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Rasch Analysis and Differential Item Functioning of the Time Management Questionnaire among University Students

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Abstract

Time management, crucial for success in personal, professional, and social life, is frequently assessed using scales, with the Time Management Questionnaire (TMQ) being a widely used tool. This study examines the psychometric properties of the TMQ using Item Response Theory. Specifically, the Rasch model is applied to estimate item and examinee parameters, while confirmatory factor analysis is used to confirm the scale's factorial structure. The study also investigates differential item functioning (DIF) for scale items with respect to respondent gender. A sample of 1026 university students was analyzed. The new proposed three-factor model was found to outperform the original model and a one-factor model. Rasch analysis confirms the items' fit to the model. Additionally, significant DIF was identified across gender for six items, offering insights into refining the TMQ's measurement accuracy. These findings enhance our understanding of time management as a construct and reinforce the TMQ's reliability. Recommendations include further refinement of the TMQ and considerations of its moderating effects. The results highlight the importance of ongoing evaluation to ensure the TMQ's validity and effectiveness in accurately assessing time management behaviors.

Keywords: *Time Management, Differential Item Functioning, Rasch Model, Psychometric Properties, Item Response Theory, Confirmatory Factor Analysis, Gender Differences.*

Introduction

Time management is the process of organizing and planning how to divide time between different activities and tasks. The aim of time management is to maximize efficiency, enabling individuals to achieve more in less time and to produce better outcomes. Time management is considered an important life skill as modern times require the effective balance of different aspects of an individual's personal, professional and social life. Since effective time management is regarded as essential for success, it becomes pertinent to have accurate and reliable measures for assessing time management in individuals.

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Over the years, a number of time management scales have been developed to assess an individual's time management behavior, skills and attitudes. These scales aim to quantify different facets of time management and offer insights into an individual's ability to efficiently manage their time. Notable examples of time management scales include the Time Management Behavior Scale (TMBS), which assesses behaviors such as planning, goal setting, prioritizing tasks, avoiding distractions, and meeting deadlines, measuring the frequency of engaging in these behaviors (Adams & Jex, 1997; Adams & Jex, 1999; Davis, 2000; Eerde, 2003; Francis-Smythe & Robertson, 1999; Jex & Elacqua, 1999; Kelly, 2002; Lay & Schouwenburg, 1994; Macan, 1994; Macan, 1996; Macan, Shahani, Dipboye & Phillips, 1990; Mudrack, 1997; Shahani, Weiner, Streit, 1993; Williams, Verble, Price, & Layne, 1995). Slightly different is the Time Management Disposition Scale (TMDS), which assesses an individual's disposition towards time management, measuring attitudes, preferences, and values such as punctuality, organization, and time importance (Chen, Chen, Chen, & Zhao, 2014; DeDonno, & Demaree, 2008; Hue, Yang & Zhang, 2010; Xie, Wu, Li, Li, Xiao, Wang et al., 2022; Zhang, 2011). Other examples include the Multidimensional Time Management Scale (MTMS) which offers a comprehensive assessment of various time management dimensions, including time attitudes, planning and organizing, goal setting, prioritizing, self-monitoring, and handling distractions (Claessens, Van Eerde, Rutte, & Roe, 2007). Finally, the Time Management for Academic Tasks Scale (TMATS) was specifically designed to measure time management behaviors and skills in the context of academic tasks such as study scheduling, goal setting, time allocation for different tasks, and avoiding procrastination (Janeslatt, Holmqvist, White, & Holmefur, 2018).

Among the most prominent time management scales is the Time Management Questionnaire (TMQ). As a leading instrument in time management assessment, the TMQ measures different subscales of time management, including time attitudes, time planning, time wasting, and time control. It assesses behaviors, beliefs, and perceptions related to time management (Barling, kelloway, & Cheung, 1996; Britton, & Tesser, 1991; Williams, Verble, Price, & Layne, 1995). Over the past three decades, the TMQ has gained in popularity, becoming one of the most widely used time management scales. Elegant and effective, it is recognized as a valuable tool for assessing the motivational tendencies of individuals and the impact these tendencies may have on various aspects of behavior and performance. Understanding an individual's motivational profile can provide important insights for personal development, educational interventions, and organizational management (García-Ros, Pérez-González, & Hinojosa, 2004). It therefore becomes essential to ensure the accuracy, reliability, and validity of the TMQ as a measurement tool.

Given the importance of accurate measurement, particularly in light of the TMQ's widespread use, the present study aims to examine the psychometric properties of the TMQ, with a specific focus on investigating the presence of Differential Item Functioning (DIF) across gender. DIF refers to the concept where individuals from different groups (e.g., age, gender, ethnicity) may respond differently to items on a scale, even if they possess the same underlying level of the latent trait (Cohen & Bolt, 2005; Gamerman, Goncalves, & Soares, 2017; Hendriks, Fyfe, Styles, Skinner, & Merriman, 2012; Holland & Wainer, 2006; Penfield & Camilli, 2006; Walker, 2011). In the present study, by exploring DIF, we can gain a deeper understanding of whether particular items of the TMQ exhibit differential functioning for males and females, which may have important implications for the interpretation of the scale.

Previous research has highlighted the importance of considering multidimensionality within the TMQ as motivational tendencies can encompass different dimensions or subscales (Williams,

Verble, Price, & Layne, 1995; Barling, Kelloway, & Cheung, 1996; Britton & Tesser, 1991). Additionally, prior studies have indicated that the TMQ may have varying levels of effectiveness for individuals with different levels of TMQ (Taylor & Wright, 2003). These factors underscore the need for further investigation into the psychometric properties of the TMQ and its applicability in diverse populations.

The TMQ has been used in various research and applied settings. With increased application and recognition, the scale has been adapted for use in a number of different contexts and for different populations. For example, it has been adapted to the African culture (Mpofu, D'Amico, & Cleghorn, 1996) and to a British context (Trueman & Hartley, 1995). In educational settings, it has been adapted for use on different student or teacher populations including Spanish secondary school students (García-Ros, Pérez-González, & Hinojosa, 2004), seventh-graders from five states across the USA (Liu, Rijmen, MacCann, & Roberts, 2009) and potential Turkish teachers to test the scale's validity and reliability (Alay & Kocak, 2002).

Traditional psychometric approaches, such as classical test theory, have previously been employed to examine the psychometric properties of the TMQ (García-Ros, & Pérez-González, 2012). However, these approaches have limitations, including assumptions of equal interval measurement and item characteristic depend on persons (Millsap, 2012). To overcome these limitations, the present research aims to employ the Rasch model, a powerful tool in modern psychometrics to evaluate the psychometric properties of the TMQ. The Rasch model provides a robust framework for analyzing the structure of measurement scales, ensuring accurate measurement and meaningful interpretation of the results. The Rasch Rating Scale Model has found widespread application in various fields, including education, psychology, health sciences, and social sciences. The model has been applied in research studies, clinical assessments, and educational measurement to develop and validate scales, evaluate measurement properties, and compare individuals or groups on the measured construct (Andrich 2011).

Rasch Model

The Rasch Rating Scale Model is a psychometric measurement model that is used to analyze and interpret responses to rating scale items, such as Likert scales or other rating formats with multiple response options; this model focusses on assessing the difficulty (threshold) of the rating (Likert) scale items and the ability of individuals to respond to those items. One of the key features of the Rasch Rating Scale Model is the ability to evaluate the fit of each item to the underlying construct being measured. Fit statistics, such as item fit residuals and chi-square tests, are used to assess the extent to which the observed responses conform to the expected response patterns predicted by the model. Overall, the Rasch Rating Scale Model provides a powerful framework for analyzing responses to rating scale items, enabling researchers to obtain reliable and valid measurement results, and contributing to the development of robust measurement instruments in various domains, including time management research. The Rasch Rating Scale Model is implemented in various software packages, such as RUMM, WINSTEPS, and jMetrik, which provide the necessary tools for parameter estimation, fit assessment, and measurement analysis (Andrich, 2011; Andrich, 1988; Fischer, Molenar, 2012; Royal, Ellis, Ensslen, & Homan, 2010; Wright, 1977; Wu & Adams, 2007). The Rasch model, known for its robustness and objective evaluation of latent traits, was selected as the analytical approach to assess the TMQ properties (Hendriks, Fyfe, Styles, Skinner, & Merriman, 2012).

Gender Differences in Time Management

A number of studies have addressed the issue of gender differences in time management skills. The bulk of this research shows that there are no significant differences between males and females in their ability to manage their time (Abu-sultane, Al-qussairy, 2017; Aluinin, 2018; Hana, 1998; Mukhtar, 2014; Shraideh, 2005). There are some studies, however, that found that females have better time management skills than males (Bidjerano, 2005; Ghazvini & Khajehpour, 2011; Kaya, Kaya, Pallos, & Kucuk, 2012; Misra & McKean, 2000), while a few other studies have shown the opposite, that males are more effective at managing their time (Murugan, 2007; Shakur, 2022). There appears to be some inconsistency in results reporting gender differences in time management.

Based on the issues highlighted in the existing literature, our research aims to investigate the following: (1) the presence of DIF across gender within the TMQ, (2) the multidimensional nature of the TMQ, and (3) the effectiveness of the TMQ in assessing individuals with varying levels of TMQ. Addressing these issues can enhance our understanding of the TMQ's measurement properties and provide valuable insights for its practical application in different contexts. In the following sections, we describe the methodology employed in this study, present the results of the DIF analysis and multidimensionality assessment, and discuss the implications of these findings. Finally, we provide recommendations for the appropriate utilization of the TMQ and avenues for future research to further enhance our understanding of motivational assessment.

The findings of this research will provide valuable insights into the psychometric properties of the TMQ and its applicability in assessing time management skills accurately by utilizing the Rasch model. Ultimately, the results of this study may have practical implications for researchers and practitioners as well individuals seeking to improve their time management skills. By establishing a reliable and valid measure of time management, interventions and training programs can be developed to enhance time management skills effectively, thereby promoting productivity and overall well-being. In summary, this research seeks to employ the Rasch model to evaluate the psychometric properties of the time management scale developed by Britton & Tesser (1991). By conducting a comprehensive analysis, including examining unidimensionality, item and person fit, item difficulty, and person ability, this study aims to contribute to a better understanding of time management as a construct and provide a robust assessment tool for future research and practical applications.

Methods

Participants

Responses from participants were collected via online survey featuring the TMQ. A link to the survey was sent through email and social media to university students at the Sultanate of Oman. The link provided participants with information about the purpose of the study. Participants were informed that their participation was entirely voluntary and that they could withdraw at any point from the study without consequence. A total of 1026 responses were received (46% male, 54% female).

Ethical Considerations

This study was reviewed and approved by the Research Ethics Committee of the College of Education at Sultan Qaboos University [approval number: REAAF/EDU/PSYC/2024/13]. All

aspects of the study were conducted in accordance with institutional guidelines and the Declaration of Helsinki. Participants were informed that consent to participate in the study and publish their data would be assumed on completion and submission of the online survey.

Measure

TMQ (Britton & Tesser, 1991) consists of 18 items, each rated on a 5-point scale ranging from always to never. Five points were assigned to the response indicating the best practice and 1 point to the least desirable response. Intermediate values were given for the other responses. The resulting scale reflects higher scores for better time-management practices. This rigorous methodology ensures accurate and reliable results. The total score on the time-management questionnaire ranges from 18 to 90. The TMQ is a three-factor scale that measures both behaviors and attitudes towards time management. The three factors are short-range planning, long-range planning, and time attitudes. Short-range planning includes tasks such as creating daily to-do lists, while long-range planning involves setting goals for an entire quarter. Time attitudes refer to an individual's perception of control over their own time.

Data Analysis

The present research aimed to develop the TMQ using the Rasch rating scale model, which were analyzed with the WINSTEPS software allowing for the calibration of polytomous items. Prior to estimating item and person parameters, certain prerequisites needed to be verified, such as the unidimensionality of the subscales and local independence of items. Principal component analysis on the standardized residuals (PCAR) was utilized to investigate unidimensionality, while confirmatory factor analysis (CFA) was conducted to examine the fitting of one-factor and three-factor structures. To ensure local independence of items, standardized residual correlations were checked. In addition, infit and outfit mean-squares were used to assess an item's fit to the Rasch model. Reliability coefficients and separation indices were estimated for both items and persons, with separation indices indicating the ability of items to discriminate between different levels of performance and persons' ability to distinguish differences in item calibration. Adequate values for separation indices and reliability coefficients were considered to be above 2 and 0.70, respectively. DIF analysis was conducted based on Gender using the Rasch-Welch test statistics and MH chi-squares generated by WINSTEPS, with significant DIF Welch and MH values rejecting the null hypothesis. Descriptive statistics were computed using the Statistical Package for the Social Sciences (SPSS, version 26).

Results

Descriptive Statistics

Table 1 displays the descriptive statistics, revealing a clear normal distribution of the scores. As shown in Table 1, Short-Range Planning and Long-Range Planning exhibit higher levels than Time Attitudes. Skewness values fall within the range of -0.33 to 0.23, while kurtosis values range between -0.25 and 0.40. Collectively, these findings strongly suggest that the participants' scores follow a normal distribution. The TQM has been shown to have positive correlations between Short and Long-Range Planning subscales, and negative correlation with time attitude, with alpha coefficients indicating reliable results, ranging from 0.58 to 0.80.

Factor	M	SD	Skewedness	Kurtosis	Short-Range Planning	Time Attitudes	Long-Range Planning	Total
Short-Range Planning	3.55	.76	-.33	-.19	0.80	-0.17	0.57	0.86
Time Attitudes	2.36	.68	.23	.40		0.27(0.58)	-0.29	0.14
Long-Range Planning	3.40	.75	.03	-.25			0.46(0.72)	0.77
Total	3.17	.47	-.47	.21				0.72

Table 1. Mean, Standard Deviation, Skewedness, Kurtosis, And Correlation Among Factors

Rasch Analysis

Unidimensionality

To ensure the accuracy estimates of person and item parameters using the Rasch model analysis, two techniques were utilized to verify the assumption of unidimensionality. Firstly, Principal component analysis of the standardized residuals (PCAR) was employed through the WINSTEPS software to assess the dimensionality of the scale. Secondly, a confirmatory factor analysis was conducted to compare the one-factor, three-original factor. Standardized residual correlations were also examined to verify the local independence assumption, which is crucial for the Rasch model. The WINSTEPS analysis provided residual item correlations for each item pair.

With regard to the PCAR, the findings presented in Table 2 demonstrate that a significant amount of variance (32.5%) was explained, indicating the dimensionality of the scale. Furthermore, the eigenvalues of the first and second factors were notably high, providing additional support for this conclusion. Upon further analysis of each sub-scale, it was discovered that in the original model the total variance explained ranged from 38.8% to 42.9%, and the eigenvalue of the first factor was less than or equal to 2. The initial Rasch model analysis revealed that the scale was not unidimensional due to the unexplained variance in the first, second, and third contrasts. This unexplained variance is a component of the PCAR and was only utilized in this study to assess the unidimensionality of the scale.

	Factor	Raw variance explained by measures (%)	Unexplained variance			Separate index		Reliability	
			Total	1st contract	2st contract	Persons	items	Persons	items
One Factor	**Total**	8.7(32.5)	18(67.5)	3.4(12.8)	1.8(6.6)	1.65	15.89	0.73	1.00
Original Model	**Short-Range Planning**	5.3(42.9)	7(57.1)	1.5(12.2)	1.4(11)	1.94	5.10	0.79	0.96
	Time Attitudes	4(40.3)	6(59.7)	2(20.6)	1.1(10.8)	0.87	18.68	0.43	1.00
	Long-Range Planning	3.2(38.8)	5(61.2)	1.6(19)	1.2(15.1)	1.15	13.06	0.57	0.99
	Time Attitudes	3.3(40)	5(60)	1.4(16.9)	1.2(14.3)	0.98	16.6	0.49	1.00
	Long-Range Planning	5(45.4)	6(54.6)	1.5(13.6)	1.3(11.6)	1.90	5.22	0.78	0.96
New Model	**Short-Range Planning**	5.3(42.9)	7(57.1)	1.5(12.2)	1.4(11)	1.94	5.1	0.79	0.96
	Time Attitudes	3.3(45.2)	4(54.8)	1.5(20.2)	1.2(20.2)	0.93	18.79	0.46	1
	Long-Range Planning	5(45.4)	6(54.6)	1.5(13.6)	1.3(11.6)	1.90	5.22	0.78	0.96

Table 2. Results Of Principal Component Analysis of the Standard Residuals, Separation and Reliability of Persons and Items

AMOS software version 22 was utilized to conduct a CFA in order to compare the theoretical structures of three models as illustrated in Fig. 1. Model 1 assumes that the items measure a single latent trait (TMQ). Model 2 was the original three-factor structure model (Britton & Tesser, 1991), whereas model 3 is the new model Suggests the following changes: a) item 9 was deleted because the standardized regression is 0.227 (less than3), b) item 14 was transferred

from factor 3 (Long-Range Planning) to factor 2 (Time Attitudes), and c) item 11 and item 13 were transferred from factor 2 to factor 3.

The results presented in Table 3 clearly demonstrate that the new three-factor model is a better fit for the data, as evidenced by the goodness-of-fit indices which fall well within acceptable limits (with CFI and TLI values being close to 1, and RMSEA being less than 0.05). In comparison, the one-factor, and original-factor models statistics indicate a less satisfactory fit.

Figure 1

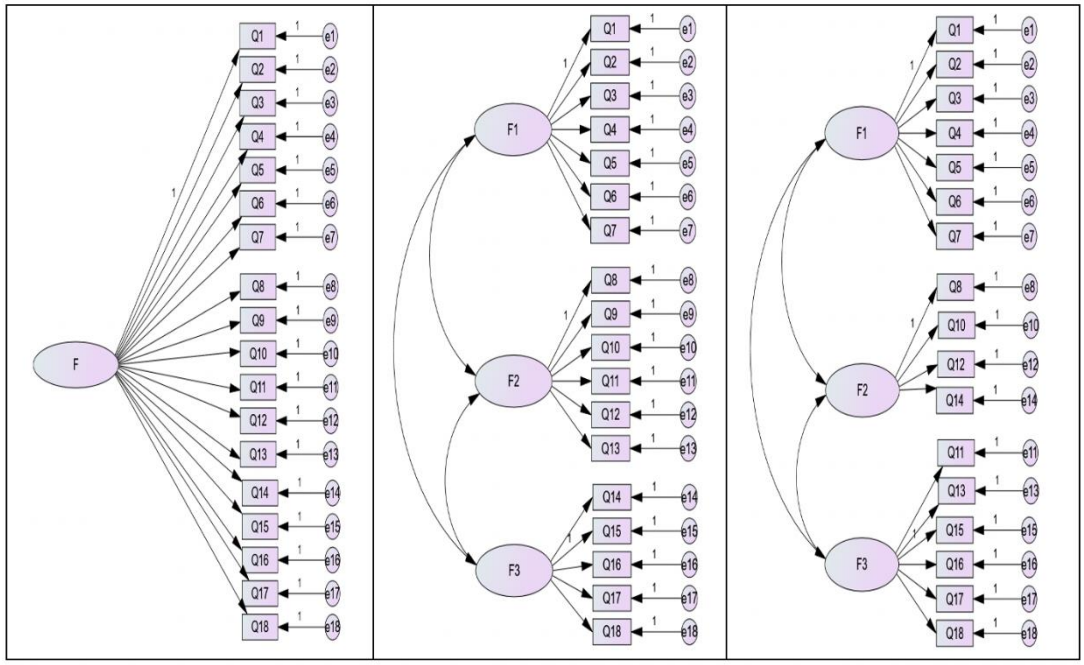

Fig. 1. One, three original and new three factors models of the TQM. F2 refers to Short-Range Planning, F2 to Time Attitudes and F3 to Long-Range Planning.

Model	**CMIN/DF(P)**	**CFI**	**TLI**	**RMSEA**	**AIC**	**BIC**
One factor	7.27(0.00)	0.775	0.744	0.079	1053.93	1267.11
Original	5.37 (0.00)	0.846	0.822	0.066	787.41	979.36
New-9	3.4(0.00)	0925	0.911	0.049	466.81	653.83

Table 3. Model Fit Indices for One and Three Factor Models

Furthermore, Table 4 illustrates that the items standardized regression weight (SRW) ranged from 0.466 to 0.704, and this is not consistent with the original model, which showed that the SRW ranged from -0.65 to 0.70, and contains 6 items that had SRW less than 3 (Adams & Jex, 1997).

Items	**One factor-Model**	**ORGINAL- Model**	**NEW-Model**
1	0.56	0.58	0.552

2	0.53	0.56	0.532
3	0.62	0.67	0.665
4	0.66	0.69	0.698
5	0.53	0.53	0.537
6	0.68	0.70	0.704
7	0.46	0.46	0.466
8	-0.13	0.17	0.473
9	-0.17	0.19	
10	-0.21	0.25	0.494
11	0.53	-0.59	0.559
12	-0.25	0.30	0.541
13	0.58	-0.65	0.611
14	-0.10	-0.21	0.519
15	0.50	0.61	0.58
16	0.43	0.55	0.506
17	0.42	0.55	0.499
18	0.50	0.58	0.556

Table 4. Items Standardized Regression Weights

Local Independent

Through WINSTEPS, Q3 statistic was examined to determine the local independence between items. Certain pairs of items were discovered that correlated (Q_3>0.3) in assumption models: model 1 (one factor), and model 2 (original model), but after analyzing the data for model 3 (new proposed model), local independence was maintained for all four subscales. The largest standardized residual correlations did not exceed the limit indicated in relevant studies, suggesting that the scale is multi-dimensional. As a result, we recommend that future users of the scale utilize separate scores for each of the TMQ subscales instead of relying on the total score. This approach will provide a more accurate and nuanced understanding of the construct being measured.

Model	**Factor**	**MIN**	**MAX**
1		-0.3	0.36
2	1	-0.31	0.06
	2	-0.38	0.35
	3	-0.4	-0.1
3	1	-0.31	0.06
	2	-0.44	-0.24
	3	-0.33	0.02

Table 5. Largest Standardized Residual Correlation (Q3)

Item Fit to the Rasch Model

The results presented in Table 4 exhibit the infit and outfit statistics of the items. The infit values ranged from (0.88:1.2, 0.81:1.15, and 0.89:1.29) for Short-Range Planning, Time Attitudes, and Long-Range Planning, while the outfit values ranged from (0.89:1.24, 0.83:1.25, and 0.90:1.29). These values are within the acceptable limits of Rasch analysis (0.4, 1.6), as indicated by

previous research (Linacre, 2016). Furthermore, the point bi-serial correlation (PTME) values between items in each subscale and the entire scale were greater than 0.4, indicating the strong discriminant ability of these items. These findings highlight the reliability and validity of the tool and its ability to accurately measure time management ability.

Person and Item Reliability Using the Rasch Model

To ensure reliability for model 3, the person separation index was used, with a value of 0.93 for Time Attitudes and 1.94 for Long-Range Planning. Additionally, the item separation index was found to be 5.1 for Short-Range Planning and 18.79 for Time Attitudes (see Table 2). These results suggest that the items and individuals were effectively discriminated, and the estimation of parameters was highly consistent. Furthermore, the items in all three subscales demonstrated exceptional reliability, exceeding a score of 0.96. Overall, these findings underscore the subscales' capacity to effectively distinguish various levels of the latent trait.

Person and Item Calibration

For the Short-Range Planning subscale, items difficulty parameters ranged from -0.19 for item 1 (Do you make a list of the things you have to do each day?), and item 7 (Do you set and honor priorities?) to 0.32 for item 6 (Do you spend time each day planning?) as shown in Table 6. For the time attitudes subscale, difficulty parameter ranged from -0.99 for item 14 (The night before a major assignment is due, are you usually still working on it?) to 0.83 for item 10 (Do you often find yourself doing things which interfere with your schoolwork simply because you hate to say "No" to people?). Finally for Long-Range Planning subscale, items difficulty ranged from -0.23 for item 11 (Do you feel you are in charge of your own time, by and large?) to 0.31 for item 18 (Do you regularly review your class notes, even when a test is not imminent?). It appears that none of the items exceeded the difficulty coefficient of the well-known range (-3, +3). This is substantiated by the individual item mapping of the three subcategories, which reveals that item clusters exist at the halfway point of the personality spectrum (see Fig. 2). Consequently, the TMQ has the ability to furnish more exact and dependable data for individuals possessing moderate levels of TMQ in comparison to those with either low or high levels. This substantiates the belief that the TMQ is an effective tool for assessing individuals with a moderate degree of TMQ.

Factor	**items**	**Item difficulty**	**SE**	**Infit**		**Outfit**		**PTME**
				MSQ	ZSTD	MSQ	ZSTD	
1	Q1	-0.19	0.04	0.94	-1.2	0.96	-0.8	0.60
	Q2	-0.09	0.04	0.97	-0.6	1	0	0.61
	Q3	-0.06	0.04	0.88	-2.7	0.89	-2.4	0.68
	Q4	0.28	0.04	0.9	-2.3	0.91	-2	0.69
	Q5	-0.08	0.04	1.2	4.2	1.2	4.1	0.59
	Q6	0.32	0.04	0.9	-2.3	0.89	-2.6	0.69
	Q7	-0.19	0.04	1.16	3.4	1.24	4.9	0.55
2	Q8	0.12	0.03	0.81	-4.9	0.83	-4.3	0.62
	Q10	0.83	0.04	1.14	2.9	1.10	1.9	0.48
	Q12	0.04	0.03	0.93	-1.6	0.94	-1.5	0.63
	Q14	-0.99	0.03	1.15	3.4	1.25	5.4	0.40
3	Q11	-0.23	0.04	0.96	-1	0.98	-0.4	0.63

	Q13	-0.13	0.04	0.98	-0.4	1	0	0.64
	Q15	-0.1	0.04	0.9	-2.2	0.92	-1.7	0.69
	Q16	0.26	0.04	0.89	-2.6	0.9	-2.4	0.72
	Q17	-0.11	0.04	1.29	5.9	1.29	5.9	0.60
	Q18	0.31	0.04	0.94	-1.3	0.94	-1.4	0.70

Table 6. Item Calibration, Standard Error of Item Calibrations, Point-Biserial Correlations and Infit/Outfit Mean Squares Generated by WINSTEPS (NEW MODEL)

Figure 2

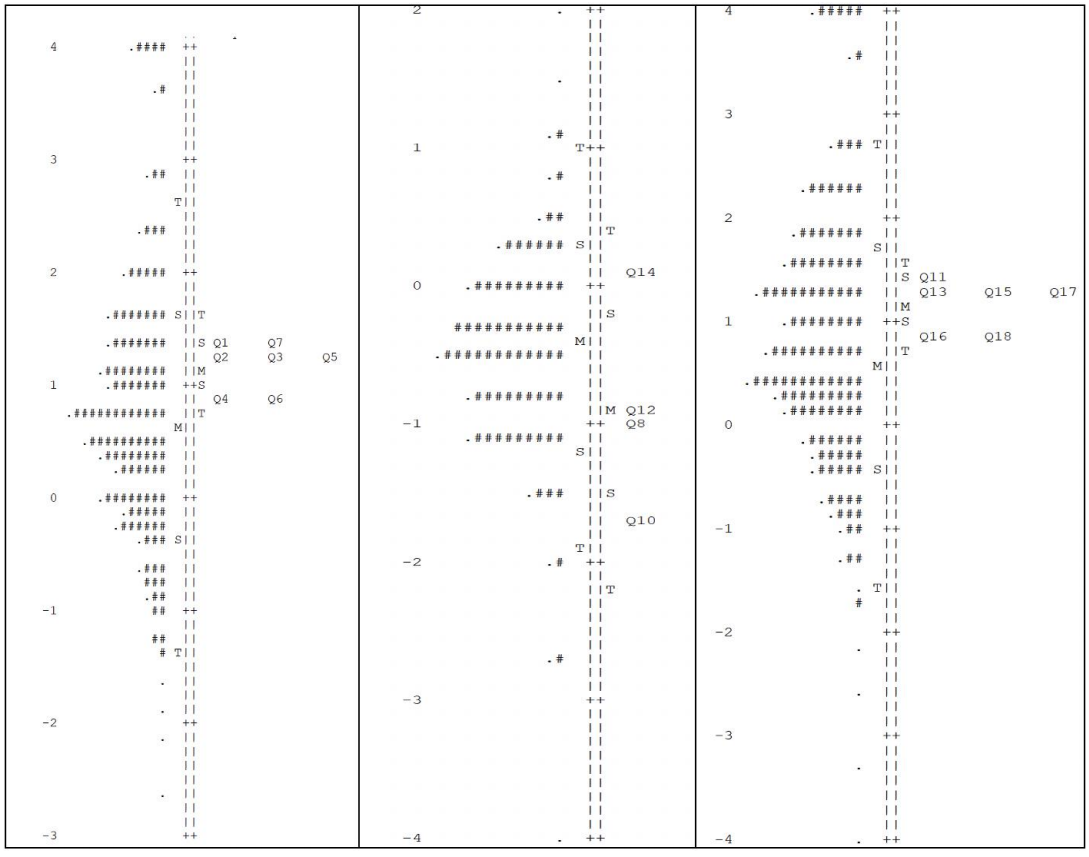

Fig. 2.

Person-item map of the three subscales after calibration by Rasch model. The person-item map displays the location of person abilities and item difficulties respectively along the same latent dimension. Left-hand column locates the person ability measures along the variable. The persons often have a normal distribution. M is the Mean, S and T are the Mean plus 1 and 2 Standard Deviations, respectively, for the persons and items.

Gender DIF The Detection of DIF in this study was accomplished through the Rasch-Welch's t and MH values by WINSTEPS. The analysis revealed that Welch's t values (refer to Table 5) were significant for six items: 1, 5, 10, 12, 13, and 15. Furthermore, the MH values also showed significant differences to the same items. These results suggest that there is no apparent variation

in item performance between genders except for the above six items. The test information curves for the four subscales of ELAS (as shown in Fig. 3) provide further insight into our findings.

The TMQ subscales are a valuable tool, as demonstrated by Fig. 3 which displays the DIF value in relation to overall baseline item difficulty for person classification by gender. This figure provides further support for the findings of the Rasch-Welch's t and M-H methods, showcasing items that fall within the ability measure range of 1 to -1 for the four subscales outlined in Table 5. Additionally, Table 6 highlights the lack of significant differences between sexes in both the subscales and total score of the ELAS. These results emphasize the significance and reliability of the ELAS scales.

Items	**Male**			**Female**			**DIF contrast**	**Join S.E**	**Rasch-Welch**		**MH**	
	OBs AV	DIF measure	DIF S.E	OBs AV	DIF measure	DIF S.E			t	p	Chi-squ	**p**
Q1	.12	-.36	.06	-.09	-.05	.05	-.31	.08	-3.93	**0.000**	14.154	**0.000**
Q2	.01	-.09	.06	-.01	-.09	.05	.00	.08	.00	1.000	0.054	**0.816**
Q3	-.02	-.03	.06	.02	-.09	.05	.06	.08	.79	0.432	0.707	**0.401**
Q4	.02	.25	.05	-.01	.28	.05	-.02	.07	-.29	0.770	0.051	**0.822**
Q5	-.08	.04	.06	.07	-.18	.05	.22	.08	2.87	**0.004**	5.093	**0.024**
Q6	.02	.29	.05	-.02	.35	.05	-.06	.07	-.77	0.440	0.678	**0.410**
Q7	-.06	-.11	.06	.05	-.26	.05	.15	.08	1.95	0.052	2.348	**0.126**
Q8	-.02	-.17	.05	.01	-.17	.05	.00	.07	.00	1.000	.123	**.7260**
Q10	.19	.35	.06	-.15	.88	.06	-.53	.08	-6.54	**.000**	27.467	**.000**
Q11	-.02	-.11	.05	.01	-.13	.05	.02	.07	.29	0.773	0.040	**0.841**

Q12	-.09	-.16	.05	.07	-.34	.05	.18	.07	2.59	**.0099**	6.669	**.0110**
Q13	-.09	-.09	.05	.08	-.31	.05	.22	.07	3.05	**0.002**	8.568	**0.003**
Q14	-.08	-.09	.05	.07	-.27	.05	.18	.07	2.54	.0114	4.866	**.0274**
Q15	.14	.34	.05	-.11	.63	.05	-.29	.07	-4.22	**0.000**	12.87	**0.000**
Q16	.02	-.01	.05	-.01	.02	.05	-.02	.07	-.32	0.750	0.384	**0.535**
Q17	-.03	-.07	.05	.03	-.15	.05	.08	.07	1.08	0.282	1.554	**0.213**
Q18	-.01	-.07	.05	.01	-.07	.05	.00	.07	.00	1.000	0.143	**0.705**

Table 7. Differential Item Functioning Analysis of the Items Of Subscales Using Rasch–Welch's T And Mantel–Haenszel Chi Square Indices

Figure 3

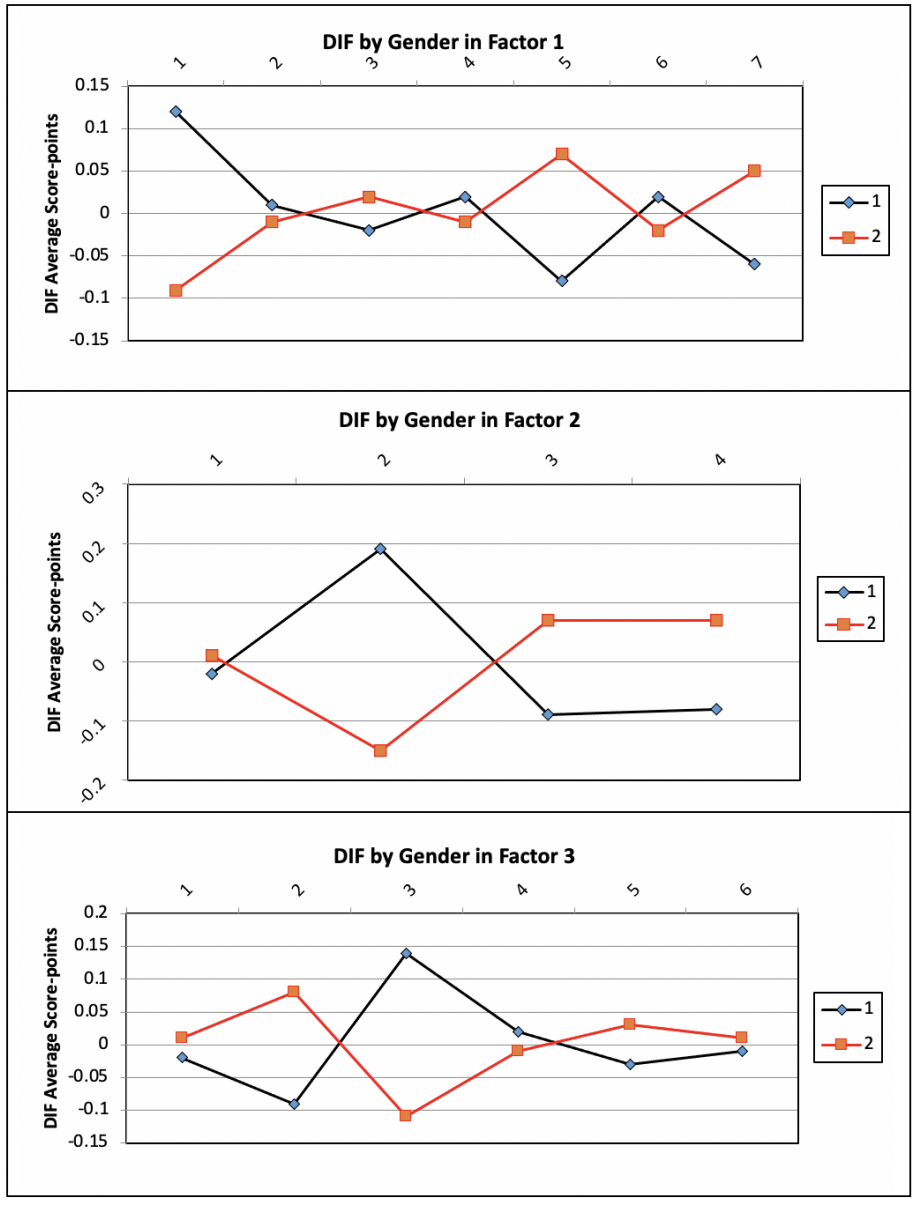

Fig. 3.

DIF average score-point across sex in the three subscales. The red line represents the performance of females on the dimension items, and the black line represents the performance of males. The items are located on the x-axis and the performance level is on the y-axis.

Discussion

The present study aimed to evaluate the psychometric properties of the TMQ using the Rasch rating scale model and to examine DIF due to gender in time management scale items among

university students. Through rigorous analysis utilizing WINSTEPS software, the calibration of polytomous items was achieved, contributing to the psychometric properties of the scale. Several prerequisites, including the verification of dimensionality and local independence of items, were examined. The findings contribute to a better understanding of time management as a construct and provide insights for future research and practical applications.

The results of this study reveal important findings regarding the psychometric properties of the TMQ. Specifically, positive correlations were observed between the Short and Long-Range Planning subscales, indicating a consistent relationship between these two aspects of planning. This suggests that individuals who score higher in one planning dimension are also likely to score higher in the other, signifying a cohesive pattern in their planning tendencies. Furthermore, a negative correlation was found between the TMQ and time attitude. This indicates that individuals with more favorable attitudes towards time management tend to score higher on the TMQ, reflecting a stronger inclination towards effective time management practices. The importance of acquiring skills in utilizing time management and organization tools is widely recognized. A systematic review conducted by Gillespie, Best (2012) supports this notion, providing evidence that tools such as computers with reminder features are beneficial for individuals with cognitive limitations in compensating for challenges related to organization, planning, and time management. The review indicates at least moderate evidence for the usefulness of these tools in both home and work settings, facilitating improved performance in various activities

The present findings have important implications for the understanding and utilization of the TMQ as a tool for assessing time management tendencies. The positive correlations between planning subscales provide support for the interconnectedness of different planning dimensions, suggesting that individuals who excel in one aspect of planning are likely to exhibit proficiency in others as well. Moreover, the negative correlation with time attitude highlights the association between positive time attitudes and higher scores on the TMQ, indicating the relevance of attitudes toward effective time management. This finding is consistent with previous research conducted by (McKenzie, Sallis, Prochaska, Conway, Marshall, & Rosengard, 2004) as well as (Macan, Shahani, Dipboye, & Phillips, 1990), who also found a similar relationship between positive time attitudes and better performance in time management.

The reliability of the TMQ was assessed through alpha coefficients, which ranged from 0.58 to 0.80. These coefficients provide a measure of the internal consistency or reliability of the questionnaire. The obtained alpha coefficients indicate that the items within the TMQ's subscales consistently measure the intended constructs. Although there may be slight variation in the coefficients across subscales, they fall within an acceptable range, indicating reliable results.

The recent research employed two approaches to assess the dimensionality of the scale; The PCAR and CFA were used to evaluate the dimensionality of the scale. The results indicated that the scale was not unidimensional in the initial PCAR analysis due to ratio of unexplained variance in the first, second, and third contrasts.

According to the findings of Hendriks, Fyfe, Styles, Skinner, & Merriman (2012), item misfit suggests that certain items within the questionnaire may be measuring something other than or in addition to the intended latent trait or construct of interest. However, reassuringly, the goodness-of-fit indices (CFI, TLI, RMSEA) for the new three-factor model in the current research were within acceptable limits, indicating a good fit to the data. The Rasch analysis supports the conclusion that the TMQ can be considered a valid and reliable tool for objectively

measuring time management's skills, as it adheres closely to the assumptions of the Rasch model. By providing such a scale, researchers can gather robust and accurate data, enabling a more profound understanding of the time management construct.

The recent research found that the standardized regression weights (SRW) for the items ranged from 0.466 to 0.704, which is inconsistent with the original model. Previous studies reported SRW ranging from -0.65 to 0.70 and identified six items with SRW less than 3. This discrepancy highlights differences in item contributions and relationships between factors compared to previous research.

Based on this finding, it is advisable for future users of the scale to consider individual scores for each of the TMQ subscales instead of relying solely on the total score. The examination of both person and item reliability for all items revealed that the TMQ items exhibited consistency and replicability. However, evidence emerged suggesting that the scale does not solely measure a single trait, thereby reducing its utility as a standalone measure. Nevertheless, upon conducting a renewed analysis by subdividing the TMQ into subscales, this will offer a more precise and comprehensive comprehension of the construct under assessment. These results align with the findings of our research group's analyses of the TMQ, further supporting the overall strength of the scale in assessing the intended constructs.

In this study, the detection of Differential Item Functioning was conducted using Rasch-Welch's t and MH values. Analysis of the data revealed that Welch's t values (refer to Table 7) were statistically significant for six items: 1, 5, 10, 12, 13, and 15. Similarly, the MH values demonstrated significant differences for the same items. These findings indicate that there is no apparent variation in item performance between genders, with the exception of the aforementioned six items. Additionally, there was absence of statistically significant differences between genders in both the subscales and total score of the ELAS which is in line with previous studies (Abu-sultane, Al-qussairy, 2017; Aluinin, 2018; Hana, 1998; Mukhtar, 2014; Shraideh, 2005). The non-significant differences between males and females suggest that the participants exhibit similar levels of the TMQ. These findings highlight the importance and robustness of the TMQ scales, indicating their reliability in assessing time management experiences regardless of gender. One potential interpretation for the lack of significant differences between males and females could be attributed to the inherent nature of time management as a human trait, which is deeply intertwined with one's personality. Additionally, the development of time management skills is influenced by situational factors.

Limitations

It is important to acknowledge some limitations of this study. Firstly, the sample used consisted of Omani university students, which may limit the generalizability of the findings to other populations. Future research could include more diverse samples to enhance the external validity of the results. Secondly, the study relied on self-report measures, which could be subject to response biases and social desirability effects. Incorporating objective measures or observational methods could provide a more comprehensive understanding of time management behaviors. Lastly, the study focused on university students, and the findings may not directly apply to other age groups or educational settings.

Recommendations

Based on the findings of this study, several recommendations can be made. Firstly, it is recommended to utilize separate scores for each of the TMQ subscales instead of relying solely

on the total score. The analysis demonstrated the scale's multidimensionality and the absence of excessive standardized residual correlations supported this recommendation. By considering individual subscale scores, a more accurate understanding of the construct being measured can be obtained.

Secondly, it is important to take into account the moderating effect of TMQ levels when interpreting and utilizing the scale. The study found that the TMQ tends to provide more reliable and precise data for individuals with moderate levels of TMQ, compared to those with low or high levels. Recognizing and considering this moderating effect can lead to a more effective and appropriate assessment of individuals with varying degrees of TMQ.

Additionally, further research is recommended to validate and expand upon the findings of this study. Replicating the study with a larger and more diverse sample, exploring other statistical techniques or measurement approaches, and investigating the influence of contextual factors such as cultural differences or educational settings can enhance the overall understanding and generalizability of the TMQ.

Furthermore, continuous evaluation and refinement of the TMQ are essential. This entails assessing its psychometric properties, conducting item analysis, and seeking feedback from users to ensure its validity, reliability, and relevance in measuring TMQ. Regular updates and improvements to the TMQ will enhance its effectiveness as a measurement tool and ensure its continued relevance in assessing motivational tendencies.

In conclusion, by implementing these recommendations, researchers and practitioners can enhance the accuracy, reliability, and applicability of the TMQ. This will lead to more accurate assessments and provide valuable insights into individuals' motivational profiles, supporting their personal development, educational interventions, and organizational management strategies.

Conclusion

The findings of this study provided important insights and recommendations for the utilization of the TMQ. Firstly, the scale demonstrated multidimensionality, suggesting the need for separate scores for each of the TMQ subscales. This approach will enable a more nuanced understanding of the construct being measured. Secondly, the study highlighted the moderating effect of TMQ levels on the scale's effectiveness. Individuals with moderate levels of TMQ exhibited greater reliability and precision in their data compared to those with low or high levels. Recognizing this moderating effect is essential to ensure appropriate assessment and interpretation of individuals with different degrees of TMQ.

It is important to acknowledge that this study is an initial step in the development and validation of the TMQ, and further research is recommended. Replicating the study with larger and more diverse samples, exploring alternative measurement techniques or statistical approaches, and considering contextual factors, will enhance the generalizability and applicability of the TMQ across different populations. Continuous evaluation and refinement of the TMQ is also crucial to maintain its validity, reliability, and relevance. Regular assessments of its psychometric properties, item analysis, and feedback from users will contribute to its ongoing improvement and effectiveness as a motivational assessment tool.

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