

Teachers Perspective on Factors Affecting Learning Outcomes in Mathematics

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Abstract

Perceptual information on factors affecting learning outcome on mathematics viewed by teachers was investigated in this inquest. It was aimed at examining and elucidating the potential factors determined students achievement in learning mathematics. Quantitative approach was utilized with the help of path analysis. The survey was conducted to gather information from 200 chosen respondents by using simple random sampling technique. The respondents were teachers who are studying at Universitas Terbuka of Regency Study Group, District of Tangerang. In this inquest, mathematics achievement was the dependent variable. Whereas attitude toward mathematics and motivational achievement were independent variables; tutorial participation was a moderating variable. Five hypotheses were developed with respect to the four variables involved. It was finally found that all main hypotheses were validated by the analysis. It implies that mathematics achievement was directly and positively influenced by attitude towards mathematics, motivational achievement and tutorial participation respectively.

Keywords: Mathematics achievement, attitude toward mathematics, motivational achievement, tutorial participation, path analysis.

Introduction

It is generally acknowledged that developing human resource capacity is mainly through education, mainly in conjunction with entering the 21st century era. Universitas Terbuka, the Indonesia Open University, is one of a relevant and available institution to respond that needs in Indonesia context. Universitas Terbuka is moreover a state University and the only one in Indonesia delivers the services totally by means of distance education (Universitas Terbuka, 2009). The University was established in 1984 with three main initial missions, they are to: (1) Widen access to higher education, especially to recent graduates of senior high schools, (2) Train increasing number of students in areas required for the country's economic and cultural development, and (3) Upgrade primary and secondary school teachers who graduated from short-term programs, to enable them obtaining the full-scale teaching degree.

Distance education system applied by the University forced the students act as independent learners. By the systems, students were asked to have their own indicatives in their study, especially in comprehending the materials, accomplishing assignment, and utilizing their knowledge and skills while doing their daily work as a teacher; Universitas Terbuka is offering programs for teacher with in-service mode only. To certain extent, the success of the student (as a teacher and an independent learner at Universitas Terbuka), were mostly determined by their own capability to manage their own time effectively.

In distance education system, student has to manage their own time to study while their working as well. They must be able to decide what and how many cources should be taken in a semester for example. They must also be able to decide how to manage their time, where and when they will study the cources accordingly (Panen, 1999). This implies that student has to have self-discipline, self-initiative, and strong self-motivation to study. In supporting student being able to deal with all cources they took, the University provides various support services; one of them is academic support as the so-called face-to-face tutorial. It was aimed at facilitating students to improve their learning proficiency and independency.

As a system, teaching at a distance also relates to the whole learning processes activities, such as learning objective/outcome, student, teacher, curriculum, facilities, and evaluation. Objective, process, and evaluation should be in one system as well and their related one to another. Evaluation, for example, is such activity to collect data in measuring how far learning objective has been accomplished by students (Arikunto, 2003). Evaluation is a systemic process of collecting, analyzing, and interpreting information in determining the rate of student achievement objectively (Gronlund, 1990). By doing the evaluation accordingly then accurate information on learning achievement will accurately be found in relations to accomplishment learning objectives. Having found the result through this comprehensive approach, then it will give us clearer view on how a subject will be delivered and with what methodology to improve student performance. This effort is relevant at the moment, especially for Indonesia context, in equipping teachers with respect to preparing effective mathematical classroom in anticipating skills needed for the 21st century era.

The Context

In learning process, tutor act as a facilitator in terms of providing learning facilities to support student needs in their academic activities. Student as a component in educational system has a unique character. This implies that there are many aspects that might influence efforts in pursuing success in their study physically and psychologically. Psychologically, for instance, students might be influenced by motivation, attitude, interest, talent, perception, and intellectual ability. Motivation as a total force of the student intrinsically is the most influential factor within the student him/herself that potentially drive to their success in learning activities. Motivation has a power internally to do something in fulfilling their intended goal (Uno, 2009). Moreover, motivation will drive someone to pursue their intention behaviorally, including in pursuing success in the study as well. Motivation as one of psychological aspect within student-self had been studied by many scholar and it is considered to be one of the critical factor in determining success of one's study.

Factors that considered influencing student learning outcome in fact can be viewed from three different outlooks. They are internal, external and approach to learning. Internal outlook refers to as an internal of the student, physically and spiritually. External outlook refers to environment surrounding the students. Approach to learning outlook refers to student's effort consisting of strategy and method chosen by them in dealing with the materials (Syah, 2008).

One of educational function is forming attitude and orientation toward learning through positive behavior in pursuing knowledge to develop study skills effectively. Student success in education is also influenced by motivational achievement. Motivational achievement as a driving force is to enable someone to achieve their intended dream. Someone who highly motivated tends to always achieve their intended goal even if so many barriers in it. Highly motivated person will bring and direct him/her to have positive attitude to accomplishing success in study satisfactorily. In other words, motivation cannot be separated from someone's intention essentially to their success in study.

An internal factor that also influences someone success in study is attitude. Attitude can be viewed as tendency to act and usually related to certain learning object. In learning process, attitude can be related to courses and tutors that teach the subject. Attitude alternately can either be positive or negative. Generally, positive attitude will give positive impact to the learning process and its result. On the contrary, negative attitude might give negative impact on student tendency. The question is how both students with positive and negative attitude still have the same and high motivation; motivation to have high performance as well as high achievement in their study.

In this context, attitude has significant contribution towards student success so that this aspect should be taken into account. Furthermore, it is relevant to further pursue on how student attitude of Universitas Terbuka who are doing S1 PGSD (Bachelor Degree for Primary School Teacher Program) in mathematics course, as this course is mandatory in the program. The aim is to see how their attitude will influence their way in studying mathematics.

Three in one elements of attitude can be moreover described with the so-called: (1) Cognitive or perceptual component includes related knowledge, standpoint and belief in conjunction with how people making perception on attitude as an object, (2) Affective or emotional component includes feeling of happiness or unhappiness on attitude as an object, and (3) Connative or behavioral component includes related tendency on doing something viewed from attitude perspective. These components show the intensity of attitude, that is to show how significant somebody to act on an object or not.

Other component that should also be taken in to account in learning process is evaluation. Evaluation system should be developed in a proper way so that it will be able to give accurate feedback as well as improve students to learn and perform better. The format and type of evaluation should be chosen adequately that endorse the student to learn even in a better circumstance and give positive effect on student performance. It is therefore critical to choose good evaluation tools in the first place.

In the tutorial session, evaluation tool that commonly used is a kind of test developed by tutors. The test usually in the form of formative and/or sumative type. The test is aimed at measuring how greatly student mastering on one subject learnt. It is therefore important that tutor should be able to develop such kind of a test as a tool to evaluate student mastery in a subject.

Previous research conducted related to the variables involved has been done by Siskandar (2008). This research showed that student attitude and motivation had a positive influence toward learning outcome in mathematics. Ngatikoh (2012) and Sappaile (2008) also conclude relatively the same results. Alam (2012) and Pardjono (2007) come to the similar results. In general, results cited above stated that contextually the outcome of mathematical learning had a positive and significant correlational toward both attitude and motivation aspects.

Based on the previously explanation contextually, the hypotheses of this research can be developed into the following five formulation: (1) Mathematics achievement is directly influenced by attitude towards mathematics, (2) Mathematics achievement is directly influenced by motivational achievement, (3) Mathematics achievement is directly influenced by tutorial participation, (4) Tutorial participation is directly influenced by attitude toward mathematics, and (5) Tutorial participation is directly influenced by motivational achievement.

Objectives, Methodology and the Model

This inquest is mainly aimed at investigating factors that potentially influencing mathematics achievement. In a more detail, it is also of interest to elucidate on how attitude toward mathematics, motivational achievement and participation in tutorials will affect mathematics achievement as learning outcome in mathematics. This inquiry, is a quantitative research with the help of path analysis technique to draw the conclusion inferentially. Survey was done to gather data from the respondents (Singarimbun & Effendi, 1989). Eligible respondents as a sample of the research was determined by using simple random sampling approach (Sugijono, 2012). The total population are teachers who in 2013 registered as students at Serang Regional Office of Universitas Terbuka in undergraduate Program for Primary School Teachers (in Indonesia it is called S1 PGSD). While the targeted population is those teachers who belong to Study Group at Tangerang District. Samples of the research are those 200 teachers who belong to Regency Study Group, District of Tangerang.

Methodologically, descriptive and inferential analysis is later used in the discussion. Prior to it, however, there are several tests conducted to assure that the conclusion drawn is valid and reliable. Prior to it, the tests are conducted for normality and linearity of the data. Inferential analysis is used to analyse sample and its result will be used for the sake of generalization. While path analysis (Sarwono, 2012) will be used for data analysis and hypotheses testing.

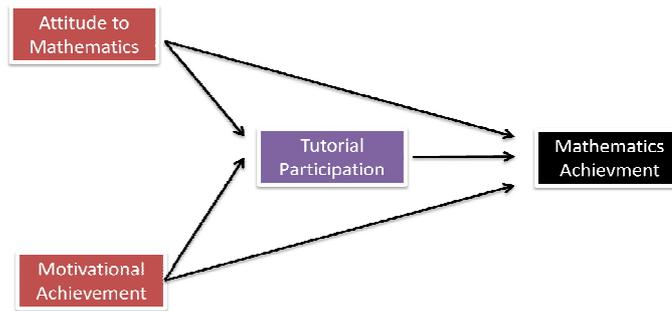


Figure 1: Model of the Research

Conceptually, mathematics achievement as a learning outcome in mathematics is the dependent variable. Attitude towards mathematics and motivational achievement are both independent variables. Participation in tutorial is a moderating variable. Graphically, the model of this research can be seen in Figure 1.

Results and Arguments

Operationally, the research includes four variables, they are: (1) Mathematics achievement (Y), (2), Attitude to mathematics (X₁), (3) Motivational achievement (X₂), and (4) Tutorial participation (X₃). Y is the dependent variable. X₁ and X₂ are independent variables. X₃ is an intervening variable. The summary of statistical descriptive for all variables involved can be better explained as can be seen in the Table 1.

Data	Variableles			
	X ₁	X ₂	X ₃	Y
Sample	200	200	200	200
Total Score	35009	35521	24268	3959
Maximum	197	200	131	24
Minimum	146	130	112	11
Mean	175,04	177,60	121,34	19,0950
Median	175	179	72	19
Modus	172	180	72	19
Deviation	12,894	13,019	5,06187	2,13277
Variants	166,274	169,496	25,623	4,54

Table 1: Summary of Descriptive Statistic

Before testing all the hypotheses, analitical requirement should be done first. Having fulfilled all requirements, path analysis can then be implemented. Normality and linearity tests should be performed first and they are all validated by the tests in fact. The first step after having the normality tests is to show correlation coefficient of variables; and they are shown in the Table 2.

Correlation	X1	X2	X3	Y
X1	1.0000	0.9023**	0.2460**	0.3811**
X2		1.0000	0.2152**	0.3800**
X3			1.0000	0.2080**
Y				1.0000

Table 2: Correlation Matrix Coefficient

Based on the result shown in Table 2 above, it then can be made a constellation amongst variables involved including the coefficient attached to it as can be seen in Figure 2.

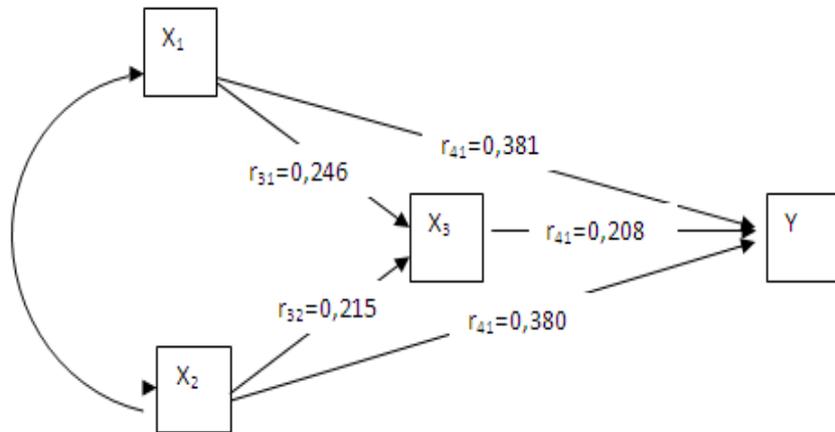


Figure 2: Constellation of the Coefficient

Next is path coefficient calculation and it is done with the help of structural equation modeling or SEM (Jogiyanto, 2011), using Lisrel version 8.80. Here, we come to the result as follows: $\beta_{31} = 0,10$; $\beta_{32} = 0,17$; $\beta_{41} = 0,07$; $\beta_{42} = 0,87$; and $\beta_{43} = 0,34$. The summary of this calculation can be better understood by putting them into Table 3.

No	Variable	Path Coefficient (ρ)		t_{table} $\alpha = 0,05$	t_{table} $\alpha = 0,01$
		SLF*	$t_{\text{calculation}}$		
1	Y on X_1	0,07	6,98	1,960	1,665
2	Y on X_2	0,87	90,09	1,960	1,665
3	Y on X_3	0,34	35,03	1,960	1,665
4	X_3 on X_1	0,10	1,41	1,960	1,665
5	X_3 on X_2	0,17	2,37	1,960	1,665

*= Standardized Loading Factor

Table 3: Summary of Path Coefficient

To make clearer relations amongst variables involved in the study, it will be shown in Figure 3 how each of the variable interact each other. The figure below explains sub-structure of the model to show how those variables (X_1 , X_2 , X_3 , and Y) interacts. Complete result of Sub-structure 1 analysis can be explained by showing that $Y = \rho_{Y1} X_1 + \rho_{Y2} X_2 + \rho_{Y3} + \varepsilon_1$.

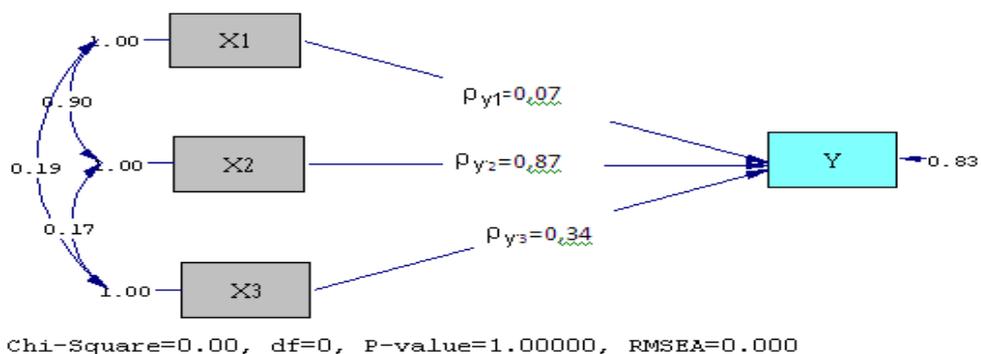


Figure 3: Model of Sub-structure 1

Analysis on Sub-structure 1 elaborated above will give us background to draw conclusions based on hypotheses 1, 2 and 3.

Next, it needs to do an analysis on the model of Sub-structure 2 that will be easily explained through Figure 4, they are relations amongst X_1 and X_2 on X_3 . Analysis on this model is expressed as follows, $X_3 = \rho_{31} X_1 + \rho_{32} X_2 + \varepsilon_2$. Analysis on the Sub-structure 2 will be the rationale to conclude the results for hypotheses 4 and 5.

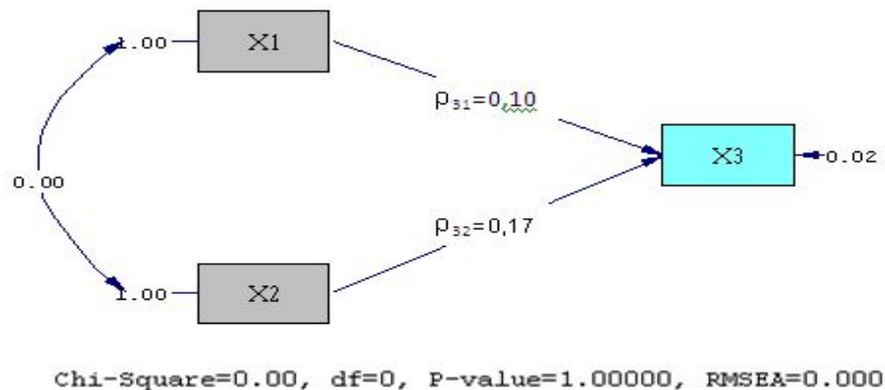


Figure 4: Model of Sub-structure 2

Hypothesis Testing 1

Hypothesis 1 stated that mathematics achievement (Y) is directly influenced by attitude towards mathematics (X_1). It means that $H_0 : \beta_{y1} \leq 0$ or $H_1 : \beta_{y1} > 0$. Calculation of path coefficient for this causal model comes to $\beta_{y1} = 0.07$ where $t_{\text{calculated}} = 6,98$ and $t_{\text{table}} = 1.960$ at $\alpha = 0.05$. As $t_{\text{calculated}} > t_{\text{table}}$, then H_0 is rejected. It implies that mathematics achievement is directly influenced by attitude towards mathematics.

Hypothesis Testing 2

Hypothesis 2 stated that mathematics achievement (Y) is directly influenced by motivational achievement (X_2). This means that $H_0 : \beta_{y2} \leq 0$ or $H_1 : \beta_{y2} > 0$. The calculation shows that path coefficient for $\beta_{y2} = 0,87$ where $t_{\text{calculated}} = 90.09$ and $t_{\text{table}} = 1.960$ at $\alpha = 0.05$. As $t_{\text{calculated}} > t_{\text{table}}$ then H_0 is rejected. This implies mathematics achievement is directly influenced by motivational achievement.

Hypothesis Testing 3

Hypothesis 3 stated that mathematics achievement (Y) is directly influenced by tutorial participation (X_3). This means that $H_0 : \beta_{y3} \leq 0$ or $H_1 : \beta_{y3} > 0$. The result shows that path coefficient $\beta_{y3} = 0,34$ where $t_{\text{calculated}} = 35.03$ and $t_{\text{table}} = 1.960$ at $\alpha = 0.05$. As $t_{\text{calculated}} > t_{\text{table}}$, then H_0 is rejected. This means that mathematics achievement is directly influenced by tutorial participation.

Hypothesis Testing 4

Hypothesis 4 stated that tutorial participation (X_1) is directly influenced by attitude toward mathematics (X_3). This implies that $H_0 : \beta_{31} \leq 0$ or $H_1 : \beta_{31} > 0$. The result shows that path coefficient $\beta_{31} = 0.10$ where $t_{\text{calculated}} = 1.41$ and $t_{\text{table}} = 1.960$ at $\alpha = 0.05$. As $t_{\text{calculated}} < t_{\text{table}}$, then H_0 is accepted. This means that tutorial participation is not significantly directly influenced by attitude toward mathematics.

Hypothesis Testing 5

Hypothesis 5 stated that tutorial participation (X_3) is directly influenced by motivational achievement (X_2). This implies that $H_0 : \beta_{32} \leq 0$ or $H_1 : \beta_{32} > 0$. The result shows that path coefficient $\beta_{32} = 0.17$ where $t_{\text{calculated}} = 2.37$ and $t_{\text{table}} = 1.960$ at $\alpha = 0.05$. As $t_{\text{calculated}} > t_{\text{table}}$ then H_0 is rejected. This means that tutorial participation is directly influenced by motivational achievement.

Based on the direct influence as can be seen in Figure 3 and Figure 4, then findings of this inquest can objectively described in five vital points, as follows:

- (1) Attitude towards mathematics measured by mathematics achievement has direct and positive influence on the level of learning outcome in mathematics. This implies that learning outcome in mathematics can be positively explained by attitude towards mathematics.
- (2) Motivational achievement measured by mathematics achievement has direct and positive influence on the level of learning outcome in mathematics. This implies that learning outcome in mathematics can be positively explained by motivational achievement.
- (3) Tutorial participation measured by mathematics achievement has direct and positive influence on the level of learning outcome in mathematics. This implies that learning outcome in mathematics can be positively explained by tutorial participation.
- (4) Attitude toward mathematics measured by tutorial participation has direct influence on the level of tutorial participation. This implies that tutorial participation can be positively explained by attitude toward mathematics.
- (5) Motivational achievement measured by tutorial participation has direct and positive influence on tutorial participation. This implies that tutorial participation can be explained by motivational achievement.

Concluding Remarks

Having answered all the hypotheses, it can be concluded that learning outcome in mathematics was influenced directly by attitude toward mathematics, motivational achievement and participation in the tutorial activities. This means that teachers can reflect on this result by giving more illustration to those students whose doing mathematical subjects that motivational aspect is also important apart from strong logical thinking. In other words, learning mathematics should also use both right and left brain simultaneously. This is important as so many beliefs saying that learning mathematics can only be effectively accomplished if you have a strong left brain. This finding assured us that it would be much better if teachers are able to deliver this finding to students in how to achieve high performance in mathematical subjects. This is also relevant to one of the calls of the 21st century skills, i.e., problem solving and critical thinking aspects, as mathematics is considered to be one of foundations course of them. Last but not least, if this result is applicable according to Indonesian teachers, it would also be possible for other teachers all over the places.

Acknowledgement: We would like to express our great appreciation to Udan Kusmawan, Ph.D., the Dean of Faculty of Education and Teacher Training, Universitas Terbuka for his support to make this paper possible.

References

- Alam, B.I. (2012). Peningkatan Kemampuan Pemahaman dan Komunikasi Matematika Siswa SD melalui Pendekatan Realistic Mathematics Education. *Paper*, presented on *Seminar Nasional Matematika dan Pendidikan Matematika*, 10 November 2012, di Jurusan Pendidikan Matematika FMIPA UNY, Yogyakarta, pp. 1-16.
- Arikunto, S. (2003). *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.
- Gronlund, N.E & R, Linn. (1990). *Measurement and Evaluating in Teaching*. New York: MacMillan Publishing Company.
- Jogijanto. (2011). *Konsep dan Aplikasi Structural Equation Model*. Yogyakarta: UPP STIM YKPN.
- Muhidin, S.A & A. Soemantri. (2006). *Aplikasi Statistika dalam Penelitian*. Bandung: Pustaka Setia.
- Ngatiqoh, S. (2012). Pengaruh Motivasi Berprestasi dan Kreativitas Berpikir terhadap Prestasi Belajar IPA (Fisika) Kelas VIII SMP Negeri se-Kabupaten Purworejo Tahun Pelajaran 2011/2012. *Jurnal Radiasi Vol 1* (1), pp. 24-27.

- Panen, P. (1999). *Pendidikan Terbuka dan Jarak Jauh: Pengertian Terbuka Jarak Jauh*. Jakarta: Universitas Terbuka.
- Pardjono. (2007). Kemadirian Belajar Mahasiswa Pendidikan Teknik Mesin ditinjau dari Asal Sekolah, Tempat Tinggal dan Lama Studi.” *Jurnal Cakrawala Pendidikan* Nomor 1 Tahun XXVI, pp. 83-104.
- Sappaile (2008). Pengaruh Tipe Tes dan Motivasi Berprestasi Terhadap Hasil Belajar Peserta Didik SMAN 30 DKI Jakarta. *Jurnal Pendidikan dan Kebudayaan*, No. 072, Tahun ke-14, Mei 2008, p. 474.
- Sarwono, J. (2011). *Path Analysis*. Jakarta: Elex Media Komputindo.
- Singarimbun, M & S. Effendi. (1989). *Metode Penelitian Survei*. Jakarta: LP3ES.
- Siskandar. (2008). Sikap dan Motivasi Siswa dalam Kaitan dengan Hasil Belajar Matematika. *Jurnal Pendidikan dan Kebudayaan*, No. 072 Tahun ke-14, Mei 2008, pp. 438-451.
- Sugijono. (2012). *Metode Penelitian Kombinasi*. Bandung: Alfabeta.
- Syah, M. (2008). *Psikologi Belajar*. Jakarta: PT. Raja Grafindo Persada.
- Universitas Terbuka. (2009). *25 Years Making Higher Education Open for All Indonesians*. Jakarta: Universitas Terbuka.
- Universitas Terbuka. (2012). *Katalog Program Pendas*. Jakarta.
- Uno, H.B. (2001). *Pengembangan Instrumen untuk Penelitian*. Jakarta: Delima Press.