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Self-Efficacy of the Elementary School Pre-Service Teacher Students in Science Learning

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ABSTRACT
This study aimed to examine the self-efficacy profile of pre-service teachers from the Islamic Elementary School Teacher Education Program at Universitas Islam Negeri Syekh Ali Hasan Ahmad Addary in Padangsidimpuan, specifically focusing on their science teaching self-efficacy. Using a descriptive quantitative research design with a survey method, the study utilized a 26-item self-efficacy questionnaire. The data were analyzed descriptively, calculating the average percentage of students who demonstrated self-efficacy for each criterion within the corresponding indicators. The research involved 180 out of 207 fifth-semester students enrolled in the 2024/2025 academic year. A Google Form survey, structured according to the Science Teaching Self-Efficacy Belief Instrument (STEBI), assessed two key indicators: Science Teaching Outcome Expectancy (STOE) and Personal Science Teaching Efficacy (PSTE). Modifications were made to align the indicators with the specific context and characteristics of the participants. Additionally, a small group of respondents was interviewed. Findings revealed that 14.2% of students strongly agreed with the PSTE criterion, while 54.9% agreed. For STOE, 20.7% strongly agreed, and 51.1% agreed. When combining both indicators, 68.9% of students exhibited a high level of self-efficacy in PSTE, and 71.8% in STOE. Overall, the majority of aspiring MI/SD teachers demonstrated high self-efficacy in their science teaching abilities.

Keywords: *MI/SD pre-service teacher students; self-efficacy; science learning*

INTRODUCTION

Self-efficacy refers to the belief in one's ability to plan and execute the steps necessary to achieve specific goals. It is a core concept in social learning theory (Bandura, 1977) and plays a pivotal role in shaping an individual's motivation, performance, and overall success within educational contexts, particularly in science education. This concept laid the foundation for the development of the Science Teaching Self-Efficacy Belief Instrument (STEBI), a tool designed to assess the confidence of both current and prospective teachers in their ability to teach science effectively.

Self-efficacy encompasses not only technical competencies but also a person's belief in their ability to overcome challenges and attain goals (Bandura, 1977). As a domain-specific construct, self-efficacy beliefs are shaped by various factors and may vary depending on the context or discipline. Bandura identified four primary sources that influence the development of

self-efficacy beliefs (Hodges, 2008; Waddington, 2023). First, mastery experiences—successful task completion—are the most powerful influence, reinforcing a sense of competence, while failure may diminish confidence. Second, vicarious experiences, gained through observing the successes of others, enhance self-efficacy by fostering identification and modeling. Third, verbal persuasion, which involves providing constructive feedback and encouragement, can strengthen an individual's belief in their abilities. Finally, physiological and emotional states play a crucial role; feelings of calmness and emotional stability tend to enhance efficacy beliefs, while anxiety or stress may impede them. An understanding of these sources offers educators valuable insights into how to cultivate and enhance students' self-efficacy across various learning environments.

In the context of science education, self-efficacy significantly influences students' cognitive, practical, and problem-solving skills. Fauziana (2022) demonstrated that there is a positive correlation between students' self-efficacy and their ability to solve scientific problems, which directly affects their learning outcomes. Moreover, self-efficacy plays a critical role in shaping positive attitudes toward science, which are essential for future educators in crafting engaging and effective teaching strategies. Research has shown that students' self-efficacy in science fluctuates over time. For instance, Wilujeng (2009) found that although many students possessed foundational knowledge in science, they lacked sufficient confidence in their ability to teach science at the junior high school level. This finding underscores the need for pedagogical interventions, such as creative learning models and constructive feedback, that can help boost students' self-efficacy.

To design effective instructional strategies that enhance students' self-confidence, it is essential to understand their self-efficacy profiles in science learning. The goal is for students not only to grasp scientific content intellectually but also to possess the confidence to apply this knowledge both in the classroom and in everyday life. Therefore, this study aims to examine and characterize the self-efficacy profiles of aspiring MI/SD teacher students in science learning, focusing on two key aspects: Science Teaching Outcome Expectancy (STOE) and Personal Science Teaching Efficacy (PSTE). These dimensions are critical for all students aspiring to become future educators, as they are fundamental to effective teaching and learning in science.

METHODOLOGY

The primary aim of this study was to characterize the self-efficacy profile of MI/SD pre-service teacher students studying science at the Islamic Elementary Teacher Education Study Program of Universitas Islam Negeri Syekh Ali Hasan Ahmad Addary Padangsidimpuan. A descriptive quantitative survey approach was employed to gather data, incorporating both quantitative and qualitative methods to provide an in-depth description of a specific group in their natural context, without any experimental manipulation (Creswell, 2014; Sukmadinata, 2010).

The study focused on 180 student respondents, consisting of 11 males and 169 females, all of whom were in their fifth semester of the 2024–2025 academic year. The selection criteria for participants included students who had completed the Basic Science Concepts for Elementary School course in the third semester and the Science Learning for Elementary School course in the fourth semester. As a result, the study's findings on self-efficacy were grounded in the students' prior academic knowledge and experience.

Data were collected using a Self-Efficacy questionnaire, developed in alignment with the Science Teaching Self-Efficacy Belief Instrument (STEBI) (Riggs, I. M., & Enochs, L. G, 1990).

This questionnaire consisted of 25 items, divided into two key indicators tailored to the research context: Science Teaching Outcome Expectancy (STOE), which included 11 items, and Personal Science Teaching Efficacy (PSTE), which consisted of 14 items. The following table presents the questionnaire, outlining the indicators and sub-indicators related to the self-efficacy profile of MI/SD pre-service teacher students in the context of science education.

Table 1. Self-efficacy Questionnaire Indicators in Science Learning

No	Indicators	Sub-indicators	Types of statements		Number of statements
			Positive (+)	Negative (-)	
1	Personal Science Teaching Efficacy (PSTE)	Confidence in self abilities	1.2	15. 23	4
		Professional competence	3.17	13	3
		Confidence in facing challenges	5	6.18	3
		Mastery of science materials	8.12	21	3
		Flexibility in teaching	22		1
2	Science Teaching Outcome Expectancy (STOE)	Confidence in positive outcomes	10	4.11	3
		Expectations regarding students' abilities	14.19	24	3
		Efficacy on teaching impacts	20	9	2
		The influence of teaching approaches	7.25	16	3
Total Number			**14**	**11**	**25**

(Source: Researchers, 2024)

Table 1 presents the nine sub-indicators of self-efficacy, detailing four sub-indicators for the Science Teaching Outcome Expectancy (STOE) and five sub-indicators for Personal Science Teaching Efficacy (PSTE). The questionnaire used in this study included a total of 25 statements—11 negative and 14 positive—designed to assess students' self-efficacy. Each statement was accompanied by the following response options: strongly agree (SA), agree (A), uncertain (U), disagree (D), and strongly disagree (SD).

Before the questionnaire items were administered via a Google Form link to the student respondents, they underwent a validation process. Three experts—one in psychology, one in education, and one in language—reviewed the items for clarity, relevance, and accuracy. Based on their feedback, the researcher made necessary revisions to the items to ensure their validity before the final distribution. In addition to the questionnaire, data were also collected through brief interviews with a randomly selected group of respondents. The interviews aimed to provide more in-depth and detailed insights into the factors influencing students' self-efficacy in science learning.

The responses from all 180 student participants were analyzed using quantitative data analysis. To determine the self-efficacy of MI/SD pre-service teacher students in science learning, the percentage of responses for each criterion (SA, A, U, D, and SD) on each indicator (PSTE and STOE) was calculated. These percentages were then tabulated, and the average percentage for each sub-indicator was computed to provide an overall measure of self-efficacy.

RESULT AND DISCUSSION

The data for this study were obtained from the responses of 180 student participants who completed the questionnaire via Google Form. The findings of this study are presented in detail in Table 2 below.

Table 2. The Percentage of Self-Efficacy of the MI/SD Pre-Service Teacher Students in Science Learning

Self-Efficacy Indicators	Sub Indicators	Self-Efficacy Criteria				
		SA (%)	A (%)	U (%)	D (%)	SD (%)
Personal science teaching efficacy (PSTE)	Confidence in self abilities	15.1	56.8	17.8	8.5	1.8
	Professional competence	13.7	57.8	18.5	8.2	1.9
	Confidence in facing challenges	9.3	41.8	20.3	22.6	6.0
	Mastery of science materials	16.2	56.3	19.5	6.5	1.5
	Flexibility in teaching	16.7	61.7	20.6	1.1	0.0
	Average Score	**14.2**	**54.9**	**19.3**	**9.4**	**2.2**
Science teaching outcome expectancy (STOE)	Confidence in positive outcomes	19.6	49.8	11.1	14.8	4.7
	Expectations regarding students' abilities	33.0	51.5	8.5	5.4	1.7
	Efficacy on teaching impacts	15.3	50.0	19.2	13.1	2.5
	The influence of teaching approaches	15.0	53.2	21.1	8.9	1.9
	Average Score	**20.7**	**51.1**	**15.0**	**10.5**	**2.7**

(Source: Researchers, 2024)

Note: SA = Strongly Agree, A = Agree, U = Uncertain, D = Disagree, SD = Strongly Disagree

Table 2 displays the average percentage of students exhibiting varying degrees of self-efficacy across each sub-indicator. Among the PSTE indicators, the sub-indicator of flexibility in teaching had the highest self-efficacy levels, with 16.7% of students strongly agreeing (SA), 61.7% agreeing (A), and 20.6% expressing uncertainty (U). This suggests that the majority of students felt confident in their ability to adapt and adjust their teaching approaches in science education. Conversely, the sub-indicator of confidence in facing challenges demonstrated the highest proportions in the disagree (D) and strongly disagree (SD) categories, with 22.6% and 6.0%, respectively. This indicates that a notable portion of students lacked confidence in their ability to overcome obstacles in the science teaching context. For the criteria of strongly agree (SA) and agree (A), the confidence in facing challenges sub-indicator showed the lowest percentages, with only 9.3% and 41.8%, respectively, reflecting a gap in self-assurance among the students.

In terms of the confidence in self-abilities sub-indicator, the lowest percentage was observed in the uncertain (U) criterion, with 17.8% of respondents expressing uncertainty about their abilities. This suggests that some students were unsure about their capacity to effectively teach science. Additionally, the flexibility in teaching sub-indicator had the lowest percentages for the disagree (D) and strongly disagree (SD) criteria, with 1.1% and 0.0%, respectively, indicating minimal doubts about their ability to adapt teaching methods. Figure 1 provides a visual comparison of the percentage of students who believe they are capable of meeting the criteria for

each of the PSTE indicators, further illustrating the variations in self-efficacy among the respondents.

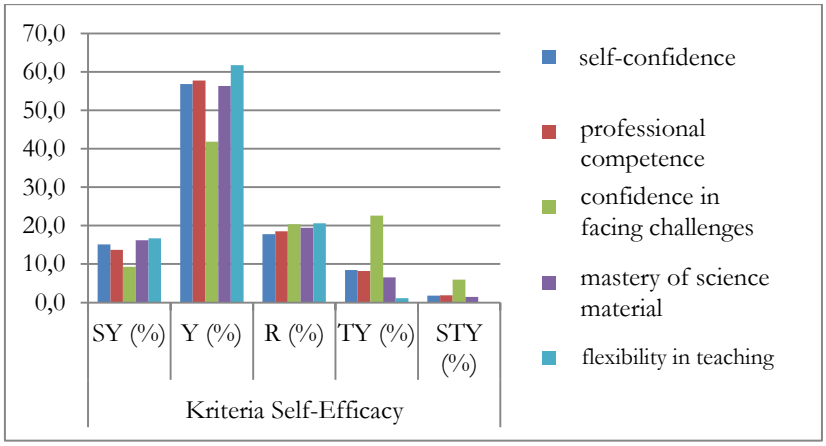

Figure 1. The Profile of Students' Self-Efficacy for PSTE Indicators

Figure 1 illustrates that the agree (A) criterion accounted for the highest proportion of student responses regarding self-efficacy within the PSTE indicators, with percentages ranging from 40% to 60% across all five sub-indicators among the 180 respondents. This finding indicates that more than 100 MI/SD pre-service teacher students demonstrated confidence in both their ability to effectively teach science in classroom settings and their comprehension of scientific concepts acquired during their coursework. In contrast, the strongly disagree (SD) criterion yielded the lowest proportions, ranging from 1% to 6%, suggesting that only a small minority—approximately ten students—expressed significant doubt about their capability to teach science in the future or fully understand the scientific principles studied.

Turning to the STOE indicators, the highest average percentage of responses under the strongly agree (SA) criterion was recorded in the sub-indicator expectations of students' abilities, at 33.0%. For the agree (A) and uncertain (U) criteria, the highest percentages appeared under the sub-indicator influence of teaching approaches, with 53.2% and 21.2%, respectively. Conversely, the sub-indicator confidence in positive outcomes recorded the highest percentages in the disagree (D) and strongly disagree (SD) categories, with 14.8% and 4.7%, respectively. The lowest percentage under the strongly agree (SA) criterion—15.0%—was also observed in the influence of teaching approaches sub-indicator. Additionally, the sub-indicator confidence in favorable outcomes had an agree (A) response rate of 49.8%. Notably, the expectations of students' abilities sub-indicator showed minimal skepticism, with only 8.5%, 5.4%, and 1.7% of students selecting uncertain (U), disagree (D), and strongly disagree (SD), respectively. These trends are further visualized in Figure 2, which compares the distribution of student self-efficacy across all STOE sub-indicators.

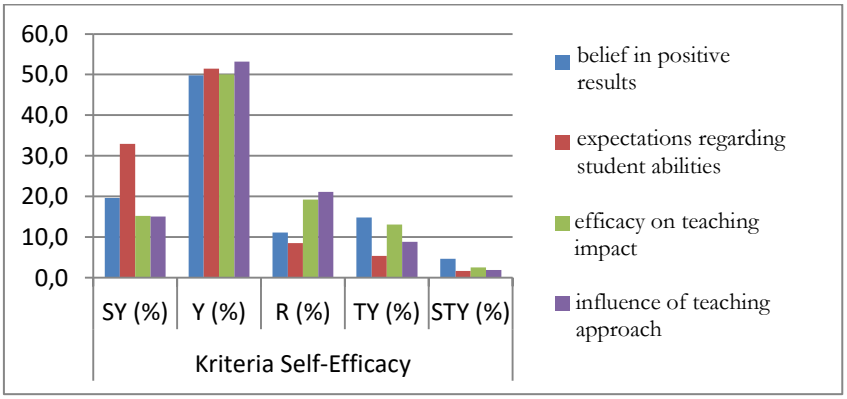

Figure 2. The Profile of Students' Self-Efficacy for STOE Indicators

Figure 2 illustrates that the highest proportion of students' self-efficacy related to the STOE (Science Teaching Outcome Expectancy) indicators was found in the agree (A) category, representing 50% of the total 180 respondents across all four sub-indicators. This finding suggests that approximately 90 MI/SD pre-service teachers expressed confidence in their ability to positively influence students' learning outcomes through their science teaching efforts. Conversely, the strongly disagree (SD) category recorded the lowest percentage, ranging between 1% and 4%, indicating that only about 8 respondents expressed significant doubt regarding the effectiveness of their teaching in improving students' scientific abilities and outcomes. A comparative analysis of students' self-efficacy in science teaching, as measured through the PSTE (Personal Science Teaching Efficacy) and STOE indicators across each response category, is presented in Figure 3.

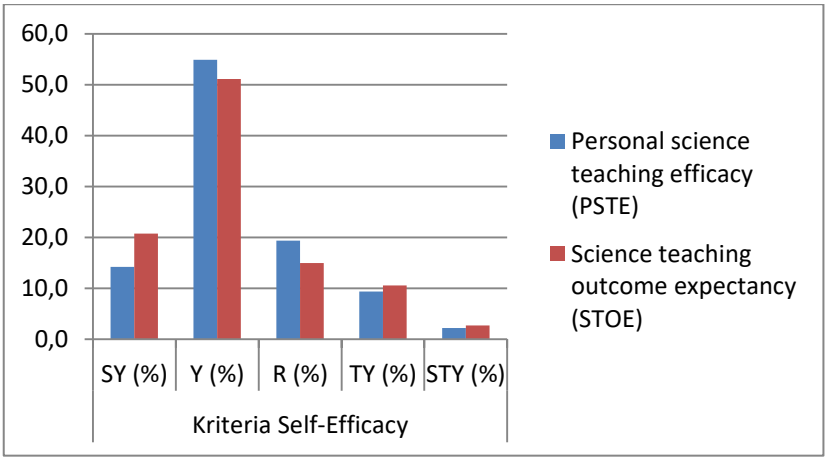

Figure 3. The Comparison of Students' Self-Efficacy between PSTE and STOE

Figure 3 presents a comparative analysis of students' self-efficacy levels between the PSTE (Personal Science Teaching Efficacy) and STOE (Science Teaching Outcome Expectancy) indicators. The highest proportions for both indicators were observed in the agree (A) category, with average percentages of 54.9% for PSTE and 51.1% for STOE. This suggests that approximately 90 pre-service MI/SD teachers perceived themselves as both capable of understanding and teaching science effectively (PSTE), and confident that their teaching efforts would yield positive impacts on student outcomes (STOE). Students with high self-efficacy were identified through the combined percentages of the strongly agree (SA) and agree (A) responses, which reached 68.9% for PSTE and 71.8% for STOE—indicating a generally high level of teaching self-efficacy (Hasbi et al., 2022).

To complement the quantitative findings, brief interviews were conducted with five student respondents who had completed the self-efficacy questionnaire. These interviews aimed to validate and enrich the survey data. When asked about their interest in learning science, Respondent 1 expressed enjoyment due to the relevance of science to everyday life and the fact that most scientific content could be directly verified through experiments and hands-on activities. This perspective aligns with the findings of Saputra & Kurniawati (2024) and Lin et al., (2024), which emphasize that self-efficacy in science learning is significantly enhanced by instructional strategies that emphasize direct engagement and experiential learning (i.e., hands-on and minds-on approaches).

Respondent 2 also conveyed enthusiasm for science learning, particularly in biology, highlighting its simplicity and strong connection to nature as motivating factors. Similarly, Respondents 3 and 4 noted that science's real-life relevance and the opportunity to engage in experiments boosted both their interest and confidence in understanding scientific concepts. These qualitative insights are consistent with theoretical perspectives suggesting that positive emotional states and physiological responses contribute to the development of self-efficacy

(Waddington, 2023; Belova et al., 2024). Furthermore, intrinsic motivation and the use of effective learning strategies were also noted as key contributors to enhanced self-efficacy (Bartimote-Aufflick et al., 2016; Tillotson-Chavez & Weber, 2024).

Finally, when asked whether they felt confident in teaching science in MI/SD classrooms, two respondents affirmed their confidence, citing prior mastery of relevant science concepts. They noted that the science material at the MI/SD level was relatively simple and had been learned progressively from elementary school through college, often through practical and foundational activities. This supports Bandura(1977) assertion that mastery experiences—successful past engagements with tasks—serve as a critical source of self-efficacy development. Indeed, a strong sense of self-efficacy has been shown to positively influence student learning outcomes (Kartimi et al., 2021; Özcan & Kültür, 2021; Arianto & Hanif, 2024). These findings further corroborate existing literature that highlights the robust correlation between self-efficacy and academic achievement (Bartimote-Aufflick et al., 2016; Zhu & Luo, 2024; Morales-Navarro et al., 2024).

CONCLUSION

Based on the findings and discussions presented, it can be concluded that the level of self-efficacy among MI/SD pre-service teacher students was generally high. According to the PSTE (Personal Science Teaching Efficacy) indicator, the distribution of responses was as follows: 14.2% very confident, 54.9% confident, and 19.3% unsure, with smaller percentages for the less confident and very unsure categories. For the STOE (Science Teaching Outcome Expectancy) indicator, among the 180 respondents, 20.7% reported being very confident, 51.1% confident, 15.0% indecisive, 10.5% unsure, and 2.7% very unsure. The aggregation of responses in the very confident and confident categories revealed that 68.9% of students demonstrated high self-efficacy in the PSTE dimension, while 71.8% exhibited similarly elevated self-efficacy in the STOE dimension. These figures reflect a strong belief among pre-service teachers in both their ability to understand science content and to positively influence student learning outcomes. Thus, it can be inferred that the majority of MI/SD pre-service teacher students possessed a high level of self-efficacy in science learning and teaching.

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