ATMI TO MEASURE THE MATHEMATICS ATTITUDE IN ELEMENTARY STUDENTS

Siska Nur Rahmawati[1], Muh. Faathir Husain[2]

[1,2]Yogyakarta State University, Jln. Colombo No.1, Sleman, Daerah Istimewa Yogyakarta, Indonesia
email: siskagamaya@gmail.com

Abstract

Character education could not be separated from the affective sphere or student attitudes. Students 'attitudes have been known to be influenced the students' activeness and achievement toward mathematics learning. Some instruments have long been developed to measure students' mathematical attitudes such as Attitudes Toward Mathematics Inventory (ATMI) that developed by Tapia & Marsh. The purpose of this research is to analyze the construct validity of ATMI. Instruments were distributed to 150 students at 6th grade elementary school. Confirmatory Factor Analysis were used to see the good model for dimensions in mathematics attitude. This validation tried to reveal the suitability of the instruments to measure the elementary students' mathematics attitude in the Yogyakarta context.

Keywords: *Mathematics attitude, ATMI, Construct Validity, CFA*

1 INTRODUCTION

Many researchers still interest to assess the attitudes of students, parents, teachers, or even administrators (Adelson and McCoach: 2010). Allport in Pickens (2005) defined an attitude as a readiness, organized through experience, exerting a directive or dynamic influence on the individual's response to all objects and situations to which it is related. So that the mathematics is field that an attitude could impact the mental process of individuals even students (Majeed, Darmawan, Lynch, 2013; Di Martino & Zan, 2011; Goldin, 2000, 2002; Grootenboer & Hemmings, 2007; Malmifuori, 2001, 2006, 2007; Schloglmann, 2003).

There is an increased understanding of the factors that influence cognitive understanding, while affective factors play a crucial role in the process of learning mathematics. The study conducted by McLeod around the 90's, in the newest, was arranged about the affective domain in mathematics education. McLeod (1992) Together with his colleagues divided affective spheres into three sub-domains: emotions, attitudes, and beliefs. DeBellis and Goldin (2000) add subdomain ie value. Recent research, "attitude" is used to sum it all up. Affective math is directed to chart the basics of anxiety and mathematical procedures (Evans, 2006). Leder and Grootenboer (2005) express statements with the category inside. The attitude is more stable than emotions and feelings, but not more stable than belief and/ or value.

. Based on the statement, somehow the primary students are suitable to explore the attitudes. At the growing phase of them, the attitudes of primary students are a dominant subdomain that recognizably to measure. The development of study about student attitudes at long period of time concludes that it has powerful impacts on their effective engagement, participation and achievement in mathematics (Majeed, Darmawan, Lynch, 2013). Many researchers claim that despite the fact that research on attitude, as compared to other subdomain of affects, has the longest history, the term attitude remains an "ambiguous construct" (e.g. Hart, 1989; Hannula, 2002) with an ambiguous

theoretical framework (McLeod, 1992; Zan & Di Martino, 2003) that needs to be developed further.

The Attitudes Toward Mathematics Inventory (ATMI) (Tapia & Marsh, 2004) is one of the latest instruments, but it has not enjoyed significant application in research (Chamberlin, 2010). It was chosen for this study because it provides a sharp and distinct focus and identifies four dimensions along which attitudes toward mathematics could be measured. The improved ATMI comprised 40 items that measured four domains: enjoyment, value, motivation, and self-confidence (Majeed, Darmawan, Lynch, 2013). Scoring was done with a five-point Likert Scale, with response options from "strongly disagree" to "strongly agree".

As a development process of ATMI, based on that definition above, (1) is the ATMI a reliable and a valid instrument to measure elementary students' attitudes toward mathematics in the Yogyakarta context? So, the purpose of this research is to find the construct validity of the ATMI in Yogyakarta context especially in elementary students.

2 METHOD

This study conducted as quantitative descriptive to explore the construct validity of ATMI for elementary student in Yogyakarta context. A total of 184 elementary students participated in this study. The respondents were elementary students at 5 and 6 grades in 7 public elementary schools in Sleman regency.

Reducing the total of items of the instrument, only 32 were used and omitting eight items to make the instrument more manageable length and prevent the negative impact on completion by the respondent without compromising its validity.

2.1 Research Settings

The study was conduct at September 2017 in 7 public elementary school in Sleman Regency, Special Region of Yogyakarta.

2.2 Research Subject

Using cluster random sampling out of 14 public elementary schools in Sleman Regency as population, 7 elementary schools were chosen, and reaching 184 elementary students at 6 grades as respondent.

2.3 Procedure and Data Analysis

The ATMI instrument was adapted by translating it from English to Bahasa Indonesia keeping in mind that this study conducted to explore the ATMI in Yogyakarta context. After translating and proofreading it, 40 items of ATMI then reduced to 32 items and omitting eight items without compromising its validity to prevent the respondent dropouts during data collecting. The final instrument then distributed to the respondent.

The data then analysed using Lisrel 8.80 to measure the construct validity.

Confirmatory factor analysis was used to analyse the construct validity of the data. Firstly, the overall model fit was conduct to examine the fit of the model based on the goodness fit indices then measure the measurement of fit. The criteria that were used to evaluate the goodness of fit are: normed chi-square ($\chi^2/d.f.$), RMSEA (Root Mean Square Error of Approximation), RMR (Root Mean-square Residual), GFI (Goodness-of-Fit Index), NFI (Normed Fit Index), Non-Normed Fit Index (NNFI), and CFI (Comparative Fit Index). Loading factor and *t*-Value are criteria that were used to analyze the measurement model fit. The standard of significance value for the validity based on Hair, Black, Babin, Ander-son, & Tatham (2010) were "factor loadings ± .3 to .4 are minimally acceptable".

3 RESULTS AND DISCUSSION

Before examine the construct validity of the instrument, reliability was assessed to confirm the internal consistency of instruments items. The Cronbach's alpha statistics for the instrument was .741. These results

confirmed the adequacy of the internal consistency of the instrument.

To examine the overall and measurement model fit, confirmatory factor analysis was used. The explanation of each criteria in overall model fit that mentioned before i.e. Normed Chi-Square is ratio between Chi-Square and degree of freedom. RMSEA is most informative indicator for model fit. RMR represent the residual mean by matching the covariance matrix of the data. GFI is a scale of precision of the model that resulting covariance matrix. NFI has a tendency to lowering the fit in small sample size. NNFI was used to fix the problem that caused by the complexity of the model.

3.1 Overall Model Fit

To analyse the construct validity, it is necessary to fit the overall model first. If overall model fit match with the criteria, then the measurement model fit could be conduct to fulfil the construct validity analysis condition.

The table below shows the overall model fit value after the data was analysed using Lisrel 8.80.

No	GOF Criteria	Result	Level of Fit
1	Normed χ^2	3.11	Poor fit
2	RMSEA	.107	Poor fit
3	RMR	.089	Marginal fit
4	GFI	.67	Good fit
5	NFI	.88	Marginal fit
6	NNFI	.91	Marginal fit
7	CFI	.92	Marginal fit

Table 1 shows the normed $\chi 2$, that is the ratio between the $\chi 2$ and degree of freedom. Good fit level suggests that the score must be range from 1.00 to 2.00. because the score is 3.11 so that the normed $\chi 2$ is in the poor level. RMSEA scored .055. Because the score is greater than the suggested score (RMSEA< .05), so the level of fit is in poor fit (Browne & Cudeck, 1993). The result of RMR and CFI is .089 and .92 respectively, with N≤250 the model will in good fit level if Standardized RMR ≤ .09 and CFI> .92 (Hair, Black, Babin, Anderson, & Tatham, 2006) so that those criteria are in marginal fit. The criteria of GFI range from 0 (poor fit) to 1 (perfect fit). The GFI scores .67 so that the fit level is in good criteria. The criteria of GFI is same for NFI and NNFI. Considering the condition above, it could say that the overall model is fit to measure the construct validity of the instrument.

3.2 Measurement Model Fit

After the overall model is fit, the measurement model fit was conduct. The result of measurement model fit for Skills for Learning Questionnaire instrument were described here. Measurement model fit conduct using first order confirmatory factor analysis or 1st CFA. The criteria for construct validity are loading factor and *t*-Value. If loading factor is greater than .3 and *t*-Value more than 1.96 then the item is categorized as valid item. Those criteria refer to assumption that "factor loadings ± .3 to .4 are minimally acceptable." (Hair, Black, Babin, Anderson, & Tatham, 2006).

Factor	Item	First Order CFA		Interpret
		LF	t-Val	
SlfCon	SF1	.80	10.28	Valid
	SF2	.79	10.91	Valid
	SF3	.81	11.20	Valid
	SF4	.76	11.82	Valid
	SF5	.83	11.57	Valid
	SF6	-.46	-5.33	Not Valid
	SF7	-.57	-9.18	Not Valid
	SF8	-.50	-6.85	Not Valid
	SF9	-.49	-7.22	Not Valid
	SF10	.61	7.87	Valid
	SF11	-.49	-6.63	Not Valid
	SF12	-.51	-7.98	Not Valid
Val	Val1	.52	9.82	Valid
	Val2	.30	5.84	Valid
	Val3	.39	7.04	Valid
	Val4	.68	10.53	Valid
	Val5	.66	10.83	Valid
	Val6	.68	10.67	Valid
	Val7	.59	8.70	Valid

Enj	Enj1	.69	10.40	Valid
	Enj2	-.73	-8.02	Not Valid
	Enj3	.58	7.74	Valid
	Enj4	.60	7.74	Valid
	Enj5	.71	9.04	Valid
	Enj6	.47	6.09	Valid
	Enj7	.74	10.97	Valid
	Enj8	.44	6.77	Valid
	Enj8	.57	8.43	Valid
Mot	Mot1	.62	9.37	Valid
	Mot2	-.52	-5.83	Not Valid
	Mot3	.65	8.99	Valid
	Mot4	.55	8.43	Valid

Table 2 shows the summary of construct validity using 1st CFA. It shows that the items of the instrument have loading factor > .3 and t-Value > 1.96 it means the instrument was valid constructively and could measure the gap of skills of vocational students. Item SF 6, SDF 7, SF 8, SF 9, SF 11, SF 12, Enj 2, Mot 2 is not valid.

4 CONCLUSION

Based on analysis result, it can be concluded that conclusion 24 items have factor loading > .3 and t-value > 1.96 so that out of 32 items only 24 items are valid. 2) The 24 items of adapted ATMI are constructively valid to measure the mathematics attitude from elementary student in Yogyakarta context. The results are consistent with the factor structure reported by Majeed, Darmawan, & Lynch (2013), whose sample involved 699 Osuth Australian students in 7 and 8 grades.

By reducing the 40 items of ATMI, the 24 items he reliability and validity estimates for ATMI are stable over many years after its initial administration in 1996 and beyond the initial samples. These considerations provide compelling rationale for its use in future research about attitudes toward mathematics (Majeed, Darmawan, & Lynch, 2013). The ATMI is particularly useful, both for teachers, who want to monitor students attitude toward mathematics, and for researchers, who often use different instruments in their studies. For the further study, larger sample and better translating may give more credible result.

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