



The Exploration of Self-Efficacy Beliefs among Generation Z Preservice Physics Teachers for Physics Learning Strategies

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Abstract

This study aims to explore the self-efficacy beliefs of Generation Z preservice physics teachers by analyzing the relationship between self-efficacy dimensions and expectations of student learning outcomes. The research method used quantitative descriptive analysis involving 75 preservice physics teachers. Data were collected using the STEBI-B instrument and analyzed using mean split-based scatter plot quadrant analysis. The findings show that the average PSTE score (72.86) is consistently lower than the STOE score (75.25). Quadrant analysis reveals that the majority of respondents are in the low PSTE area, which indicates a strong phenomenon of teaching insecurity and uncertainty in facing complex professional tasks. Another finding was the high STOE scores of preservice physics teachers, indicating that they still have positive expectations of their students' potential. The conclusion of this study is that Gen Z prospective physics teachers experience an internal crisis of confidence despite having high external expectations. This study recommends physics learning strategies that combine autonomy, metacognitive training, and self-reflection before students are involved in complex social collaboration.

Keywords: Self-efficacy; preservice physics teachers; generation Z

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INTRODUCTION

Researchers around the world are concerned about the preparation of preservice teachers in the field of Education for Sustainable Development (ESD). Social, economic, and environmental issues require preservice teachers to be ready to become professional teachers. The demand for ESD integration in the education system is in line with the demand for the preparation of future teachers. In an effort to integrate sustainable development into the education system, various courses that support ESD have been offered in physics education programs. Although various courses have been prepared to prepare preservice teachers and offered in the curriculum, research conducted to study the results of this initiative is very limited (Ikeda et al., 2025; Nousheen et al., 2024). Teacher education programs are expected to develop preservice teachers' self-efficacy, content knowledge (CK), and pedagogical knowledge (PK), which are relevant to various subjects and concepts. There has been no research specifically investigating the influence of learning strategy courses related to education in support of ESD. Given this, the current study aims to assess the self-efficacy of prospective physics teachers in preparing to teach in schools.

Preservice teachers' self-efficacy beliefs in teaching physics are an important variable to study because they determine the level and persistence of preservice teachers'

efforts in facing obstacles to teaching in future classrooms. Novikasari et al. (2024) argue that teachers' self-efficacy can be improved by increasing their knowledge of physics subject matter. Bottomley et al. (2024) state that improving preservice teachers' understanding and knowledge of physics concepts in learning is very helpful in increasing self-efficacy beliefs. Many researchers identify teachers' lack of knowledge, experience, and efficacy as some of the main obstacles in implementing learning in the classroom.

The difference in self-efficacy has serious implications for the selection of learning strategies. Teachers with low self-efficacy beliefs tend to avoid complex strategies such as inquiry, discovery learning, or project-based learning, even though teachers are aware that these strategies have a positive impact on students. Self-efficacy is one of the most important factors in understanding an individual's level of effort and persistence in facing problems and unpleasant experiences (Bandura, 1977). Self-efficacy refers to an individual's belief in their ability to perform certain tasks and achieve a certain level of performance (Zimmerman, 1995). Bandura (1977) defines self-efficacy as a belief in one's ability to organize and execute the actions necessary to produce a specific outcome. According to Enoch and Riggs (1990), they developed the Science Teaching Efficacy Beliefs Inventory (STEBI) instrument, which consists of Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy (STOE). With simple and reasonable modifications, STEBI-B can be used as a tool to positively influence preservice teachers' science education courses (Slater et al., 2021).

The sources of individual self-efficacy are mastery experience, vicarious experience, verbal persuasion, and physiological state. Many studies have identified and emphasized the importance of structured teaching practicums in increasing the self-efficacy of preservice teachers (Lee & Davis, 2023; Mubarok et al., 2025; Ugwuanyi et al., 2023). A challenging teaching environment provides preservice teachers with the opportunity to master challenging learning strategies, thereby increasing their sense of efficacy. Many researchers argue that teaching practice can cause work-related stress (Klassen & Durksen, 2014; Bagazi, 2025; Vieira et al., 2024). One teaching practice in the learning strategies course presents unique difficulties for preservice teachers, including teaching, preparing learning tools, and preparing supporting learning media. One daunting challenge for preservice teachers is the transformation from student to teacher (Caires et al., 2009; Klassen & Durksen, 2014). Therefore, researchers not only obtained the self-efficacy profile of preservice teachers but also formulated strategic implications to equip Generation Z prospective physics teachers to face real physics learning.

A unique characteristic of Generation Z is their optimistic yet anxiety-prone attitude toward teaching in the classroom. Generation Z was born between 1995 and 2010, an age group that is currently pursuing undergraduate degrees at universities (Yuan et al., 2024). The physics education study program is a program that prepares prospective physics teachers before they become teachers. Similar to other study programs, prospective physics teachers who are currently attending lectures are on average, Generation Z. Generation Z has a main characteristic of liking intrapersonal learning (Chardonnnens, 2025; Gochenouer et al., 2024). The learning process that suits Generation Z is video-based learning and applied learning, where preservice teachers can see demonstrations of tasks that need to be done either in person or online. Learning related to real-world problems, contextual problems, and problem-solving are some types of learning that Generation Z likes (Seemiller & Clayton, 2019). This generation is proficient in technology but not yet skilled in teaching physics concepts through technology.

There has not been much research discussing the preparation of preservice physics teachers, but literature on the concept of self-efficacy is still scarce, especially in Indonesia. Most studies only look at the total self-efficacy scores of preservice teachers, even though teachers can have high PSTE self-confidence but be pessimistic about STOE, or vice versa.

These concepts are interconnected within a coherent framework of teacher professional development. Pre-service teachers' readiness to teach physics is fundamentally driven by their self-efficacy, which consists of personal teaching efficacy (PSTE) and outcome expectancy (STOE). Developing this readiness within the context of contemporary pre-service teachers—who share Generation Z demographics—presents specific cognitive challenges. When teacher candidates possess low PSTE despite having high expectations for student success (STOE), it creates an internal imbalance that hinders their overall teaching readiness. By mapping how these self-efficacy dimensions intersect into distinct profiles, this study clarifies the specific internal barriers faced by these candidates, thereby providing an integrated blueprint to enhance teacher readiness through targeted pedagogical interventions. Given this, this study aims to investigate the self-efficacy of preservice physics teachers in teaching physics concepts in the classroom. The aims of this study are as follows.

1. Exploring the self-efficacy profile of Generation Z preservice teachers in terms of PSTE and STOE dimensions
2. Assessing the relationship between PSTE and STOE average scores among Generation Z prospective physics teachers
3. Assessing the differences in PSTE and STOE average scores among Generation Z prospective physics teachers

METHODS

The selected research design used in this study was a quantitative approach with an explanatory correlational and comparative research design (Creswell & Creswell, 2018). This design was employed to investigate the profiles, relationships, and significant differences between PSTE and STOE among Generation Z pre-service physics teachers. The systematic procedure of this research is illustrated in the flowchart in Figure 1.



Figure 1. Research Flowchart

The process was initiated with the identification of populations, which comprised Generation Z preservice physics teachers at Universitas Jember. Participants were selected based on purposive sampling. 75 participants were preservice physics education teachers in at least their 7th semester with an IPK of 3.00 to 4.00 and aged 18-22 years. Participants were selected based on a minimum of 3 years of study to ensure that each participant had taken courses in learning strategies and microteaching.

The research instrument used was a self-efficacy beliefs survey developed from the STEBI-B (Creswell and Riggs, 1990, 2000). This instrument remains a highly regarded and widely utilized tool in recent science education research, as demonstrated by Naidoo and Naidoo (2021). The instrument used was STEBI-B (23 items), consisting of PSTE (13 items) and STOE (10 items), measured on a 1-5 Likert scale. In its original development, the instrument demonstrated strong internal consistency, with Cronbach's alpha coefficients of 0.90 for the PSTE subscale and 0.76 for the STOE subscale. Since the original instrument was in English, it was translated into Indonesian to suit the research context. To ensure linguistic clarity and readability, the translated version underwent a peer-review process by two university lecturers majoring in education. Minor adjustments were made based on their feedback to ensure that all items are easily understood by the respondents.

Data collection was systematically carried out through digital distribution (Google Form) under direct observation. The collected data were subjected to a three-tier data analysis explicitly mapped to each objective: (1) to address the first objective (profiling), a mean-split analysis was utilized to segment participants into four distinct self-efficacy quadrants; (2) to address the second objective (examining relationships), a Pearson product-moment correlation test was conducted to determine the linear relationship between PSTE and STOE; and (3) to address the third objective (identifying differences), a paired-sample t-test was administered to assess the significant mean differences between the two efficacy dimensions.

RESULTS & DISCUSSION

Results

Profile of Self-Efficacy of Generation Z preservice teachers. Based on the mean split analysis technique, respondents were mapped into four different types of self-efficacy in Figure 2. The scatter plot visualization results show that the belief profiles of Generation Z prospective physics teachers are very heterogeneous, but have certain tendencies.

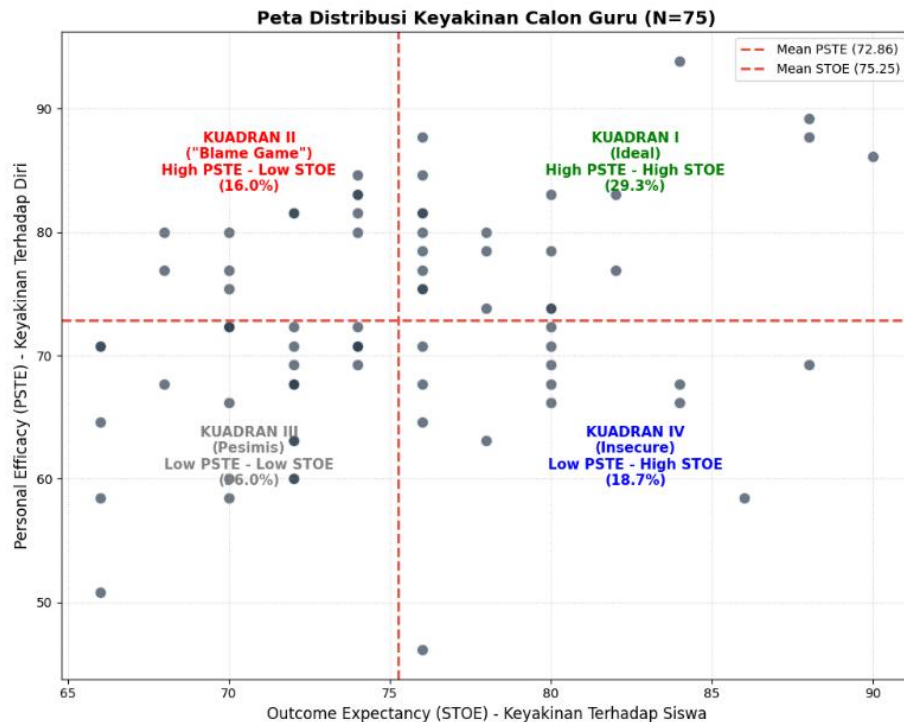


Figure 2. Distribution Map of Self-Efficacy Beliefs of Prospective Physics Teachers

The application of the mean-split technique in this study was methodologically driven by the psychometric nature of the STEBI-B instrument. Original literature by Enochs and Riggs (1990) does not establish standardized, normative cut-off points for clinical classification. Therefore, utilizing the sample mean is the most empirically justified approach to map relative cohort tendencies, as it accounts for the actual mathematical average of the group better than a median split, which can arbitrarily divide clustered scores. Furthermore, the resulting quadrant labels, namely 'pessimistic,' 'insecure,' and 'blame game,' are introduced explicitly as interpretative categories developed by the authors to qualitatively conceptualize the intersections of PSTE and STOE, rather than standard subscales of the original STEBI-B. Specifically, 'blame game' characterizes individuals with high personal teaching efficacy but low outcome expectations (externalizing student failure), 'insecure' represents those with low personal efficacy despite high outcome expectations, and 'pessimistic' denotes a low standing in both dimensions.

The dominant group is in Quadrant III (pessimistic type) at 36.0%. Students in this group have PSTE and STOE scores below average, indicating that most preservice teachers not only doubt their teaching competence but are also skeptical about the potential success of their students. The proportion of Quadrant I (ideal) reached 29.3%, and Quadrant IV (insecure) was 18.7%. Combined, 48% of students had high expectations of students (High STOE). Conversely, Quadrant II, which was the smallest minority group, believed that prospective physics teachers felt competent but blamed the students.

Although many are in the low PSTE area, the presence of 18% of students in Quadrant IV (insecure) shows unique potential. This group is aware of their shortcomings (low PSTE) but still believes that students have the potential to achieve learning outcomes in physics (high STOE). These preservice teachers are more open to new learning strategies because they feel uncertain, so teachers are more likely to become reflective teachers.

The analysis results show that there is a significant and positive relationship between PSTE and STOE ($r=.323$, $p=.005$). Although significant, the correlation strength

is relatively low. Based on the data analysis, an increase in the self-confidence of prospective physics teachers is slightly followed by an increase in expectations of students, but this is not always strongly proportional. The results of the analysis of the relationship between PSTE and STOE can be seen in Table 1.

Table 1. Correlation Measurement Result for PSTE and STOE on STEBI-B

	N	Correlation	Sig.
PSTE & STOE	75	.323	.005

Testing the difference in confidence levels between PSTE and STOE. The results of the paired-sample t-test reveal a significant difference between the average PSTE and STOE items ($t=-2.288$, $p=.025$). The average STOE item score ($M=75.25$) is statistically higher than that of PSTE ($M=72.86$). Generation Z preservice physics teachers have higher confidence in their students' potential for success than in their own teaching abilities. The results of the PSTE and STOE difference test can be seen in Table 2.

Table 2. Difference Test Result for PSTE and STOE on STEBI-B

Variable	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Self-Efficacy beliefs			-2.288	74	.025
PSTE	72.86	9.04			
STOE	75.25	5.65			

Discussion

The high percentage of students in the low PSTE area (Combined Quadrants III and IV reaching 54.75%) confirms the existence of massive self-doubt. Generation Z preservice physics teachers feel that they are not yet competent enough to teach physics content that is considered difficult. Students are aware that physics is a subject that can be learned. Preservice teachers already understand and believe that science is objective and that students can achieve learning outcomes if they study physics well. This is evident in their high STOE scores, but students are anxious about whether they will be able to teach it well (lower PSTE). Generation Z preservice physics teachers are often afraid to teach physics concepts because they feel unsure of their abilities (Seemiller & Clayton, 2019). This is relevant to the characteristics of Generation Z, who tend to doubt themselves when facing complex professional tasks while teaching physics (LaPalme et al., 2022; Vilppu et al., 2024).

The positive correlation (.323) shows that students who are more confident in teaching physics (PSTE increases) also believe that students will understand physics lessons (STOE increases). The correlation is relatively low, indicating that preservice teachers' lack of confidence (PSTE) does not necessarily make them look down on students. Preservice teachers remain positive about students even though they feel less capable in teaching physics. This suggests that their outcome expectancy (STOE) operates independently of their personal teaching efficacy (PSTE). Mastery experience is an important factor in building self-efficacy, meaning that the experience of mastering something or past successes will increase a person's confidence to succeed again (Chang et al., 2025; Dilling et al., 2024; Lendínez Muñoz et al., 2024; Nousheen et al., 2024).

Preservice physics teachers have higher confidence in their students' potential for success than in their own teaching abilities. A total of 16% of respondents fell into the blame game category, while the majority of teacher candidates did not view students as the cause of failure. Based on this, learning strategies should focus more on strengthening PSTE than STOE. Preservice teachers have lower PSTE than STOE, which means that their

self-efficacy regarding their teaching confidence is still lower than their belief that their students are capable of mastering physics. This implies that students' mindset about students is already good. The focus on preparing preservice teachers is more on building students' readiness to teach physics. Providing positive feedback during teaching practice in learning strategies can reduce this insecurity (Amemasor et al., 2025; Dilling et al., 2024). The preparation program for preservice physics teachers is recommended to increase teaching training, especially in courses that support the physics concepts to be taught and the pedagogical readiness of preservice teachers (Kozhabekova et al., 2025).

Educating Generation Z teacher candidates presents unique challenges due to their mental state and learning styles. Low student self-efficacy is characterized by low self-regulation and low self-confidence (Vilppu et al., 2024). LaPalme et al. (2022) found that most of these teacher candidates actually feel incapable or experience severe imposter syndrome when they have to teach. This problem is further complicated by the fact that, according to Gochenouer et al. (2024), they prefer to be alone and are uncomfortable learning in groups. Therefore, the solution offered by Chardonens (2025) is to give them space to learn independently first. With the help of technology and self-reflection exercises, they can slowly build their self-efficacy before they are finally ready to collaborate with others.

Based on social cognitive theory, self-efficacy is a teacher's belief in their ability to organize and select the actions necessary to achieve student learning outcomes. Teachers with high self-efficacy are assumed to be more persistent when dealing with difficult students, more open to new teaching methods, and better at classroom management. Although some studies mention that there is no direct relationship between self-efficacy and student learning outcomes, self-efficacy is able to provide socio-emotional energy and enthusiasm from teachers to students (Novikasari et al., 2024; Jerrim et al., 2025). Increasing the self-efficacy of preservice teachers can boost their confidence in designing lessons, make them more confident in predicting student responses before teaching, and make them feel capable of managing the classroom (Lendínez Muñoz et al., 2024).

It is very important to consider the type of learning approach in learning strategy courses taught to students in teacher education programs. One of the physics teaching strategies recommended for Generation Z preservice physics teachers is the application of the modeling strategy. Lecturers must first provide real examples (role models) so that preservice teachers have concrete examples to boost their confidence before teaching practice. Overcoming insecurity often arises due to individual burdens. Based on the results of the study, it is recommended that lesson study strategies be used by designing physics learning strategies as a team, thereby reducing students' cognitive load and anxiety, so that PSTE can increase while maintaining high STOE. It is advisable to train students starting from simple strategies (direct instruction with simple experiments) before forcing preservice teachers to use open-ended inquiry strategies. This is done so that the PSTE of preservice teachers is built through structured activities. This is crucial to move students from quadrants III and IV to quadrant I (ideal), by providing teaching experiences both conceptually and pedagogically.

This study highlights the specific dynamics of self-efficacy beliefs, particularly the decoupling between PSTE and STOE among Generation Z preservice physics teachers. While previous research often treats self-efficacy as a uniform trait, our findings reveal a critical internal mismatch that provides essential information for redesigning teacher preparation curricula. An important question for future research is to examine how this specific gap between personal content confidence and high pedagogical expectations is bridged during teacher education. In addition, a longitudinal design should be used to track how field practices and the Teacher Professional Program (PPG) are able to reconcile these dual beliefs and support their holistic development as future physics educators.

Notwithstanding its contributions, several inherent limitations of this study must be acknowledged to properly contextualize the findings. First, this research employed a cross-sectional design and relied exclusively on self-report data through the STEBI-B instrument, which may inherently capture transient psychological states or be subject to social desirability bias. Second, the study utilized a purposive sampling technique involving a relatively small sample size ($N = 75$) drawn from a single university. Consequently, these empirical insights should be interpreted with caution and may not be broadly generalizable to the wider population of Generation Z pre-service physics teachers across diverse geographical and cultural landscapes in Indonesia. Instead, this study offers localized yet valuable baseline data regarding the internal psychological alignments of prospective physics educators, catalyzing future large-scale, cross-institutional longitudinal investigations.

CONCLUSION

The profile of self-efficacy beliefs among Generation Z preservice physics teachers shows a unique dynamic in which expectations of student success (STOE) are more dominant. There is a significant but low positive correlation (.323) between PSTE and STOE. There is a significant difference ($p < 0.05$) where PSTE scores are lower than STOE. This indicates that the main challenge for prospective physics teachers today is not a negative perception of students, but rather self-doubt. The implications of this study require adjustments to learning strategies at the university. It is recommended that collaborative approaches (lesson study) and modeling be used to bridge the gap between high expectations of students and low self-competence beliefs among Generation Z pre-service physics teachers.

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