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Article

Factors Affecting the Ability of Science Pre-Service Teachers of Elementary Education in Indonesia

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ABSTRACT

This study aims to obtain information on the effect of attitudes towards science, achievement motivation and learning activities on science learning outcomes. This research has been conducted in the elementary school teacher education institutions in Jakarta, Bogor and Tangerang District, Indonesia. In this study, 200 samples were randomly selected, and data was collected through a survey. The respondents were the students who took the science course. This study used quantitative approach, survey methods, and path analysis. Data were analyzed using descriptive analysis, analysis of the requirement test, and inferential analysis. The research findings indicate: 1) science learning outcomes are positively influenced directly by attitudes towards science, achievement motivation and learning activities, 2). learning activities are directly influenced positively by attitudes towards science and achievement motivation. on these findings, it can be concluded that the increase in science learning outcomes is influenced by attitudes towards science, achievement motivation and learning activities.

INTRODUCTION

In the learning process, the teacher functions as a facilitator, who has the task of providing various facilities needed by students in carrying out learning activities. Students as one of the components of the learning system have a unique character, wherein students there are many aspects that can affect their efforts and success in carrying out the learning process, both physical and psychological aspects. In the psychological aspects, including motivation, attitudes, interests, talents, perceptions and intellectual abilities. Motivation as the overall driving force of students within students that leads to learning activities, ensures continuity of learning activities and provides direction for learning activities, so that the desired goals of students can be achieved. Motivation is the drive and strength in a person to carry out certain goals that he wants to achieve (Gareau et al., 2019).

The factors that affect learning can be divided into three types, namely 1) internal factors (internal factors), namely students' physical and spiritual conditions 2) external factors (factors

from outside the student), namely environmental conditions around students 3) approach to learning factors, namely the types of student learning efforts that include strategies and methods used by students to carry out learning activities of subject matter (Kaneko et al., 2018).

The success of students in their education is also influenced by their achievement motivation. Achievement motivation is the driving force that enables a person to succeed in achieving what he desires. A person who has high achievement motivation tends to always try to achieve what he wants even though he experiences obstacles and difficulties in achieving it. The motivation that is in someone will manifest a behavior that is directed at the goal of achieving goals or satisfaction, one's learning success cannot be separated from the motivation of the person concerned, therefore basically learning motivation is a factor that greatly determines one's learning success.

One of the internal factors that can affect a person's learning outcomes is attitude. Attitude can be defined as a tendency to act which is usually associated with certain learning objects. In the learning process, attitudes can be linked to a course or with a lecturer who teaches the subject, in this case the science course. Attitudes can be positive as well as negative. In general, it can be assumed that a positive attitude will have a positive impact on student learning outcomes. Conversely, a negative attitude will have a negative impact on the tendency of student activity. The problem is how students who have negative attitudes or positive attitudes will still have high motivation to achieve, so that in the end they can improve their learning achievement.

In this case, attitude also has a significant contribution to student learning success, so that one of these psychological aspects needs serious attention. In this context, the researcher is interested in examining the attitudes of education students towards science courses, because science courses are compulsory subjects that need to be studied. Conditions like this will have an impact on students' attitudes towards science courses.

Researches that have been carried out related to the variables in this study which are the background of the problem are: research on student attitudes and motivation has a positive influence on mathematics learning outcomes (Siskandar, 2008), research on the effect of achievement motivation and creativity thinking on Science learning achievement (Physics) class VIII SMP Negeri Purworejo regency 2011/2012 academic year (Ngatiqoh et al., 2012), research on the effect of test types and achievement motivation on mathematics learning outcomes of students at SMAN 30 DKI Jakarta (Sappaile, 2008), and research on improving elementary students' mathematical understanding and communication skills through the Realistic Mathematics Education (RME) approach (Alam, 2012), and research on the learning independence of mechanical engineering education students in terms of school origin, residence and length of study (Pardjono, 2007).

The conclusion of the researchers mentioned above is that contextual science learning has an influence on students' attitudes towards science, and there is a positive and significant correlation between science attitudes and learning motivation together on science learning outcomes, and there is no difference in student learning independence when viewed. from school origin, also in terms of residence and also when viewed from the length of study. This research was conducted to determine the effect of attitudes towards science, achievement motivation and learning activities on science learning outcomes.

METHODS

This study uses a quantitative approach, survey methods, and path analysis techniques. In this research, the target population is all elementary school teacher candidates in Jakarta, Bogor and Tangerang. Meanwhile, the affordable population is all Elementary School Teacher Education students. The selected samples were respondents from all students from DKI, Bogor and Tangerang Regency who took the science course, totaling 200 people.

The analysis used includes descriptive analysis, analysis of the requirements test, and inferential analysis. The test requirements are: 1) The data normality test uses the regression equation to test the normality of the regression linearity estimation error using the Lilliefors technique, 2) The regression linearity test, uses the regression equation test with Analysis of variance (ANOVA). Inferential analysis is used to analyze the sample data, and the results will be generalized to the population from which the sample was drawn. Data analysis to test the hypothesis using path analysis.

RESULTS AND DISCUSSION

This study includes four variables, namely: Science Learning Outcomes (Y) as the dependent variable, while Attitudes Toward Science (X1), Achievement Motivation (X2), and Learning Activities (X3) as independent variables. A summary of statistical descriptions for all research variables is presented in Table 1.

Table 1. Summary Statistical Descriptions

Data distribution	Variable			
	Attitude Toward Science (X_1)	**Achievement motivation (X_2)**	**Learning activity (X_3)**	**Science learning outcome (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
Standard Deviation	12.894	13.019	5.06187	2.13277
Varian	166.274	169.496	25.623	4.54

Based on table 1 above, it can be explained that after the data was analyzed through descriptive statistics, it showed the mean score, standard deviation and variance of the variance of each variable (attitude, individual motivation, activity and science learning outcome scores) from a sample of 200 students. This data will then be tested directly through the correlation path coefficient between each variable.

All test requirements analysis has been carried out, so that it can be continued with hypothesis testing by first calculating the path analysis. The first step presents the correlation coefficient between variables which is presented in the form of a correlation coefficient matrix as in Table 2.

Table 2. Correlation Coefficient

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

Based on the correlation coefficient contained in the correlation matrix between variables above, a complete inter-variable constellation can be made with a correlation coefficient as shown in Figure 1.

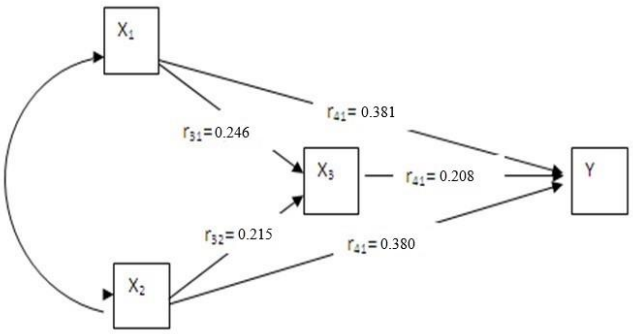

Figure 1. A complete inter-variable constellation with a correlation coefficient

Furthermore, the calculation of the path coefficient is done through the Structural Equation Modeling (SEM) program LISREL 8.80 Full Version. The calculation results obtained the path coefficient β31 = 0.10; β32 = 0.17; β41 = 0.07; β42 = 0.87; and β43 = 0.34. A summary of the calculation of the path coefficient, t-value, and t-value is presented in the following Table 3.

Table 3. Summary of the Results of the Calculation of the Path Coefficient, t-value

No.	Variable	Path Coefficient (ρ)		t-table	t-table
		SLF*	T count	α = 0.05	α = 0.01
1.	Y - X_1	0.07	6.98	1.960	1.665
2.	Y - X_2	0.87	90.09	1.960	1.665
3.	Y - X_3	0.34	35.03	1.960	1.665
4.	X_3 - X_1	0.10	1.41	1.960	1.665
5.	X_3 - X_2	0.17	2.37	1.960	1.665

**Standardized Loading Factor*

To clarify the relationship between latent variables in this study, a substructure model image is presented that explains the relationship between variables X1, X2, X3, and Y.

Sub-Structure Model 1

The results of the sub-structure 1 test are fully explained through the path diagram between X1, X2, X3 to Y (Figure 2). The analysis model for the path coefficient of sub-structure 1 is expressed in the equation Y = ρY1 X1 + ρY2X2 + ρY3 + ε1.

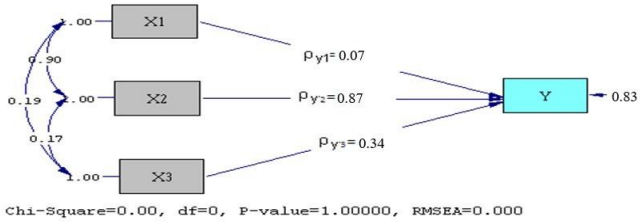

Figure 2. Path diagram between X1, X2, X3 to Y

Testing the path coefficient of the sub-structure model 1 will provide decision making to test hypotheses 1, 2 and 3.

Sub-Structure Model 2

The results of the sub-structure 2 test are completely explained through the path diagram between X1, X2 and X3 (Figure 3). The substructure path coefficient analysis model 1 is expressed in the equation X3 = ρ31 X1 + ρ32X2 + ε2.

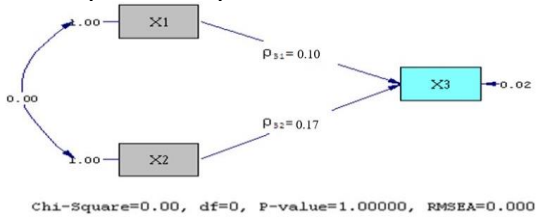

Figure 3. The path diagram between X1, X2 and X3

Testing the path coefficient of the sub-structure model 2 will provide decision making on hypothesis testing 4 and 5.

Based on the regression output of model II in the figure above, it is known that the three variables are X1: 0.07, X2: 0.87 and X3: 0.34 which is greater than 0.05. These results conclude that the regression variables in Model I and II are attitude, achievement motivation and learning activities which have a direct influence on science learning outcome variables.

The loading factor path coefficient which shows the score of the influence of students' attitudes, motivation and activities on students' science learning outcomes is 0.432. The test results obtained for each t count between variables were 6.98 and 90.09 and 35.03 and 1.41 and 2.37 = > t table = 1.96 at α = 0.05 which shows the path coefficient is very significant.

This means that the hypothesis which states that students' attitudes, motivation and activities have a direct positive influence on students' science learning outcomes can be proven.

1. First Testing Hypothesis :

The first hypothesis states that attitudes towards science (X1) have a positive direct effect on science learning outcomes (Y).

H0: βy1 ≤ 0

H1: βy1 > 0

The results of the calculation of the path coefficient for the hypothesized causal model obtained the path coefficient value β y1 = 0.07 with t-count = 6.98 and t-table = 1.960 at α = 0.05. Because the value of t-count> t-table, then H0 is rejected. That is, the first hypothesis is tested, that the attitude variable towards science has a positive effect on the variable science learning outcomes.

2. Second Hypothesis Test

The second hypothesis states that achievement motivation (X2) has a positive direct effect on science learning outcomes (Y).

H0: βy2 ≤ 0

H1: βy2 > 0

The results of the calculation of the path coefficient for the hypothesized causal model obtained the path coefficient value β y2 = 0.87 with t-count = 90.09 and t-table = 1.960 at α = 0.05. Because the value of t-count> t-table, H0 is rejected. That is, the second hypothesis is tested, that the achievement motivation variable has a positive direct effect on science learning outcomes.

3. Third Hypothesis Test

The third hypothesis states that learning activities (X3) have a positive direct effect on science learning outcomes (Y).

H0: βy3 ≤ 0

H1: βy3 > 0

The results of the calculation of the path coefficient for the hypothesized causal model obtained the path coefficient value βy3 = 0.34 with t-count = 35.03 and t-table = 1.960 at α = 0.05. Because the value of t-count> t-table, then H0 is rejected. That is, the third hypothesis is tested, that the learning activity variable has a positive direct effect on the science learning outcome variable.

4. Fourth Hypothesis Test

The fourth hypothesis states that attitudes towards science (X1) have a positive direct effect on learning activities (X3).

H0: β31 ≤ 0

H1: β31 > 0

The results of the calculation of the path coefficient for the hypothesized causal model obtained the path coefficient value β 31 = 0.10 with t-count = 1.41 and t-table = 1.960 at α = 0.05. Because the value of t-count <t-table, then H0 is accepted. That is, the fourth hypothesis

is not tested, that the attitude variable towards science has a positive but insignificant direct effect on the variable science learning outcomes.

5. Fifth Hypothesis Test

The fifth hypothesis states that achievement motivation (X2) has a positive direct effect on learning activities (X3).

H0: $\beta 32 \leq 0$

H1: $\beta 32 > 0$

The results of the calculation of the path coefficient for the hypothesized causal model obtained the path coefficient value β 32 = 0.17 with t-count = 2.37 and t-table = 1.960 at α = 0.05. Because the value of t-count> t-table, H0 is rejected. That is, the fifth hypothesis is tested, that the achievement motivation variable has a positive effect on the learning activity variable.

Based on the direct influence on the path analysis image above, the findings of this study are objectively explained as follows:

1. Attitudes towards science as measured by science learning outcomes have a positive direct effect on the level of student learning outcomes. Thus the high and low science learning outcomes can be explained by attitudes towards science (Cakır & Solak, 2015; Kleebbua & Siriparp, 2016; Schumm & Bogner, 2016).
2. Achievement motivation as measured by science learning outcomes has a positive direct effect on the level of student learning outcomes. Thus the high and low science learning outcomes can be explained by achievement motivation (Liu, 2020; Pérez et al., 2018; Urea, 2015).
3. Learning activities that are measured by student learning outcomes have a positive direct effect on the level of student learning outcomes. Thus the high and low student learning outcomes can be explained by learning activities (Aslan et al., 2020; Muro et al., 2018).
4. The attitude towards science as measured by learning activities has a positive direct effect on the level of student learning activities, but it is not significant. Thus the level of learning activities cannot be explained only by attitudes towards science alone. This can be because students have an attitude towards science but do not have action (Colomeischi & Colomeischi, 2015; Simon et al., 2018).

Achievement motivation as measured by learning activities has a positive direct effect on the level of student learning activities. Thus the level of learning activities can be explained by achievement motivation (Bernard, 2016; Murthy et al., 2019).

Based on data analysis above that examines the influence of student attitudes on science learning outcomes, this significant conclusion is clear and confirms that science learning outcomes are influenced by many factors, one of which is attitude. As stated by Leone L (1999), attitude is one of the influencing factors on student learning behavior, as is the case in studying science, meaning that positive or negative attitudes will directly influence student performance, this is supported by Herguner et.al (2020) that attitude influences a person's learning outcomes or readiness.

Furthermore, analysis of the achievement motivation variable, which has a direct influence on science learning outcomes, proves a significant conclusion. Conceptually, it is relevant that learning is a complex process, this proves that learning outcomes are influenced by many factors, namely internal and external factors. This is supported by Anderman, E.M (2020) that achievement motivation is a person's intrinsic factor that can encourage better learning outcomes. Also confirmed by If referring to the statement by Maehr M.L and Douglas D (1971) that achievement motivation is an important component in obtaining the best learning achievements. Because achievement motivation contains dimensions of ability, effort and mood, this is relevant to the research results of Hermans, H. J. (1970).

Analysis of data on the influence of student activity variables on science learning outcomes proves significant positive results, meaning this hypothesis is accepted. These

findings have proven that science learning outcomes are influenced by direct factors of student activity. This is supported by Camp (1990) and Ellis (2019) that learning is a change in behavior resulting from experience and training. This means that learning outcomes are changes in behavior, both regarding knowledge, skills and attitudes, even covering all aspects of the organism or personality that occur after someone learns through experience and have a relatively permanent impact. Therefore, active experience will influence the achievement of learning goals. This is relevant to the statement by Casey and David Azcona (2017) that optimal training activities will influence learning outcomes.

Thus it can be synthesized that the dimensions of attitude, achievement motivation and activity have a positive influence on science learning outcomes. This finding has implications if teachers want to improve science learning outcomes then they need to increase positive attitudes, high achievement motivation and optimize students' activities in learning through a learning process that is quality.

CONCLUSION

Based on the research results, several conclusions can be made as follows:

1. There is a positive effect on attitudes towards science which is significant on learning outcomes.
2. There is a positive direct effect on motivation which is significant on learning outcomes.
3. There is a positive direct effect of significant learning activities on learning outcomes.
4. There is a positive direct effect on attitudes towards science but not significant on learning activities.

There is a positive direct influence of achievement motivation which is significant on learning activities.

Based on the conclusion above, it is clear that the factors of attitude, achievement motivation and activity have a positive influence on science learning outcomes in elementary school teacher education students. This conclusion has implications if lecturers hope to improve science learning outcomes, they need to stimulate positive attitudes, high achievement motivation and optimize their students' activities. in study.

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