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Zamri Chik, Abdul Hakim Abdullah

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## The Role of Mediator in Relationship between Motivations with Learning Discipline of Student Academic Achievement

Zamri Chik, Abdul Hakim Abdullah

Faculty of Islamic Contemporary Studies, Universiti Sultan Zainal Abidin, Gong Badak Campus,  
21300 Kuala Terengganu, Terengganu, Malaysia

### ABSTRACT

This mediator is a mechanism that describes how one variable can affect other variables. Thus, this study was conducted to explain the role played by mediators to build discipline learning as a relationship between motivations to student academic achievement. A total of 260 forms of four students, taking an additional Mathematics course at a secondary school in Kuala Terengganu District. Data were analyzed using version 21.0 from IBM-SPSS-AMOS (Package Statistics for Social Sciences - Moments Structure Analysis). The findings indicate that the mediator link test is supported and the type of mediator relationship is partial mediation relations because both indirect effects for constructive constructs and construction of learning disciplines against the construction of academic achievement are significant, and the direct influence of motivational constructions on the construction of academic achievement is also significant. The bootstrap findings in this study are the effects of full mediation because the direct effects are insignificant and consistent with the findings of the mediator link test on the test procedure.

**Keywords:** Mediator, Structural Equation Modeling (SEM), Additional Mathematics, Bootstrap.

### INTRODUCTION

The purpose of this article is to explain the role played by mediators to build the learning discipline as a link between motivations toward the formation of four academic members who take the subject of Additional Mathematics at secondary school in Kuala Terengganu district.

### MEDIATOR MODEL

The basic concept of this mediator model is a mechanism that describes how one variable affects other variables (Baron & Kenny, 1986; James & Brett, 1984). According to MacKinnon (2007), complex relationships can be demonstrated by the existence of a third variable that lies between the relationship between independent variables (IV) and the dependent variable (DV). This type of

relationship is known as a mediator, and the third variable is known as the mediator variable (M). The concept of mediators as an indirect effect, intervention variables or intermediate effects (Robins, Kraley & Krueger, 2007). To illustrate this more comprehensive model of mediator can be seen in Figure 1 below.

Based on Figure 1 below, we can find translations related to the conceptual concept of mediator model. The first model shows a simple relationship between IV and DV. To prove the existence of a mediator model, the relationship between IV and DV can not be zero. This is because, if there is no correlation between IV and DV, then it can not measure the mediator effect. The second model illustrates the existence of a mediator model based on the direct impact model between IV and DV through mediator (M) using paths b and c. If IV and DV are correlated via M, path a' becomes zero, and the correlation between IV and DV can be said that variable M plays a full role as a mediator. If the path a' is not zero, but smaller than a strip, then it can be argued that the function of the variable mediator M is partial.

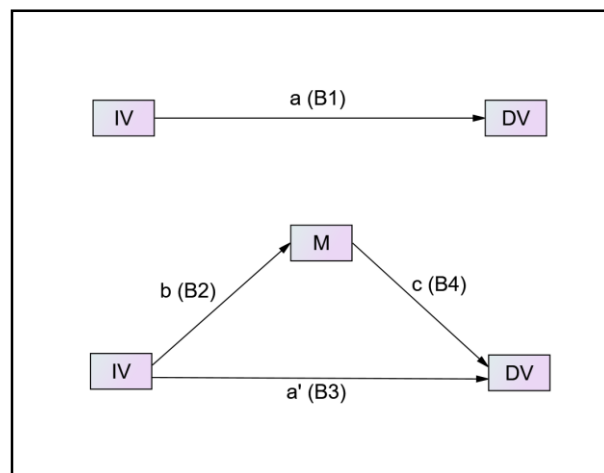


Figure 1: Mediator Path

Note: B1, B2, B3 and B4 are regression coefficients of regression equations 1, 2, and 3 that are used to predict paths. (Source: Baron & Kenny, 1986)

James & Brett (1984) suggest that full mediators are linear causal correlations. This principle is described in the form  $X \rightarrow M \rightarrow Y$ , where X antiseden, M is the mediator and Y is the result (consequence). Antisen X is expected to indirectly affect Y, because it must go through the mediator M. If there is a complete mediator process, it is assumed that the model is linear causality. Therefore, it is estimated that X has a direct effect on M, where m has a direct impact on Y, and X does not affect Y at M if constant or constant. Baron & Kenny (1986) state that there are four conditions that must be met to be able to describe the mediator model. Three statistical models are as follows:

- 1)  $DV = B_0 + B_1 (IV)$
- 2)  $M = B_0 + B_2 (IV)$
- 3)  $DV = B_0 + B_3 (IV) + B_4 (M)$

Of the three statistical models can be understood as follows:

- 1) Equation 1 illustrates the basic relationship between IV and DV and estimates the magnitude of  $B_1$ , which means the path coefficient in the first model in Figure 1.
- 2) Equation 2 gives an approximation of  $B_2$  (the relationship between IV and M) intending to explain the path coefficient  $b$ , which is seen in model 2 in Figure 1.
- 3) Equation 3 illustrates the path  $c$  ( $B_4$ ) (the relationship between M and DV) in the second model and  $B_3$  which illustrates the path  $a'$  in Figure 1.

After estimating the parameters, then to say whether the variable acts as a mediator, it is necessary to consider the following 4 conditions:

- 1) Significant IV and DV Relationships (equation 1)
- 2) Significant relation between IV and M (equation 2)
- 3) The relationship between M and DV is also significant after control IV.
- 4) The IV role for DV decreases after M is controlled.

By fulfilling these four conditions, the role of IV in DV is less than that of the IV and M versus DV, it is said that M is the mediator variable, and the proposed model proves to be a mediator model. Therefore, the role of the mediator variable describes the effect of several variables on a variable. That's not all variables are located as variables that cause changes to other variables.

### SEM Approach To Testing Mediator Models

The SEM approach is selected if the researcher wants to know more than one variable measured from the latent variable. Suppose there are latent predictive variables (A), centralized centralized mediator variables (B) and hypothetical variables (C). The first to be measured is the direct effect of  $A \rightarrow C$ . If the fit results match the direct impact model, proceed with testing the overall compatibility of the model ie  $A \rightarrow B \rightarrow C$ . If for the whole model is appropriate, then continue by testing the matching model  $A \rightarrow B$  and  $B \rightarrow C$ , to determine the coefficient of route analysis. In this case, all routes ( $A \rightarrow C$ ,  $A \rightarrow B$  and  $B \rightarrow C$ ) on model  $A \rightarrow B \rightarrow C$  must be significant (analogy of the previous regression model).

The final step to using SEM in testing the mediator model is to test the model  $A \rightarrow B \rightarrow C$  under two conditions: (1) if path  $A \rightarrow C$  is directed to 0 and if (2) if path  $A \rightarrow C$  is not directed. An appropriate test is performed by looking at the differences between the two chi-square models. The effect of the mediator will occur if the addition of  $A \rightarrow C$  to the fixed model does not improve the matching of the model. In other words, the importance of route  $A \rightarrow C$  is reduced to unimportant when the mediator is involved in the analysis (analogy of the regression approach) (Hersen & Gross, 2008).

Figure 2 shows a conceptual model of research, in which IV builds motivation, mediators of instructional constructs, while DV is a constructive achievement of student academic achievement.

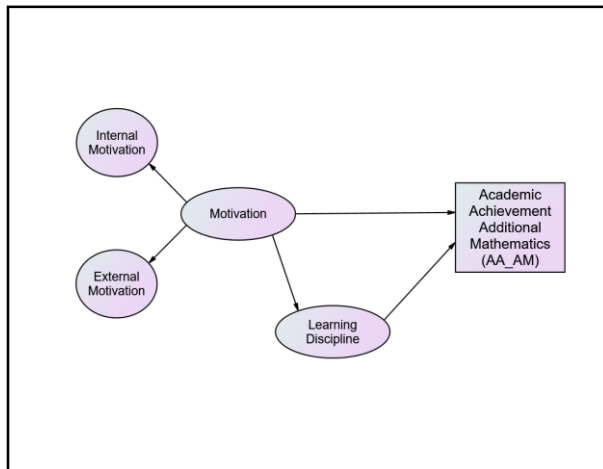


Figure 2: Conceptual Model

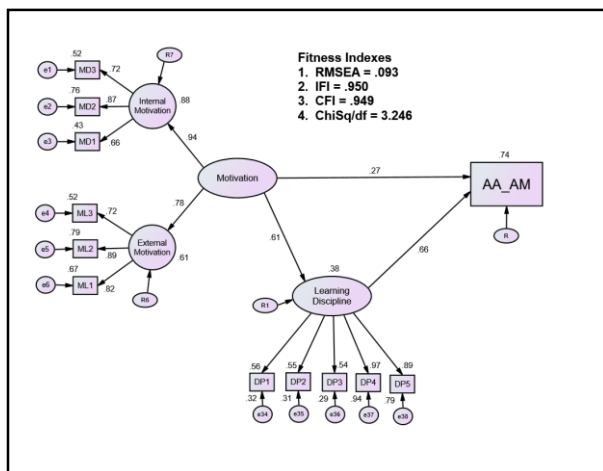


Figure 3: SEM Findings Indicates Standard Regression Value Between Constructs (Standardization Estimated)

**a) An important summary of the SEM findings in Figure 3 (Standard Regression):**

- 1) The value of  $R^2$  for the construct of "Learning Discipline" (LD) is 0.38. This shows the predecessor construct in the model (see arrow), "Motivation" (MTV) accounted for 38% of the "Learning Discipline" (LD) among the populations in the study.
- 2) The value of  $R^2$  for its construct "AA\_AM" is 0.74. This shows that the two construct constructors in the model (see arrow), "Motivation" (MTV) and "Learning Discipline" (LD) reached 74% to "AA\_AM" among the populations in the study.

Figure 4 shows the findings of the regression values between the constructs in the model, to build the required regression equations and make the hypothesis testing later.

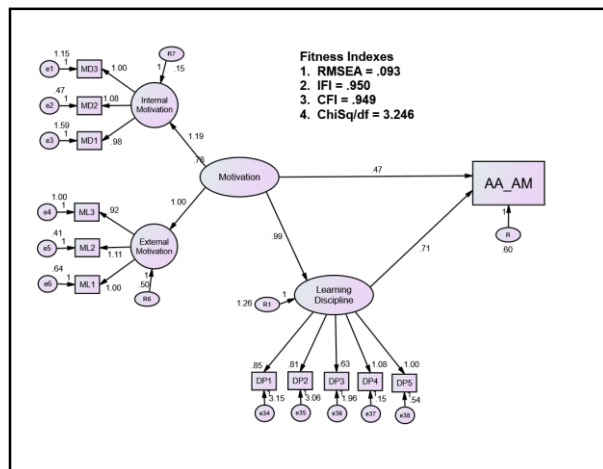


Figure 4: SEM Findings Indicate the Regression Value Between Constructs (Unstandardd Estimates)

**b) An important summary of the SEM findings in Figure 4 (Regression Value):**

The regression equations for the “Learning Discipline” (LD) and AA\_AM are as follows:

- 1) LD = 0.99MTV (R<sup>2</sup> = 0.38 or 38%)
- 2) AA\_AM = 0.47MTV + 0.71LD (R<sup>2</sup> = 0.74 or 74%)

Furthermore, the researcher will test every hypothesis proposed in this research. Table 1 shows estimates of the direct effects of the effects of each independent construction on the constructs in the model as shown in Figure 4 above.

Table 1: Regression Coefficients Between Construct Value And Probability (p)

Constructs		Constructs	Estimate	S.E.	C.R.	P	Label
Learning_Discipline	<-	Motivation	0.994	0.129	7.715	0.001	Significant
	--						
AA_AM	<-	Motivation	0.473	0.099	4.792	0.001	Significant
	--						
AA_AM	<-	Learning_Discipline	0.708	0.057	12.451	0.001	Significant
	--						

**Mediator Analysis For Learning Discipline**

Table 2 shows the hypotheses of hypothetical mediator influence "Learning Discipline" in the relationship between independent construction (Motivation) and dependent construction (AA\_AM).

Table 2: Hypothesis Test of Mediator Effect Discourse of Learning to Build

Testing Hypothesis for Mediator	Decision
H <sub>1</sub> : Learning discipline is a mediator of the relationship between motivation and academic achievement	Supported See the test in Figure 6

**Test Of Mediator Impression Hypothesis**

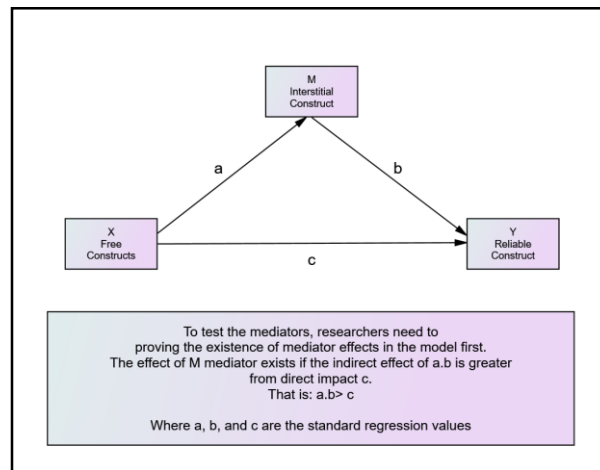


Figure 5: Testing the Mediator Behavior Hypothesis M in Model

The hypothesis test of the influence of the constructive mediator from the construction of the "Learning Discipline" in Table 1 is shown in Figure 6. This study applies the mediator effect test procedure as suggested by Awang (2014; 2015; Awang et al., 2015a; Kashif et al., 2016). This method requires a triangular diagram as shown in Figure 5. The values of a, b and c need to be extracted from the graphical output regression weight graph as shown in Figure 5.

**DISCIPLINE LEARNING IS A MEDIATOR RELATIONSHIP BETWEEN MOTIVATION AND ACADEMIC ACHIEVEMENT**

Figure 6 shows all the standard regression values that connect the three routes to test the mediator hypothesis.

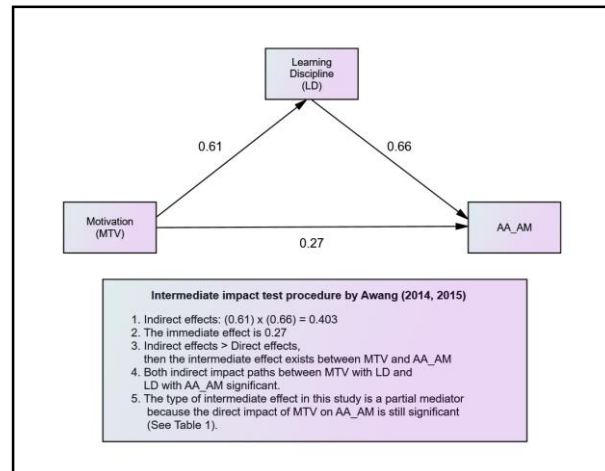


Figure 6: Testing Procedure Hypothesis Testing MTV-LD-AA\_AM Mediator

Figures 6 and Table 2 illustrate the mediator correlation test procedure in the model according to Awang (2012; 2014; 2015). In this model "Learning Discipline" (LD) is an intermediate variable, "Motivation" (MTV) is an independent variable and "Academic Achievement" (AA\_AM) is a dependent variable. The test procedure is as follows:

- 1) Indirect effect =  $0.61 \times 0.66 = 0.403$
- 2) Direct effect = 0.27
- 3) Indirect effects > Direct impact, then the mediator is valid between MTV and AA\_AM.
- 4) Both indirect impact paths between MTV with LD and LD with AA\_AM are significant.
- 5) The type of mediator effect in this study was a partial mediator because the direct effects between MTV on AA\_AM were significant (see Table 1).

Based on the above test, the results show that the mediator link test is supported and the type of mediator relationship is Partial Mediation because the two indirect effects pathway for "Motivation" (MTV) on "Learning Discipline" (LD) and "Learning Discipline" (LD) becomes "Academic Achievement" (AA\_AM) is significant, and the direct effect of "Motivation" (MTV) on "Academic Achievement" (AA\_AM).

To verify the mediator test, the researcher should perform a bootstrap test using the re-sampling size ( $n = 1000$ ) (Awang, 2012; 2015; 2015). In this study, researchers selected the re-sampling size proposed by Awang (2012; 2014; 2015) by correcting the corrected 95% bias. It aims to derive direct and indirect effects along with their respective probability ( $p$ ) values. The investigators then compared the findings of bootstrap findings from mediatorial relationships with findings tested by conventional procedures.

The importance of direct effects is to know the type of mediator effect that exists, whereas for indirect effect is to know the existence of mediator effect (Awang, 2015, 2015). Table 3 below shows



the bootstrap findings for constructs Motivation (MTV) regarding the construction of Academic Achievement (AA\_AM).

Bootstrapping results in Table 3 shows the direct effect of the same route of 0.218, whereas the indirect effect of Motivation (MTV) on Academic Achievement (AA\_AM) is 0.389. This indicates that there is influence of Mediator Learning Discipline (LD) because the indirect effect (ie through LD) is greater than direct impact (ie without via LD) between MTV and AA\_AM relationship. The findings in Table 3 also show the direct impact is insignificant and the indirect impact is significant. The importance of indirect effects indicates the role of mediators, while the direct significance of direct effects does not indicate the type of mediator. Therefore, it can be concluded that the bootstrap findings in Table 3 are full mediation effects because the direct effects are insignificant and consistent with the findings of the mediator linking test in the test procedure. This means the hypothesis H<sub>1</sub> is supported.

Table 3: Bootstrapping Findings Between Construct Studies

<b>Non-Direct Impact Standard: Motivation (MTV) on Academic Achievement (AA_AM) = 0.389</b>			
Relationship	MTV	LD	AA_AM
Learning Discipline (LD)	0.000	0.000	0.000
Academic Achievement (AA_AM)	0.389	0.033	---
<b>P-Value (Indirect) Motivation (MTV) on Academic Achievement (AA_AM) = 0.002</b>			
Relationship	MTV	LD	AA_AM
Learning Discipline (LD)	---	---	---
Academic Achievement (AA_AM)	0.002	---	---
<b>Direct Standard Impact: MTV Against AA_AM = 0.218</b>			
Relationship	MTV	LD	AA_AM
Learning Discipline (LD)	0.590	0.000	0.000
Academic Achievement (AA_AM)	0.218	0.659	0.000
<b>P-Value (Direct Impact) MTV to AA_AM = 0.054</b>			
Relationship	MTV	LD	AA_AM
Learning Discipline (LD)	0.002	---	---
Academic Achievement (AA_AM)	0.054	0.002	---
<b>Summarizing Indirect Effects and Direct Impacts</b>			
Relationship	Indirect Effect		Direct Effect
Bootstrapping Results	0.389		0.218
P-value <i>Bootstrapping</i>	0.002		0.054
Results	Significant		Not significant
Type of Mediator Relationship	The full impact of Mediation is due to its direct impact not significant		

## Conclusion

Overall, the findings indicate that disciplinary learning is a mediator in the relationship between students' motivation and achievement.

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