

THE STRUCTURAL EQUATION MODELS FROM FACTORS AFFECTING OF MATHEMATICS FUTURE TEACHERS KNOWLEDGE

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ABSTRACT-- *In order to support good education, good preparation is also needed on the education program for teachers candidate. On this basis, an understanding of the factors that influence the knowledge of teachers candidate, especially mathematics teacher candidates, is needed. The Teacher Education Study in Mathematics (TEDS-M) is a study that examines how the impact of current teacher education programs on the knowledge of mathematics teachers candidate. Based on the results of the study obtained four factors that influence the knowledge of mathematics teachers candidate, namely background, mathematical knowledge, belief in mathematics learning, and mathematics learning opportunities. This study will examine how the relationship between the knowledge of mathematics future teacher to the four factors using structural equation (SEM), and find a mathematical model that can explain how all the parameters formed can be estimated using SEM analysis method. The results obtained indicate that the background and belief in learning mathematics has a great influence on mathematics future teacher knowledge. Opportunities in learning mathematics and mathematical knowledge are not so influenced by the mathematics future teacher knowledge. This is allegedly due to other factors which have a greater effect on opportunities in learning mathematics and mathematical knowledge compared to the mathematics future teacher knowledge.*

Keywords-- *Structural equation models, TEDS-M, mathematics future teacher knowledge*

I. INTRODUCTION

Education is an important thing in human life. Through good education the potential within in oneself can develop well too. One way to realize good education is by preparing educational programs for future teachers so that future teachers not only have good knowledge but also have good ways of thinking so they can teach with good learning strategies as well. Teacher Education Study in Mathematics (TEDS-M) is a study that examines how the influence of educational programs at universities on future teachers in 17 countries and examines how their impact on the mathematics future teacher knowledge during education takes place. The results of the study indicate that there are several factors that influence the knowledge of mathematics teachers candidate, namely: background, mathematical knowledge, belief in mathematics learning, and mathematics learning opportunities. This is as explained [1] as follows:

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1. Background is one of the factors that influence the mathematics future teacher knowledge, several factors that affect the background are the age of the future teacher, gender, reasons why choosing to become a teacher, and the facilities available at home to support future teacher in education.

2. Knowledge of mathematics is one of the factors that must be mastered by mathematics future teacher, in this study the mathematics future teacher knowledge is measured by their knowledge of the mastery of mathematical content (Mathematical Content Knowledge) and mastery of how to convey the mathematics material in learning (Mathematical Pedagogy Content Knowledge).

3. The belief in learning mathematics can influence how future mathematics teachers teach in the future, to find out how much confidence the mathematics future teacher have towards mathematics learning can be seen from three aspects, namely confidence in basic mathematics mastery, mathematics learning beliefs, and belief in mathematics achievement.

4. Finally, the factors influencing the mathematics future teacher knowledge are opportunities in learning mathematics that can be seen from how much mastery they have in school mathematics, university mathematics, pedagogical education, and mathematics education pedagogical obtained during their education.

Based on these results, this study will examine how the relationship between these factors influences the mathematics future teacher knowledge and how the relationships between these factors are represented using structural model equations (SEM). In addition, estimation of all parameters of the mathematical model that is formed will be searched using the SEM analysis method.

II. METHOD

This study uses data analysis methods using the Structural Equation Model (SEM). SEM is a combination of factor analysis and regression analysis. SEM is a multivariate analysis method that can be used to describe the simultaneous relationship of linear relationships between observational variables (indicators) and variables that cannot be measured directly (latent variables) [1]. As explained earlier in the introduction, the mathematics future teacher knowledge are influenced by several factors that influence the background (BG), knowledge of mathematics teacher candidates (KNOW), beliefs in mathematics learners (BL), and opportunities in learning mathematics (OP) which are formed into latent variables. Each of these four factors consists of several career latents, namely other latent variables that affect the main latent variables, such as the following:

- The background latent variable (BG) is formed from the educational inhibiting career latent variable (PP), reasons for becoming a teacher (AJG), and existing facilities at home (FL).
- Mathematical Content Knowledge (MCK) and Mathematical Pedagogy Content Knowledge (MPCK) career latent variables are formed knowledge of mathematics.
- The latent variable of belief in mathematics learning (BL) is formed from the latent variables of nature mathematics career (NM), learning of mathematics (LM), and mathematics achievement (MA).

- The latent variable of opportunities in learning mathematics (OP) is formed from the latent variable of career knowledge of mathematics in school (MS), mathematical knowledge in universities (MU), education of pedagogy (EP), mathematics education pedagogy (MEP).

Each of these career latent variables will be measured using the indicator variables formed from the questions contained in the questionnaire. As presented in the following table:

Table 2.1: Questionnaire Indicator

Dimension	Variabel	Career Latent Variables	Indicator (Questionnaire)
the mathematics future teacher knowledge	Background	Educational inhibiting	Economy
			Having a side job
		The reason for being a teacher	Passionate in teaching
			Loving Mathematics
		Facilities	Many Books
			Vehicle at home
	beliefs	Mathematical Achievment	Having mathematical talent
			Mastering mathematics learning
		Nature of Mathematics	Mathematical definition
			The basics of mathematics
		Learning mathematics	Teaching procedure
			Solving mathematical problems
	Opportunities	Mathematics material at university	Linear algebra
			Basic calculus
		Mathematics material in school	Geometry
			Calculus
		Mathematics education pedagogy	Development of ability and mathematical thinking
			Teaching mathematics
		Education pedagogy	History of education and education system
			Educational philosophy
	mathematical knowledge	MCK	Solving the problem of linear equations
			Explaining the solution of the equation
		MPCK	Assessing student answers
			Guiding students in answering questions

The form of structural equations that can be formed from the factors that influence the the mathematics future teacher knowledge can be seen in Figure 2.1.

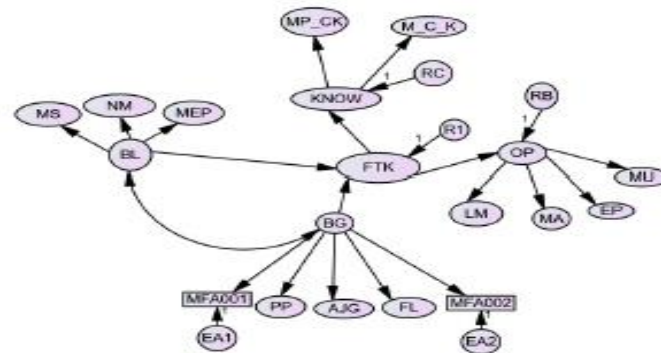


Fig 2.1: FTK construction model

III. RESULT

1.1 Goodness of Fit Compatibility Test

Based on the above construction the Goodness of Fit (GOF) compatibility test obtained is as follows:

Table 3.1: GOF index statistics

Criteria	Limit Value	Result	Conclusion
CMIN/DF	≤ 5.0	1.678	Fit
PNFI	0-1	0.637	Fit
CFI	≥ 0.90	0.833	Marginal fit
NNFI/TLI	≥ 0.90	0.824	Marginal fit
RMSEA	≤ 0.08	0.042	Fit

Based on the results of the confirmation test above, it can be seen that each GOF criterion namely CMIN / DF, PNFI, CFI, NNFI / TI, and RMSEA have a fit model fit. So it can be concluded that the above model can be used in further research.

1.2 Structural Model Measurement

As explained earlier, each latent variable has an indicator that measures each of the four factors of the latent variable so that we can analyze the effect that occurs between the latent variables. To measure it, we can use standardize estimate calculations so that it can be analyzed the influence of each of these variables. Here are the results of a standardize estimate calculation using AMOS 22:

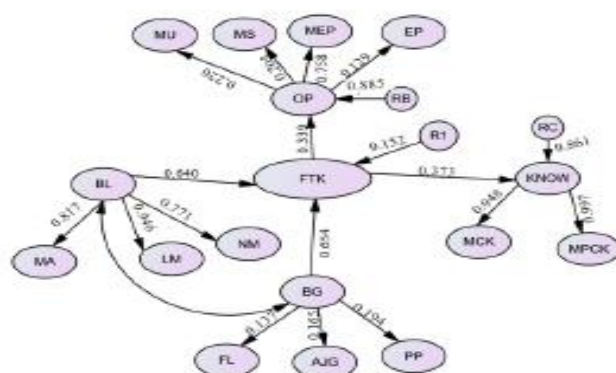


Figure 3.1: FTK construction results

Based on the calculations in Figure 3.1 structural equations can be formed from the factors that influence the knowledge of mathematics teachers candidate. The equation is as follows:

$$FTK = 0.640 * BL + 0.654 * BG + 0.152 \quad (1)$$

$$OP = 0.339 * FTK + 0.885 \quad (2)$$

$$KNOW = 0.373 * FTK + 0.861 \quad (3)$$

The analysis of the structural equation above is as follows:

- Background (BG) has a great influence on the mathematics future teacher knowledge that is equal to 0.654. That is, the better the supporting facilities at home, there is a belief that being a strong teacher, and the absence of obstacles in carrying out education makes the mathematics future teacher knowledge even better. As a result, the mathematics future teacher knowledge will be even better.
- Belief in learning mathematics also has a great influence on the mathematics future teacher knowledge (0.640). This means that when mathematics teachers candidate are confident in mastering basic mathematics, confident in learning mathematics, and confident in achieving mathematics, their confidence in learning mathematics gets stronger. This makes the mathematics future teacher knowledge better as well and future math teachers have a sense of confidence in teaching.
- Mathematics future teacher knowledge is quite influential on opportunities in learning mathematics (0.339). If seen from the structural equation above, there are other factors that influence mathematics learning opportunities in addition to the opportunity factors in learning general pedagogical education, mathematics pedagogical education, mathematics education in schools, and mathematics education in universities. Research that has been carried out by TEDS-M states that in addition to the four factors mentioned earlier there are other factors that also influence opportunities in learning mathematics, namely the opportunity to teach based on their experiences during schooling, and the opportunity to get an appropriate education for future teaching. It is likely that the two factors had a stronger influence on opportunities in learning mathematics than the mathematics future teacher knowledge.

- Mathematical knowledge is influenced by the mathematics future teacher knowledge by 0.373. It could be that the lack of influence of the mathematics future teacher knowledge on mathematics knowledge in both the MCK and MPCK fields occurs due to the lack of understanding in analyzing the questions given in the research questionnaire. In addition, if analyzed from the structural equation, there are other factors that influence mathematical knowledge. Another factor influencing mathematical ability from the results of research conducted stems from the desire of education experts to choose an appropriate curriculum for learning mathematics and increase the duration of learning so that the teaching and learning activities of mathematics future teachers are more effective.

IV. CONCLUSION

From the results of research and discussion, the following conclusion can be obtained:

1. The Background and belief in learning mathematics both affect the knowledge of the mathematics future teacher with great value, so the better the background of mathematics future teacher and the greater their belief in teaching make the knowledge of mathematics future teacher better.
2. Opportunities in learning mathematics and mathematical knowledge both in the field of MCK and MPCK are not so influenced by the mathematics future teachers knowledge. This is allegedly due to other factors that have a greater effect on opportunities in learning mathematics and mathematical knowledge compared to the mathematics future teachers knowledge.

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