

Does Pre-Service Elementary Teachers' Attitude Towards Science Affect Their Science Teaching Efficacy?

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Abstract: The Primary School Teacher Education Study Programme is responsible for preparing community members who have academic qualifications and competencies as learning agents. This readiness is the main capital for students to do the work of a teacher. In providing education to students, a teacher should have self-efficacy. This research is a quantitative study with an ex-post facto research type. The objectives of this study determine whether there is an effect of attitudes toward science on the efficacy of teaching science subjects. 147 4th-semester students majoring in Elementary School Teacher Education, Yogyakarta State University, were involved. The data collection technique used a questionnaire using a Dimensions of Attitude Towards Science (DAS) Instrument and The Science Teaching Efficacy Belief Instrument (STEBI-B). The study revealed a significant influence between attitudes toward science and the science teaching efficacy of elementary school teacher education students. The results of the analysis revealed that the coefficient of determination is 0.322, which means that 32.2% of variations in science teaching efficacy can be explained by attitude towards science.

Keywords: Pre-Service Elementary Teacher; Attitude Towards Science; Science Teaching Efficacy.

Introduction

The teaching profession has enormous roles and responsibilities in the teaching field (Hasnawati et al., 2022). The effectiveness of education in the learning process is dependent on the teacher's capacity to process learning, which can generate situations in which students can learn (Zagoto, 2019). Indeed, teachers in elementary schools can only be done by some, because teachers must be competent in their fields (Haqqi et al., 2021). The Primary School Teacher Education Study Programme is responsible for preparing community members who have academic qualifications and competencies as learning agents (Taufik, 2016). This readiness is the main capital for students to do the work of a teacher and determine whether the quality of pre-service teachers will lead to the quality of education (Hidayah, 2018). Many subjects pre-service elementary

school teacher education teachers must master, one of which is science (Asrial et al., 2019).

Science education should be holistic and aim to motivate students to be able to understand the science topics studied by relating the material to the context of daily life, be it personal, social, or cultural so that they can apply their knowledge and skills adaptively to a problem or issue in the future (Nurhayati et al., 2023; Purnamasari & Nurawaliyah, 2021). Science learning in elementary school is important for students to develop thinking and scientific skills (Taufik, 2016). Teachers and students as pre-service primary school teachers must have and distribute new ideas about science learning materials in primary schools (Asrial et al., 2019).

In science teaching and learning at all levels of education, the development of positive attitudes and interest in science has become one of the main objectives, including at the university level. Learning outcomes in the attitude domain are as important as learning

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outcomes in the cognitive and psychomotor domains, as a significant relationship exists between attitude toward science and learning outcomes and academic achievement (Jeffery et al., 2016; McDonald et al., 2021; Sofiani et al., 2017). Attitudes toward science can limit a person from believing in unscientific information, and attitude towards science is also related to a person's habit of accepting scientific truth. Under certain conditions, a person's attitude toward science will determine his level of trust in science (Wintterlin et al., 2021). Whether a person is happy with science can be observed from the responses given (Wassalwa et al., 2022). A person's attitudes toward science are seen from how they respond to science in the form of both interests in science and difficulty in science (Tanti et al., 2021).

Science education engages students in inquiry-based investigations with teachers and peers, develops connections between prior science knowledge and understanding, implements science concepts to new questions, and encourages problem-solving, planning, evidence-based reasoning, and group discussions (sitasi). Therefore, teachers are expected to have experience with active science learning strategies (Rahmadani et al., 2023). In providing education to students, a teacher should have self-efficacy. A person can use their potential optimally if self-efficacy supports it (Dewi & Dalimunthe, 2022). Teachers with high self-efficacy are also reflected in their pedagogical success and the achievements of their students (Cansoy & Parlar, 2018). In addition to self-efficacy, a teacher must also have teaching efficacy. Teaching efficacy is a belief in organizing effective learning (Weasmer & Woods, 1998).

Several studies on attitudes toward science and science teaching efficacy have been conducted. Purnamasari and Nurawaliyah (2021) carried out a study to investigate the profile of attitudes towards science of pre-service teacher students in ethnoscience learning. The research results by Mazaz and Bravo Torija (2018) show that most pre-service early childhood and elementary teachers have a positive attitude toward science. In addition, the variable that influences teacher attitudes toward science is previous education (Mazas & Torija, 2018). Research conducted by Eric et al. (2018) revealed a significant relationship between attitudes toward science pre-service science teachers and science teaching efficacy.

The results study of Kırık (Taştan Kırık, 2013) showed that science teaching attitudes affect science teaching efficacy. The study conducted by Aydede (2022), showed that there is a correlation between attitudes toward science and science teaching efficacy. In addition, attitudes toward science and science teaching efficacy affect science teaching skills (Aydede, 2022). The research results by Durmus et al. (2016) showed that

early childhood teachers have higher science teaching efficacy than pre-service early childhood teachers (students). The results of Menon's research (2021) show differences in elementary education students' science teaching efficacy before and after taking a science methods course.

Previous studies show that there is still a lack of study on pre-service elementary teachers' attitudes toward science and science teaching efficacy, especially in Indonesia. Furthermore, research that examines whether or not there is an influence of attitude towards science on the science teaching efficacy is still rare as well. Therefore, the objective of this study is to find out the effect of pre-service elementary teachers' attitudes toward science on their science teaching efficacy.

Method

This study was carried out at Yogyakarta State University in the Elementary School Teacher Education department in the 2022/2023 academic year. This research is an ex-post facto research with causal or relationship type. This study aims to determine whether there is an effect of attitudes toward science on the efficacy of teaching science subjects. The participants in this study were 147 4th semester students majoring in Elementary School Teacher Education, Yogyakarta State University. The following is a description of the relationship between the research variables:

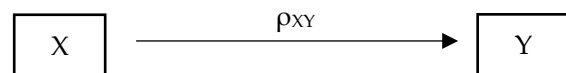


Figure 1. Path Diagram

Information:

- X = Attitude Towards Science
- Y = Science Teaching Efficacy
- ρ_{xy} = Path coefficient of Attitude Towards Science on Science Teaching Efficacy

This study used the Dimensions of Attitude towards Science (DAS) Instrument developed by van Aalderen-Smeets and van der Molen (2013) with a five-point Likert scale. In addition, another instrument used was the Science Teaching Efficacy Belief Instrument (STEBI-B) developed by Enochs and Riggs (1990) with a five-point Likert scale. The method of data analysis used inferential statistics. The analysis used to test the hypothesis is a simple linear regression analysis with the independent variable attitude towards science and the dependent variable science teaching efficacy.

Result and Discussion

Data on attitudes toward science and science teaching efficacy were obtained through questionnaires given to 4th-semester students majoring in Elementary School Teacher Education at Yogyakarta State University who became participants. After completing the data collection procedure, data analysis was performed, which included: (1) verifying the requirements of analysis, which include a normality test, a linearity test, and a significance test for regression analysis; and (2) testing the hypothesis. Before conducting linear regression analysis, the classical assumption test was performed.

Normality Test

The normality test is needed in regression analysis to check if the residual value is normally distributed as part of the classic assumption test. A decent regression model will have residual values with a normal distribution. The normality test was carried out using the Kolmogorov-Smirnov. If the significance value is greater than 0.05, The residuals follow a normal distribution, and if it is lower than 0.05, they are distributed abnormally. Table 1 is the result of normality testing using Jamovi version 2.3.

Table 1. Normality Test Results

	Statistic	p
Kolmogorov-Smirnov	0.072	0.438

From Table 1, the p-value is 0.438, which is greater than 0.05. So, the residual value can be concluded to be normally distributed.

Heteroscedasticity Test

Table 2. Heteroscedasticity Test Results

	Statistic	p
Breusch-Pagan	0.771	0.380
Goldfeld-Quandt	1.02	0.472
Harrison-McCabe	0.495	0.491

The heteroscedasticity test seeks to determine whether the residuals of one observation differ significantly from those of another in the regression model. If the significance value is greater than 0.05, then there is no heteroscedasticity, and vice versa. Based on the heteroscedasticity test, it is known that all significance values > 0.05; This indicates that there is no heteroscedasticity, as the p-value is greater than 0.05 and the regression requirements are satisfied.

Simple Linear Regression Analysis

The objective of simple regression analysis is to determine the influence of the independent variable (X) on the dependent variable (Y). The R-value ranges from 0 to 1; the closer it is to 1 indicates a greater relationship and the closer it is to 0 indicates a weaker relationship. The regression equation between Y and X is $Y = a + bX$. Table 3 shows a constant of 21.612 and a regression coefficient of 0.631. Thus, the relationship between attitudes toward science and science teaching efficacy is shown by the linear regression equation $= 21.612 + 0.631X$. It can be interpreted that whenever attitude towards science and science teaching efficacy is measured, a one-unit increase in attitude towards science is followed by a 0.631 increase in science teaching efficacy. According to Table 3, it is obtained that the p-value < 0.001. This means that variable X has a significant effect on variable Y. Based on Table 4, the coefficient of determination is 0.322, which means that only 32.2% of variations in science teaching efficacy can be explained by attitudes towards science.

Table 3. Results of Linear Regression Analysis (Model Coefficients - STEB)

Predictor	Estimate	SE	t	p
Intercept	21.612	7.1068	3.04	0.003
ATS	0.631	0.0761	8.29	<.001

Table 4. Coefficient of Determination (Model Fit Measures)

Model	R	R ²
1	0.567	0.322

Hypothesis Test

The objective of hypothesis testing is to investigate the relationship between variables and establish the extent of the independent variable's influence on the dependent variable. This study employs the t-test to find out whether variable X influences variable (Y) with a 95% confidence level or p-value of 0.05. As a result of the calculations and the verification of hypotheses in Table 3, it is known that the significance value for the effect of X on Y is less than 0.001. This indicates that H_0 is rejected and H_a is approved. Thus, there is a significant influence between attitude towards science and science teaching efficacy of 4th-semester students of Elementary School Teacher Education, Yogyakarta State University.

Based on the results of data analysis using Jamovi, there is an influence of attitude towards science with science teaching efficacy. The regression equation $= 21.612 + 0.631X$ demonstrates the relationship between attitudes toward science and science teaching efficacy. It can be interpreted that whenever attitude towards science and science teaching efficacy is measured, a one-unit increase in attitude towards science is followed by

a 0.631 increase in science teaching efficacy, meaning that the higher the attitude towards science, the higher the science teaching efficacy. The results of this analysis are relevant to several studies which state that there is a relationship between attitudes toward science and science teaching efficacy (Aydede, 2022; Eric et al., 2018).

Conclusion

Research conducted at Yogyakarta State University in the Department of Elementary School Teacher Education states that the results of attitudes toward science have an impact on the efficacy of pre-service teachers in teaching science. The relationship between attitudes towards science and science teaching efficacy is represented by the regression equation = $21.612 + 0.631X$. This indicates that if the attitude towards science and science teaching efficiency is measured, then each increase in the score of attitudes toward science by one unit will be followed by an increase in the score of science teaching efficacy by 0.631, meaning that the higher the attitude towards science, the higher the science teaching efficacy. The suggestion that can be recommended from the results of this study is to conduct other research on things that can improve the teaching efficacy of pre-service elementary school teachers.

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Author Contributions

Nur Afifah: conceptualization, writing-original draft preparation, methodology, formal analysis, investigation, visualization; Supartinah: writing - review and editing, supervision; Pratiwi Pujiastuti: validation, and resources.

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Conflicts of Interest

The authors declare no conflict of interest.

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