders were investigated in various organisations in both the private and government sectors. Findings indicated that managerial decision-making styles tend to influence and give effect on organisational performance and outcomes. Thus, the management's decision styles could determine how the organisation is run and its effectiveness in performance. In this scenario, decision-making styles could explain both the rigidity and flexibility of the management (Jamian, Sidhu, & Aperapar, 2011).

Decision-making styles reveal one's behaviours in responding to the situation. They explain the factors that contribute to the decision, the context, and the way the cues are perceived and

understood by the managers (Rowe and Boulgarides, 1987). Decision-making styles are the fundamental processes of cognition relating to mental functions, perceptions, and information processing towards exercising judgement (Rowe & Mason, 1987). In the field of knowing managers' decision-making styles, Rowe and Boulgarides' decision-making styles inventory has made a great contribution over time. In 1983, both Rowe and Boulagides were able to come up with a model of decision-making styles that was based on two perspectives: 1. values and cognitive complexity, and 2. decision-making styles comprised four models: directive, analytical, conceptual, and behavioural (Higgins, 2021).

When it comes to people's processing of information, Rowe et al. (1984) argued that people in this context are categorised into two opposing sides of a continuum. Decision-making tends to be influenced by an individual's enduring pattern, which is related to their decision style or thinking style (Pathak, Srivastava, and Dewangan, 2023). Thus, decision style is considered habit-based and comprises cognitive abilities such as information processing, self-regulation, and self-evaluation (Thunholm, 2004; Pathak, Srivastava, and Dewangan, 2023). Rowe et al. (1989) also argued that managers and leaders who concern themselves with future projection in their leadership would require them to be visionary leaders who can motivate others and make their dreams a reality (Azeska, Starc, and Kevereski, 2017). Yet, the decision-making styles inventory (DMSI) has been used to measure leadership style in terms of pattern and behaviour (Boulgarides and Cohen, 2001). According to Rowe et al. (1984), every organisation is believed to have at least one dominant style, often followed by two backup styles. Thus, this is an indication that no one style fits all in the decision-making process. However, it would all depend on context and the situation.

2.3 Rowe and Boulgarides Decision Styles:

2.3.1 Directive Style

Directive decision-makers are the ones that exercise power, are dominant, and are result-driven. They exercise low tolerance for ambiguity and complexity due to their low level of cognition. Eventually, they make decisions relatively quickly, using less information and less ambiguous information (Azeska, Starc, and Kevereski, 2017). The process of decision-making becomes one of the vital elements in today's management and organisations due to its effect on the success and failure of the organisation (Kozioł-Nadolna and Beyer, 2021), and it is possible to predict how an individual will react to different situations when knowing his or her decision-making pattern (Rowe & Boulgarides, 1994).

Moreover, Ogarca (2015) suggested that a directive decision-making style can be recommended if there are some structured tasks with a small level of cognitive complexity. Basing its decision on summary information (it prefers structured, punctual, generally verbal information) and on a restrained number of decision-making alternatives, such a decision maker offers rapid, satisfying solutions but is not necessarily optimal. In this regard, the manager with such a style focuses on technical decisions with a need for speed, efficiency, and limited alternatives (Subathra, 2016); the manager who focuses on control is generally efficient, result-oriented, and simultaneously wants to dominate others while at times becoming autocratic (Ogarca, 2015).

2.3.2 Analytic Style

Managers with an analytical style are characterised by an autocratic bent because they concentrate on making technical decisions and constantly require more knowledge, information, and consideration of options. They have greater tolerance for the ambiguity of tasks given (Ogarca, 2015) and a more cognitive and complex personality (Jamian, Sidhu, & Aperapar, 2016). They are fond of extensive information (generally written reports) and elaborate on many decision-making options. This style is also very suitable for a completely new decision-making situation. However, Subathra (2016) perceived this decision-making style as autocratic-inclined, neglecting control, and, by implications, highly analytical. She tends to shift to a directive style when under stress or will rarely use an analytical style unless it is required to do so.

Further, as submitted by Jamian, Sidhu, and Aperapar (2016), analytical decision-makers spend more time processing information before making a decision themselves, which could be a bad image in the minds of some investors who do not have enough time to analyse all investment options. On the other hand, it could be a good image for education as managers like to make technical decisions, always need more information and consideration of options, which are typified by the ability to cope with new situations, examine every detail in a situation, enjoy more problem solving, and always strive to achieve the maximum.

2.3.3 Conceptual Style

Subathra (2016) characterised conceptual decision-makers as those with high cognitive complexity and people-oriented personalities. The managers are found to be idealists focusing on ethics, tend to comply with some values, trust people, aim for a large time horizon, encourage participation, and are rather thinkers than action-oriented (Ogarca, 2013). Typically, they are thinkers rather than doers; hence, there is trust and openness in relationships. Goals are shared with subordinates, emphasise ethics and values, and tend to be more idealistic.

However, managers with conceptual and behavioural decision-making styles are classified as right-brain-dominant persons (less complex decision styles) and process more firm voluntary disclosure than others. Based on the findings of Pedram and Garkaz (2016), when the decision environment is less complex and rapid processing is needed, less complex decision styles will outperform more complex styles. If cognitive complexity is a learned characteristic, then an individual's cognitive abilities should increase over time. Nevertheless, the results of the findings of these scholars also revealed that there is an insignificant difference in terms of the accuracy of decisions between more complex decision styles (analytical and conceptual styles) and less complex decision styles (directive and behavioural styles).

2.3.4 Behavioral Style

Ogarca (2015) postulated that behavioural decision-makers are receptive to subordinates' suggestions, empathic, persuasive, looking forward to consensus, avoiding conflicts, and focusing on communication. It is characterised by a supportive and friendly orientation (concerned with subordinates' well-being and people-oriented). They also have a low level of cognitive complexity and are receptive to suggestions, communication, portraying warmth, being empathetic, persuasive, compromising, and accepting losing control (Subathra, 2016). Although Rowe and Boulgarides (1992) emphasised that an effective manager is the one who has a combination of behavioural and strong back-up The findings of research studies by Berisha, Pula, and Krasniqi (2018), Jamian, Sidhu, & Aperapar (2013), and Abood and Thabet (2017), affirmed that the behavioural style, which is the most predominant decision-making style among different samples of managers, has a low tolerance for ambiguity but is focused on people and social concerns in decision-making. This is supported by their similar characteristics, given that behavioural style is characterised by supportive, friendly orientation and concern for subordinates' wellbeing; they also have a limited capacity for cognitive complexity, but they are open to advice and communication, portray warmth, are persuasive, and have consented to losing control (Subathra and Jayaraj, 2019).

3. Research Design

3.1 Population & Participants

This study employs the quantitative method and applies the Rasch measurement model for instrument validation. The population consists of lecturers at public universities in Malaysia, and the instrument was tested among 1114 lecturers from various universities (UM, UKM, UPM, UiTM, IIUM, and UPSI) and disciplines.

3.2 Scale Validation

3.2.1 Phase 1: Scale/Instrument Overview on Rowe and Mason's Managerial Decision-Making Styles Inventory (DMSI)

The Managerial Decision-Making Styles Inventory (DMSI) instrument was first developed in 1987 by Alan Rowe and Richard O. Mason. Both scholars (as cited in Rowe and Boulgarides, 1992) had built and constructed the complete decision-style model, which reflected a person's cognitive complexity and values. However, in 1992, the DMSI instrument was further improved by Rowe and Boulgarides. Both of the scholars defined making styles (DMS) as the way managers make decisions. They explained that DMSI was constructed based on two key elements, such as values and perceptions. It involved factors like the context in which decisions are made, the way managers perceive and understand cues, and what managers value and judge as significant. Briefly, DMS stands for the manners in which managers react to a specific given situation. This includes how managers interpret and understand cues, what they believe, and their responses to numerous demands and forces. Hence, Rowe and Mason (1987) postulated that the DMSI model brought by them tends to probe the psychological structures of one's mind, and they classified decision-making into four styles, namely: directive, analytical, conceptual, and behavioural.

Table 1 below demonstrates the complete decision-making style model that describes an individual's personality, self-competence, interpersonal competence, situation awareness, and problem-solving capability. The model is further divided into two main components: cognitive complexity and value orientation. The lower half of the model indicates directive and behavioural styles that preferred structure, whereas the upper half indicates complexity. The values dimension would separate the left and right halves and cover the task and people dimensions. In addition, the left half of the figure demonstrates the analytical and directive styles that prefer tasks. The right half indicates the conceptual and behavioural styles that people prefer.

Table 1

Complete Managerial Decision-Making Styles Model by Rowe and Mason (1987, as cited in Rowe and Boulgarides, 1992)

	Left hemisphere	Right hemisphere	
Tolerance For Ambiguity	**Analytical** Enjoys problem solving Wants best answers Wants best control Uses considerable data Enjoys variety Is innovative Uses careful analysis	**Conceptual** Is achievement-oriented Has a broad outlook Is creative Is humanistic/artistic Initiates new ideas Is future-oriented	Leaders Thinking (Ideas)
Cognitive Complexity			
Need for Structure	**Directive** Expects results Is aggressive Acts rapidly Uses rules Uses intuition Is verbal	**Behavioural** Is supportive Uses persuasion Is empathetic Communicates easily Prefers meetings Uses meetings Uses limited data	Managers Doing (Action)
	(logical) Task/Technical	(relational) People /Social	

Values Orientation

The following is a description of the four DMS:

Directive style is characterised by autocratic and internal orientation. Individuals or managers who embrace this style would have a low tolerance for ambiguity and low cognitive complexity. The focus is on technical decisions involving a need for speed, efficiency, and limited alternatives. They would prefer specific information to be given verbally and like to dominate others. They are also results-driven yet constantly search for security and status; they are focused, structured, aggressive, and rigid in many ways. The orientation towards the internal organisation is always short-range with tight controls.

The analytical style is characterised by an autocratic bent. Individuals or managers who embrace this style would have a much greater tolerance for ambiguity and a more complex cognitive personality. They need more information and consideration for alternatives since the focus is on technical decisions. They are typified by the ability to cope with new situations, enjoy more problem-solving, and always strive to achieve the maximum. Position and ego seem to be important characteristics, and they often reach the top positions in a company or start their own company since they need more control. However, they are not rapid in decision-making but enjoy variety and prefer written reports. They also welcome and enjoy challenges and examine the details of a situation.

Conceptual style is characterised by high cognitive complexity and people orientation. Typically, conceptual decision-makers or managers are thinkers rather than doers, uphold trust, and practice openness. They share goals with subordinates, tend to be idealists, and emphasise ethics and values more. They are normally creative and can readily understand complex relationships. They use data from numerous sources and consider many alternatives when making decisions. They focus on long-term goals with high organisational commitment. They are achievement-oriented, value praise, recognition, and independence, prefer loose control to power, and exhibit participation.

Behavioural style is characterised by individuals or managers who are supportive, friendly, and people-oriented with high concern over subordinates' wellbeing. They have a low level of cognitive complexity but possess deep social concern for organisations and the development of people. They normally provide counselling, are receptive to suggestions, communicate easily, portray warmth, are empathetic, persuasive, compromising, and accept loose control. They also focus on the short-term range, use meetings for communicating, avoid conflict, and seek acceptance, but sometimes they are insecure.

3.2.2 Original Semantic Scale of Decision-Making Style Inventory (DMSI) by Rowe and Mason

The following is the original semantic scale information for measuring DMS intensity levels by Rowe and Mason (1987). The amount of DMS intensity used is determined by four levels, namely: 1. The least preferred level of intensity indicates that individuals rarely use the style but, when required, could do so. 2. Back-up level of intensity indicating that individuals use the style occasionally and reflect the typical score on the DMSI, 3. dominant level of intensity, indicating individuals frequently choose to utilise this style over others (in general, though, people can have multiple dominant styles and switch between them); and 4. very dominant level of intensity, indicating the highest level of the style preferred by individuals. Thus, this is the focus of individuals, and it can override other styles that have a lower intensity level (however, there are individuals who tend to have more than one very dominant style).

Table 2 indicates the first DMS instrument with four levels of DMS intensities, developed by Rowe and Boulgarides in 1992. It is used to determine and interpret an individual's DMS according to the scores obtained. The original DMS instrument consisted of 20 questions, and each question is further classified into 4 responses that stand for typical situations facing managers and match the characteristics or behaviours of the four styles, namely: directive, analytical, conceptual, and behavioral. In actuality, individuals or managers would respond to a total of 80 items in determining their complete decision-making styles. Hence, they are to rank behaviours in each question using a scale of 8, 4, 2, and 1, indicating the responses such as 8 = most like you, 4 = moderately like you, 2 = slightly like you, and 1 = least like you. Later, all marks will be totalled up based on each column indicating all four styles. Finally, all the marks from all four columns are to be benchmarked using the DMSI levels as shown in Table 2.

Table 2

Managerial Decision-Making Styles Intensity (DMSI) Levels (Rowe and Boulgarides, 1992)

	Intensity Levels			
Style	*Least preferred*	*Back-up*	*Dominant*	*Very Dominant*
Directive	Below 68	68 to 82	83 to 90	Over 90
Analytic	Below 83	83 to 97	98 to 104	Over 104
Conceptual	Below 73	73 to 87	88 to 94	Over 94
Behavioural	Below 48	48 to 62	63 to 70	Over 70

3.3 Results

3.3.1 Phase 2: Testing the Instrument

This study population consists of lecturers from public universities in Malaysia. To test the instrument, 1114 lecturers from five public universities participated in this study. The aim was to test lecturers' and participants' views about university decision styles. It also aimed to validate Rowe and Boulgarides Decision Styles inventory by simplifying the inventory statements and converting its original semantic scale to Likert while making the scale user-friendly. To validate the instrument, the Rasch analysis model was applied. The Rasch Model was developed by Georg Rasch in 1980 as a psychometric statistical analysis for categorical data. Rasch analysis helps to assess questionnaire responses and identify respondents' difficulty in responding to items. Under the Rasch model, this study checks the infit of MNSQ and outfit MNWQ for the fitness of the items and respondents. Infit is sensitive to the way or pattern that a person responds to items, while outfit is sensitive to a person's difficulty responding to items (Linacre, 2002). Besides that, Guttman's Item Map was also examined to determine item difficulty and how a person was measured above the line by their raw score on the instrument (Linacre and Wright, 1996).

3.3.2 Phase 3: Survey Administration and Item Reduction

Collecting data with large sample sizes is highly required in quantitative research, and minimising errors improves the reliability of the findings. After receiving low online responses from the participants (university lecturers), this study uses a face-to-face and door-to-door approach to collecting data. The responses tend to be higher and greater when using this approach compared to online. At the initial stage, permission was sought from each university authority to distribute questionnaires to the academic staff on the campuses. The data collection took more than a year to complete, and the researchers faced different challenges from the participants, such as low and slow responses, a lack of interest in completing the survey, business, and their tight schedules. Gracefully, the data were distributed to all lecturers at the universities, and lecturers from different departments (social sciences, sciences, engineering, and medicine) participated in this study. Item reduction and data cleaning were conducted immediately after data collection to ensure the internal consistency of the scale and identify missing items. Eventually, some items were discarded due to the inconsistency of the respondents in endorsing the items, and empty items were left endorsed.

3.3.3 Phase 4: Item Validation & Findings

The item and person reliability indexes on Managerial Decision-Making Styles are the estimation of how well items or persons can discriminate on a measured variable by identifying and comparing each characteristic. Table 3 shows that a total of 1114 respondents were measured with 26 items about managerial decision-making styles. The item separation in this model was 20.47; it was indicated that all items created a variable that was spread out about 20 levels. The item reliability was

1.00, which is acceptable and perfect in measurement (Jackson & Popovich, 2003). The person's reliability in this measurement is about 0.80, indicating that the reliability of this measurement was reliable and acceptable. The person separation index is about 1.95, and this can be classified into almost two levels.

Table 3

Separation Index & Reliability Index of Managerial Decision-Making Styles

PERSON	1114 INPUT	1114 MEASURED			INFIT		OUTFIT	
	TOTAL	COUNT	MEASURE	REALSE	IMNSQ	ZSTD	OMNSQ	ZSTD
MEAN	44.9	26.0	-6.50	.60	1.00	.0	.97	.0
S.D.	7.8	.0	1.80	.56	.77	1.1	.82	1.1
REAL RMSE	.82	TRUE SD	1.60	SEPARATION	1.95	PERSON	RELIABILITY	.79
ITEM	26 INPUT	26 MEASURED			INFIT		OUTFIT	
	TOTAL	COUNT	MEASURE	REALSE	IMNSQ	ZSTD	OMNSQ	ZSTD
MEAN	1922.7	1114.0	.00	.08	.97	-1.4	1.07	-1.4
S.D.	463.8	.0	1.59	.01	.22	4.1	1.09	4.0
REAL RMSE	.08	TRUE SD	1.59	SEPARATION	20.47	ITEM	RELIABILITY	1.00

Table 4 shows the calibration of the twenty-six (26) item estimates of managerial decision-making styles. Item polarity is indicated by Point Measure Correlation (PTMEA CORR) by providing information on the extent to which the test items are defining the measured construct in the same direction. An acceptable range for the PTMEA CORR is 0.3 and above, or as long as the values are positive (Bond & Fox, 2001). It was found that Item D14 (Management solves problems by relying on their feelings) had a PTMEA CORR value of 0.08. The remaining item estimate had values ranging from 0.47 to 0.72. All PTMEA were indicated with positive values, bringing the point of measurement correlation in the same direction as the objective and in line with the rule of thumb of assessment in the Rasch model.

Table 4

Item Polarity of Managerial Decision-Making Styles

ITEM STATISTICS: CORRELATION ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
14	1636	1114	1.39	.07	1.87	9.9	6.37	9.9	.08	.54	51.8	75.4	D14
17	1660	1114	1.26	.07	1.19	5.2	1.18	2.3	.47	.55	67.0	75.3	D17
23	1822	1114	.37	.08	1.15	3.8	1.48	4.7	.48	.56	73.1	77.0	D23
15	1908	1114	-.14	.08	1.09	2.1	1.05	.6	.50	.55	76.3	79.9	D15
8	1955	1114	-.45	.08	1.02	.5	.88	-1.2	.52	.55	80.0	81.8	D8
16	1897	1114	-.07	.08	1.01	.2	.90	-1.1	.54	.55	78.6	79.5	D16
7	1808	1114	.45	.08	1.02	.7	.92	-.9	.55	.56	74.9	76.7	D7
4	1837	1114	.29	.08	.98	-.4	.89	-1.3	.56	.56	76.3	77.5	D4
5	1732	1114	.87	.07	.98	-.4	.93	-.9	.56	.56	75.4	75.5	D5
3	1868	1114	.10	.08	.97	-.8	.85	-1.7	.56	.56	77.1	78.4	D3
2	1865	1114	.12	.08	.93	-1.8	.81	-2.2	.58	.56	78.8	78.3	D2
12	1888	1114	-.02	.08	.89	-2.7	.78	-2.6	.59	.56	81.7	79.1	D12
13	1882	1114	.02	.08	.89	-2.7	.77	-2.7	.59	.56	80.3	78.9	D13
9	1867	1114	.11	.08	.88	-3.0	.77	-2.8	.60	.56	80.6	78.4	D9
6	1875	1114	.06	.08	.88	-3.1	.71	-3.5	.60	.56	81.1	78.7	D6
18	1751	1114	.77	.07	.90	-3.0	.77	-3.1	.60	.56	77.3	75.7	D18
19	1771	1114	.66	.07	.89	-3.1	.77	-3.1	.60	.56	79.0	76.0	D19
24	1842	1114	.26	.08	.86	-3.8	.94	-.7	.62	.56	80.1	77.6	D24
25	1921	1114	-.23	.08	.80	-4.9	.57	-5.5	.63	.55	83.1	80.4	D25
10	1782	1114	.60	.07	.82	-5.2	.67	-4.4	.64	.56	80.2	76.2	D10
11	1850	1114	.21	.08	.79	-5.7	.64	-4.6	.64	.56	83.7	77.8	D11
21	1868	1114	.10	.08	.78	-5.9	.61	-5.0	.65	.56	85.0	78.4	D21
22	1878	1114	.04	.08	.77	-6.2	.58	-5.5	.65	.56	83.9	78.8	D22
20	1788	1114	.57	.07	.78	-6.5	.64	-4.9	.65	.56	81.7	76.3	D20
1	1828	1114	.34	.08	.77	-6.4	.59	-5.3	.66	.56	81.7	77.2	D1
26	4212	1114	-7.69	.04	1.29	6.3	1.64	9.9	.72	.76	45.9	53.0	D26
MEAN	1922.7	1114.0	.00	.08	.97	-1.4	1.07	-1.4			76.7	76.8	
S.D.	463.8	.0	1.59	.01	.22	4.1	1.09	4.0			8.9	5.0	

3.3.4 Unidimensionality of the Measured Construct of Managerial Decision-Making Styles

The Rasch model is a unidimensional measurement model that uses principal component analysis (PCA) of standard residuals to detect second factors in Rasch analysis. The following guidelines suggested by Conrad et al. (2010) and Linacre (2006) are adopted in examining the unidimensionality of the constructs in this study:

- variance explained by the measure: ≥ 40% is considered a strong measurement dimension (Linacre, 2006), ≥ 30% is considered a moderate measurement dimension, and ≥ 20% is considered a minimal dimension.
- unexplained variance in 1st contrast: ≤ 10% (Linacre, 2006).

Table 5 (Standardised Residual Variance) of managerial decision-making styles shows that the variance explained by measures was 69.1%. It indicates a strong measurement dimension because the variance explained by the measure for the teachers in this study is more than 69%. The variance unexplained by the first construct in the residuals is less than 10% (about 2.4%). The scores for the variance explained by measures and the unexplained variance in first contrast are in line with the recommendation by Conrad et al. (2010).

Table 5

Principle Component Analysis

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

		-- Empirical --			Modeled
Total raw variance in observations	=	69.1	100.0%		100.0%
Raw variance explained by measures	=	43.1	62.4%		62.6%
Raw variance explained by persons	=	8.5	12.3%		12.4%
Raw Variance explained by items	=	34.6	50.1%		50.3%
Raw unexplained variance (total)	=	26.0	37.6%	100.0%	37.4%
Unexplned variance in 1st contrast	=	2.4	3.4%	9.1%	

3.3.5 Item Fit based of Managerial Decision-Making Styles

Bond and Fox (2001) suggest that fit statistics can determine how well an instrument meets the requirements of the Rasch model. These fit statistics are reported as infit mean square (infit MNSQ) and outfit mean square (outfit MNSQ) (Wright & Stone, 1999; Bond & Fox, 2001). According to Bond and Fox (2001) and Linacre (2005), the acceptable range for infit MNSQ and outfit MNSQ fit statistics on the rating scale is between 0.50 and 1.50.

Table 6

Item Fit of Managerial Decision-Making Styles

ITEM STATISTICS: MISFIT ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
14	1636	1114	1.39	.07	1.87	9.9	6.37	9.9	A .08	.54	51.8	75.4	D14
26	4212	1114	-7.69	.04	1.29	6.3	1.64	9.9	B .72	.76	45.9	53.0	D26
23	1822	1114	.37	.08	1.15	3.8	1.48	4.7	C .48	.56	73.1	77.0	D23
17	1660	1114	1.26	.07	1.19	5.2	1.18	2.3	D .47	.55	67.0	75.3	D17
15	1908	1114	-.14	.08	1.09	2.1	1.05	.6	E .50	.55	76.3	79.9	D15
7	1808	1114	.45	.08	1.02	.7	.92	-.9	F .55	.56	74.9	76.7	D7
8	1955	1114	-.45	.08	1.02	.5	.88	-1.2	G .52	.55	80.0	81.8	D8
16	1897	1114	-.07	.08	1.01	.2	.90	-1.1	H .54	.55	78.6	79.5	D16
5	1732	1114	.87	.07	.98	-.4	.93	-.9	I .56	.56	75.4	75.5	D5
4	1837	1114	.29	.08	.98	-.4	.89	-1.3	J .56	.56	76.3	77.5	D4
3	1868	1114	.10	.08	.97	-.8	.85	-1.7	K .56	.56	77.1	78.4	D3
24	1842	1114	.26	.08	.86	-3.8	.94	-.7	L .62	.56	80.1	77.6	D24
2	1865	1114	.12	.08	.93	-1.8	.81	-2.2	M .58	.56	78.8	78.3	D2
18	1751	1114	.77	.07	.90	-3.0	.77	-3.1	m .60	.56	77.3	75.7	D18
13	1882	1114	.02	.08	.89	-2.7	.77	-2.7	l .59	.56	80.3	78.9	D13
19	1771	1114	.66	.07	.89	-3.1	.77	-3.1	k .60	.56	79.0	76.0	D19
12	1888	1114	-.02	.08	.89	-2.7	.78	-2.6	j .59	.56	81.7	79.1	D12
9	1867	1114	.11	.08	.88	-3.0	.77	-2.8	i .60	.56	80.6	78.4	D9
6	1875	1114	.06	.08	.88	-3.1	.71	-3.5	h .60	.56	81.1	78.7	D6
10	1782	1114	.60	.07	.82	-5.2	.67	-4.4	g .64	.56	80.2	76.2	D10
25	1921	1114	-.23	.08	.80	-4.9	.57	-5.5	f .63	.55	83.1	80.4	D25
11	1850	1114	.21	.08	.79	-5.7	.64	-4.6	e .64	.56	83.7	77.8	D11
20	1788	1114	.57	.07	.78	-6.5	.64	-4.9	d .65	.56	81.7	76.3	D20
21	1868	1114	.10	.08	.78	-5.9	.61	-5.0	c .65	.56	85.0	78.4	D21
1	1828	1114	.34	.08	.77	-6.4	.59	-5.3	b .66	.56	81.7	77.2	D1
22	1878	1114	.04	.08	.77	-6.2	.58	-5.5	a .65	.56	83.9	78.8	D22
MEAN	1922.7	1114.0	.00	.08	.97	-1.4	1.07	-1.4			76.7	76.8	
S.D.	463.8	.0	1.59	.01	.22	4.1	1.09	4.0			8.9	5.0	

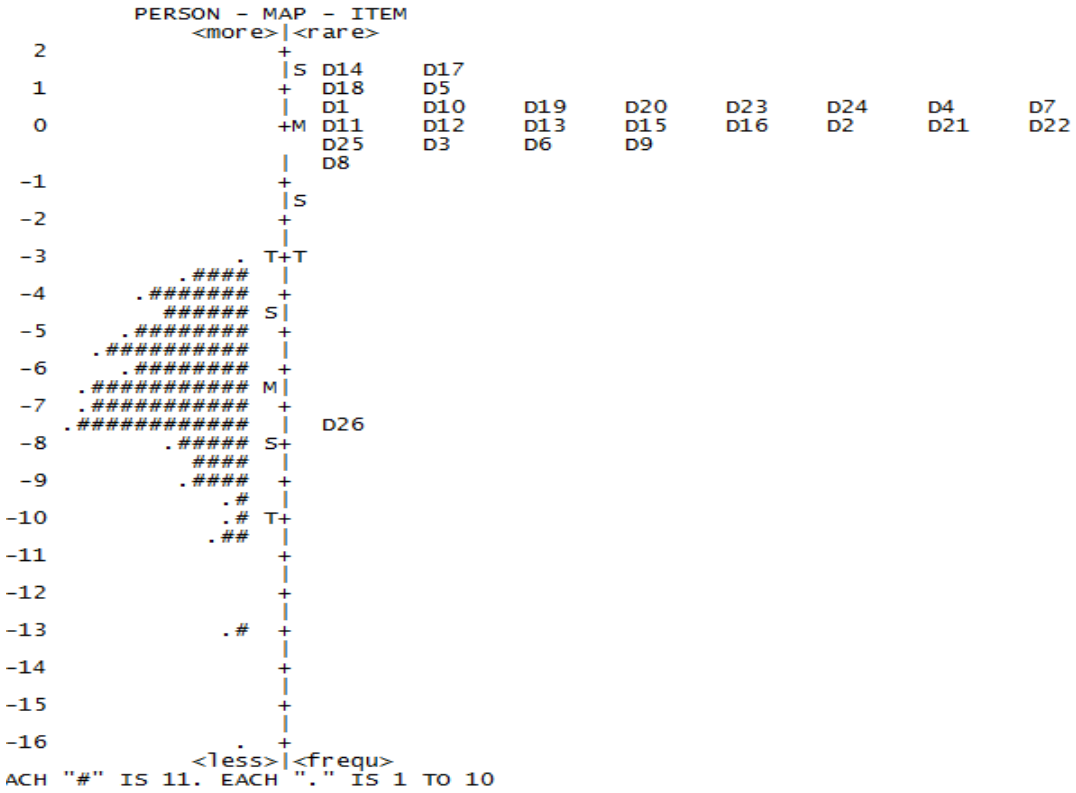
Item fit statistics in this measurement are determined by the infit and outfit mean square (MNSQ). According to Wright and Stone (1999), MNSQ uses fit statistics to assess response pattern consistency, ensure that the items are fit, and contribute meaningfully to the measured construct in validating the responses or data (Bond & Fox, 2001). Table 6 indicated all items in this measurement yielded infit MNSQ values that range from 0.77 to 1.87 and outfit MNSQ values of 0.57 to 6.37, respectively. There is one Item D14 (Management solves problems by relying on their feelings) that had mean square (MNSQ) values outside of this range: an infit MNSQ value of 1.87 and an outfit MNSQ value of 6.37.

3.3.6 Item Map of Managerial Decision-Making Styles

Information on managerial decision-making styles is indicated by the item map, which presents the numbers of respondents and the measure of difficult items in the hierarchy of a common logit scale. Figure 1 (Item Map) shows that two items (Items D14 and D17) were considered the most difficult items to endorse. Item D14 (Management solves problems by relying on their feelings), with difficulty measure (1.39), and Item D17 (Management waits for the academic staff before deciding), with difficulty measure (1.26). Moreover, the item measure and person measure on the scale are unwell-targeted (.00 and -6.50, respectively). The easiest item endorsed by respondents was Item D8 (Management looks for practical results from me) with a measure of -0.45.

Figure 1

Item Map of Managerial Decision-Making Styles



3.3.7 The New Likert Scale of Managerial Decision-Making Styles Inventory (DMSI) by Rowe and Mason

In view of the current and contemporary situation and time, more and more research are being conducted to measure the managerial decision-making styles of organisations rather than individuals. In view of this, there is an urgent need to make amendments or changes to the original DMSI instrument, as stated above. Instead of the typical semantic scale instrument of DMSI, all 80 items were converted into the Likert scale instrument with 6-point ratings based on individuals' preferences. Table 7 displays the new Rowe and Mason faced-lift instrument. All 80 items were transformed into 20 individual statements measuring individuals' cognitive processes and types of personalities, which are grounded in self-concept and values.

Table 7

New Face-lift Rowe's Managerial Decision-Making Styles Inventory (DMSI)

No	Statement	CD	MD	SD	SA	MA	CA
1	Management decision-making style helps me to be the best in my field.						
2	Management decision-making style helps me to achieve recognition in my work.						
3	Management decision-making style assists me in having variety of teaching methods.						
4	Management decision-making style encourages me to have independent action.						
5	Management involves me in their decision making.						
6	Management decision style helps me to be productive and do the job in time.						
7	Management expects suggestion from me regarding academic issues.						
8	Management looks for practical results from me.						
9	Management asks for best solution from the academic staff.						
10	Management uses new approaches in decision making.						
11	Management makes decisions that provides a good working environment for me.						
12	Management decision planning emphasizes on my future goals.						
13	Management decision planning emphasizes on developing my careers.						
14	Management solves problems by relying on their feelings.						
15	Management uses specific facts for seeking information.						
16	Management searches for facts to make decision.						
17	Management waits for the academic staff before making a decision.						
18	Management is good in solving difficult problems in the university.						
19	Management is good in seeing many responsibilities.						
20	Management is good in interacting with the academic staff.						
21	Management is confident to handle the tasks.						
22	Management is open-minded and polite towards me.						
23	Management is aggressive in dealing with academic workers.						
24	Management is disciplined in dealing with the workers						
25	Management is supportive to me.						
26	Management decisions are flexible.						

Note: CN=Completely Disagree, MD=Mostly Disagree, SD=Slightly Disagree, SA=Slightly, Agree, MA=Mostly Agree, CA=Completely Agree

4. Conclusion

Firstly, this paper presents the aim of this research, which was to validate Rowe's managerial decision-making styles for university management styles in Malaysian public universities. This validation is due to the huge influence that a manager's or leader's managerial decision-making styles have on the development of any organisation, which includes educational institutions. Secondly, this study provides literature and findings from other studies that have used Rowe's Managerial Decision-Making Styles Inventory. Thirdly, it also presents the methodological underpinnings of each step. Explaining each step is required in scale development or validation for readers and the users of the scale to understand the rigorous process that the paper went through in the validation process.

On top of the above, Rowe's Managerial Decision-Making Styles Inventory seems to be the only available scale to measure organisation and management decision styles. However, the statements or questions in the scale are 'double barrel' questions, tested four questions at a time using semantic scales. In addition to this, some statements were reworded for further clarity, while others were deleted for their ambiguity. Eventually, this research could also provide a mini and simple version of Rowe's Managerial Decision-Making Styles Inventory to identify university management styles. On the same note, the scale can also be used in non-educational sectors to determine organisational or managerial decision-making styles. Besides identifying the managerial decision-making styles of a manager or leader, the scale also helps to identify the brain hemisphere (right or left dominant) or cognitive process of a manager or leader in organisations. Interestingly, above everything, the scale assists in identifying the dominant brain hemisphere (right and left) of the university of organisational managers and leaders. In today's organisation and university, it is crucial to examine the source of decision-making, whether it solely depends on the person's intuition or is participative in nature.

In conclusion, the Rasch management model is highly recommended to be used in this study because it is an effective statistical tool for item development and scale validation. The item and person reliability obtained in this study indicate that this scale can be used in any organisation to explore workers' perceptions towards their management decisions and managerial decision-making styles. Management decision-making plays an important role in organisational performance, growth, and development. Hence, this study relies on the classical test theory approach for validating the instrument by ensuring less error in the measurement and in each person's score. The Rasch measurement model is highly suitable for this mission because it ensures less item error and person difficulty.

5. Implications and Future Research

This research provides few implications regarding management and decision-making. This research revalidates Rowe's managerial decision-making styles as instruments for effective managerial decision-making. The validation and contribution happened to the instrument and scale by shortening the items while making them friendly, flexible, and converting the original scale into Likert's 5 scales. It also contributes to the theoretical underpinning and conceptual understanding of different types of Rowe's decision styles and the antecedents, meanings, and consequences of each style on the decision outcomes. It contributes by revealing the behavioural and cognitive aspects of each hemisphere and the implications behind a manager's dominant style or hemisphere.

In practical terms, the present research contributes by rejuvenating Rowe's decision-making instrument to be used to reveal a manager's decision-making style. Besides, the instrument enables the examination of university staff perceptions about the university managers' decision-making style instantly and periodically for further or better improvement. Future studies are highly needed for further improvement of the scale and its workability, as well as the transferability of its validity and reliability to other contexts and countries in the world.

6. Co-author Contributions

Conceptualization and original draft preparation, Dr Amzat, literature review, Dr. Amzat, Dr Jamian and Dr. Yusuf, methodology, Dr. Amzat and Dr. Jamian, data collection and analysis, Dr. Amzat, Dr. Taslikhan and Dr Jamian, proofreading, Dr. Jamian and all authors have read and agreed to the published version of the manuscript.

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