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## Fostering Self-Efficacy for Future Physics Teachers: Recommendation of Future Direction of Teacher Education Institutions

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### Abstract

Self-efficacy in teaching is essential for pre-service teachers, and its development needs to be started as soon as possible. This research is descriptive research that aims to recommend policies that can be carried out by universities, faculties, and study programs related to the development of pre-service physics teachers' self-efficacy in teaching. The research participants were 113 pre-service physics teachers in one of the teacher education institutions in Indonesia. The research instrument used was an open-ended questionnaire totaling eight questions, which explores self-efficacy in three aspects: general definitions, influencing factors, and lecture activities that can increase teaching self-efficacy. The answers of pre-service physics teachers are grouped based on the study program's authority, faculty, or university. The results show that self-efficacy in teaching is influenced mainly by 1) the mastery experiences, 2) the mastery of content knowledge, 3) social persuasion, and 4) the mastery of pedagogical knowledge. Based on these results, it is necessary to have a policy by the Universities, Faculties, and Study Programs related to the development of self-efficacy in teaching. Policies needed from universities and faculties are to increase the number and length of teaching practice for pre-service teachers. The policy required from the study program is self-efficacy integration in courses, especially courses related to teaching practice. In addition, the study program also needs to make rules or guidelines for lecturers who teach subjects related to teaching practice courses, provide feedback and reflection, and strengthen teaching practice activities for pre-service teachers.

**Keywords:** Self-Efficacy, Pre-Service Physics Teachers, Policy

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### INTRODUCTION

One of the predictors of successful learning achievement is high self-efficacy (Basith et al., 2020). Self-efficacy in teaching has an essential relationship with the professional performance of teachers (Navarro et al., 2022). Someone with high self-efficacy also has a high achievement target (Boz & Cetin-Dindar, 2021). Teacher self-efficacy is one factor affecting their performance in effective classroom learning (d'Alessio, 2018). In learning and teaching activities in the school, self-efficacy can affect the teacher's condition and teaching, ultimately affecting their students (Handtke & Bögeholz, 2020). So that, it can be said self-efficacy can be a predictor of teacher performance in teaching (Kruse et al., 2021; Menon & Sadler, 2018; Seneviratne et al., 2019) and student learning outcomes (Navarro et al., 2022; Zhou et al., 2020).

Bandura et al. (1999) state four primary sources of self-efficacy: mastery experiences, vicarious experiences, social persuasion, and emotional states. In addition to these factors, studies on teaching self-efficacy also show that mastery of knowledge of pre-service teachers can increase their self-efficacy (Gray, 2017), both pedagogic knowledge

(Navarro et al., 2022) and content knowledge (d'Alessio, 2018; Kinskey, 2018; Zhou et al., 2020). A lack of understanding of the content can lead to low self-efficacy in teaching (Kinskey & Callahan, 2021).

The teaching experience (Boz & Cetin-Dindar, 2021; Meiring, 2019; Murphy et al., 2020), self-reflection (Menon & Azam, 2021), peer assessment (d'Alessio, 2018), the constructivist learning environment (Boz & Cetin-Dindar, 2021), teacher education institutions' innovative and professional activities (Murphy et al., 2020), and professional development program (Udu et al., 2021), can also affect teaching self-efficacy. Unusual teaching experiences accompanied by reflection and guidance can also increase self-efficacy (Seung et al., 2019). Van Rooij et al. (2019) state that if the teacher succeeds in directing students who often interfere in class to perform specific tasks in a lesson, the teacher's self-efficacy in teaching will increase.

Teaching self-efficacy has become one of the major research topics conducted in the field of science pre-service teachers' education (Menon & Sadler, 2018). Teacher education institutions must pay attention to pre-service teachers' self-efficacy (d'Alessio, 2018) because self-efficacy corresponds to performance practices (Oppermann et al., 2019; Sultan, 2020). Teachers and pre-service teachers should be facilitated to develop their self-efficacy (Seneviratne et al., 2019). Lecturers must integrate efforts to increase self-efficacy in the lecture content (Menon & Sadler, 2018). Positive feedback given by lecturers, university coordinators, and peers verbally (Seung et al., 2019) and promising strategies and role models shown by lecturers in teaching can also increase the self-efficacy of teaching pre-service teachers (Menon & Sadler, 2018).

Exploration of pre-service teachers' teaching self-efficacy is essential to improve the quality of teacher education (Handtke & Bögeholz, 2020). Teachers' commitment to their profession will also increase when their self-efficacy in teaching is high (van Rooij et al., 2019). Self-efficacy development is closely related to science teacher identity (Menon, 2020). Research conducted by Sultan (2020) shows that, in teaching science, pre-service teachers have higher confidence in teaching biology when compared to physics. Teacher readiness to teach physics must be adequately prepared (Sulaeman et al., 2022).

From the factors by Bandura et al. (1999) and the results of previous researchers related to factors that affect self-efficacy in teaching, we observed several teacher education institutions in Indonesia regarding their attention to self-efficacy development, especially in the physics education study program. As a result, the integration of self-efficacy development through lecture activities is still lacking. Therefore, this research was conducted to produce recommendations for policies that universities, faculties, and study programs need to be implemented to enhance future physics teachers' self-efficacy.

## **METHODS**

### ***Participants and Data***

This research is descriptive research that aims to recommend policies that can be carried out by universities, faculties, and study programs related to the development of pre-service physics teachers' self-efficacy in teaching. The research participants were 113 pre-service physics teachers in one of the teacher education institutions in Indonesia. The distribution of research participants is presented in Table 1.

Table 1. Participants

Semester	Gender		Have no experience	Teaching Experience		
	Male	Female		< 1 year	1-2 years	>2 years
2 <sup>nd</sup> Semester	9	21	23	7	0	0
4 <sup>th</sup> Semester	4	18	16	4	0	2
6 <sup>th</sup> Semester	8	18	8	13	3	2
8 <sup>th</sup> Semester	13	22	4	24	5	2
Total	34	79	51	48	8	6
	113			113		

The instrument used to obtain research data is a questionnaire. Research questionnaires were given to students in semesters 2, 4, 6, and 8 as pre-service physics teachers in Indonesia. The questionnaire questions were written on Google Forms, and the researcher directly distributed the questionnaire link to the pre-service physics teachers. A total of 113 students filled out the questionnaire.

The research instrument used was an open-ended question questionnaire totaling eight questions. The question framework is divided into three aspects, including the general definition of self-efficacy, influencing factors, and lecture activities that can increase teaching self-efficacy from the point of view of pre-service physics teachers. Three learning experts do Validity through Focus Group Discussion (FGD). The questions on the research instrument were developed using theories from Sharma et al. (2021), Haatainen et al. (2021), and Chen et al. (2022) about the factors that influence individual self-efficacy. Details of the list of questions given are presented in Table 2.

Table 2. Questions about teaching self-efficacy

No	Aspects	Questions
1	General Definitions	Have you heard before about the term self-efficacy?
2		On a scale of 0 – 10 (very unsure – very sure), how many points do you give to your self-efficacy in teaching? Why?
3		In general, does your level of efficacy in teaching affect your performance?
4		From the answer to the previous question. How do you think the level of self-efficacy ultimately affects or does not affect performance?
5	Influencing Factors	In your opinion, from the following, what can affect the level of teaching self-efficacy? (you may choose more than one answer or may choose all options)
		<ul style="list-style-type: none"> <li>a. mastery experiences</li> <li>b. vicarious experiences</li> <li>c. social persuasion</li> <li>d. emotional states</li> <li>e. Mastery of the content knowledge</li> <li>f. Mastery of the pedagogical knowledge</li> </ul>
6		Which do you think is the most influential? Then, apart from the options above, is there anything else you believe affects your self-efficacy in teaching? If yes, please write it down and give an example!

7	Lecture activities that can increase teaching self-efficacy	Have lecture activities at your university facilitated increased self-efficacy in teaching? If yes, write through what activities?
8		What would you like to improve or add concerning lecture activities to increase your self-efficacy in teaching?

The answers of pre-service physics teachers are analyzed by coding each answer, formulating the necessary follow-up policies, and then grouping them based on the authority of the study program, faculty, or university.

## RESULTS & DISCUSSION

### *Results*

This section presents the analysis of answers given by pre-service physics teachers to eight open-ended questions in the questionnaire. The results of this answer analysis will be the basis for recommending policies that universities, Faculties, and Study Programs must make to facilitate the development of self-efficacy in teaching students as pre-service teachers.

### *General Definitions*

Before distributing the questionnaires to be filled out, the participants were given a general understanding of self-efficacy. Before getting a general explanation, most pre-service teachers have heard of self-efficacy. Pre-service teachers' average teaching self-efficacy score is 6.5 on a scale of 0 to 10 (very unsure to very sure). As many as 98% of pre-service teachers believe that their self-efficacy affects the performance they will, such as the responses given by Pre-service Teachers 12 (PT-12) and PT-23. Only 2% of pre-service teachers thought that their efficacy in teaching to teach well would not affect their teaching performance.

PT-12: *"I believe self-efficacy will affect my performance because I will be much calmer and more prepared. So I will not be nervous when I practice later and can manage everything well."*

PT-23: *"When we believe in something, we usually make plans that ultimately lead us to our goals."*

### *Influencing Factors*

In the questionnaire, pre-service teachers are asked to select the factors that affect teaching self-efficacy. They can choose multiple answers and even select all options. The answers given by pre-service teachers are presented in Figure 1.

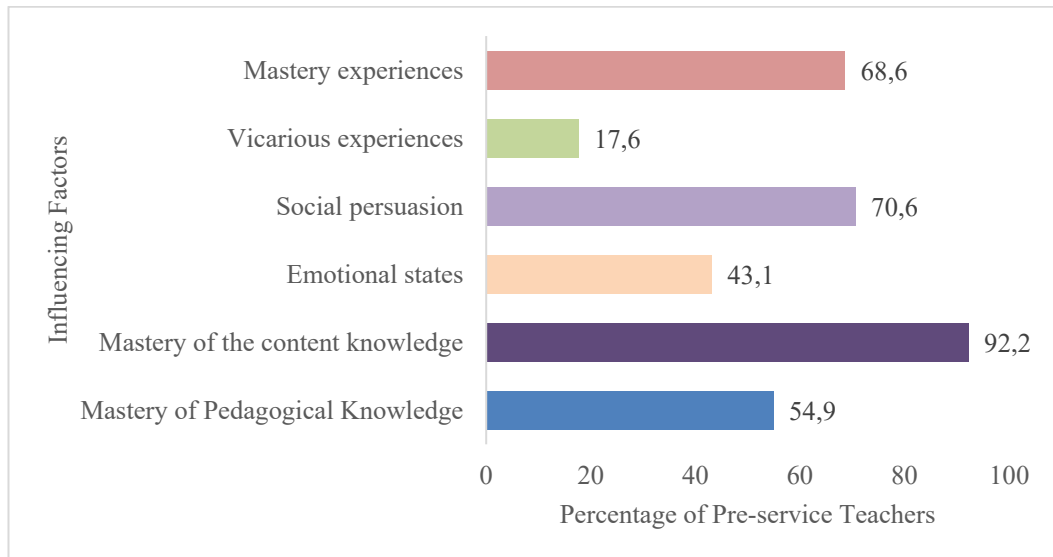


Figure 1. Percentage of pre-service teachers in choosing factors that affect self-efficacy

Pre-service teachers were then asked again to choose the most influential factor; the results are presented in Figure 2.

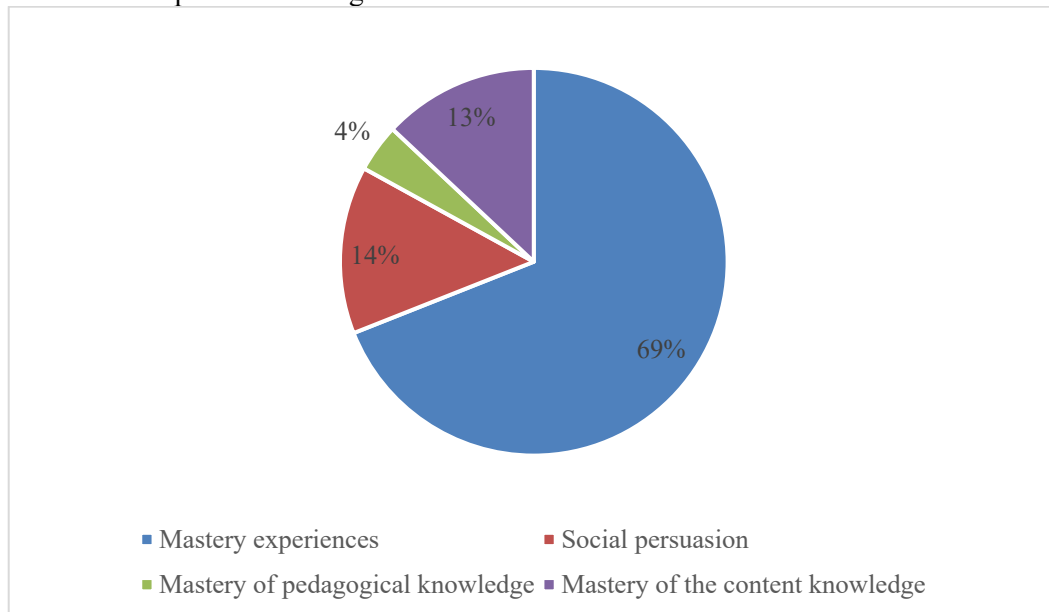


Figure 2. The most influential factor based on pre-service teachers' opinion

Pre-service teachers stated that other factors that also affect teaching self-efficacy are students' positive or negative responses (PT-54), learning motivation (PT-70), and reflection activities on teaching practices (PT -100).

PT-54: *“Student responses in learning can change my self-efficacy and performance; when students interfere with learning, my efficacy and performance will decrease, and vice versa.”*

PT-70: *“The lecturer's motivation can increase my desire to learn, so my self-efficacy also increases.”*

PT-100: *“Reflection activities on teaching practice made me realize my shortcomings in teaching, so sometimes it can reduce my self-efficacy.”*

***Lecture activities that can increase teaching self-efficacy***

Most pre-service teachers think that lecture activities have improved their self-efficacy, for example, providing opportunities to make material presentations, teaching practices through Microteaching and Field Orientation, and participation in student organizations and public speaking training.

Expectations of pre-service teachers to increase their self-efficacy so that universities, faculties, or study programs:

- a. They are increasing the frequency of teaching practices on campus by utilizing existing campus facilities.
- b. They are increasing the frequency of teaching practice in the field, meeting directly with students.
- c. Pre-service physics teachers do not have to wait for the Field Orientation Course in the 7th semester to be able to teach in schools.
- d. They conduct training related to teaching activities, such as public speaking, learning models, and teacher training as practitioners.
- e. They provide wider opportunities for pre-service teachers to discuss and express their opinions.
- f. In lectures, lecturers should increase the motivation of pre-service teachers.

The grouping of policies based on authorized stakeholders is presented in Table 3.

Table 3. Policies needed to develop teaching self-efficacy

No	Stakeholder	The policies
1	Study Program	<ol style="list-style-type: none"> <li>a. Integrate the development of self-efficacy in courses, especially courses related to teaching practice.</li> <li>b. Make rules or guidelines for lecturers, especially lecturers who teach subjects related to teaching practice courses, to provide feedback and reflection and strengthen teaching practice activities for pre-service teachers.</li> <li>c. Increase training related to PCK outside lecture activities that can increase teaching self-efficacy</li> <li>d. Opportunities for students to take field orientation or teaching practice courses are given in semester seven and earlier to increase their experience teaching pre-service teachers.</li> </ol>
2	Faculty	<ol style="list-style-type: none"> <li>a. Provide opportunities for pre-service teachers to continue to practice teaching, not just observe teachers' teaching.</li> <li>b. Provide feedback and reinforcement to pre-service teachers who have completed teaching practice.</li> </ol>
3	University	Increase the number and length of teaching practices for pre-service teachers on campus and in school, meeting directly with students.

## **Discussion**

Based on the study's results, 98% of participants believed their self-efficacy would be the same as their performance. According to them, if they think they can teach well, then it is true that their teaching performance will be good, and vice versa. Most pre-service teachers believe that high self-efficacy in teaching will make them feel calm and ready to teach; with high self-efficacy, they are motivated to prepare plans and strategies to achieve exemplary teaching performance. These correspond to (Shawer, 2013), which states that if pre-service teachers have positive self-efficacy, they will try to complete the task, but if their self-efficacy is low, it makes them hesitant. When faced with challenging conditions, people with high self-efficacy will be motivated to complete tasks and achieve goals (Seung et al., 2019). Self-efficacy is one of motivation's cognitive and affective aspects (Listyawati et al., 2021).

The study results in Figure 1 show that mastery of content is the most chosen factor by pre-service physics teachers that contributes to the level of self-efficacy in teaching. Mastery of the content makes future teachers more confident in teaching, and pre-service teachers' lack of content mastery reduces teaching self-efficacy (Thomson et al., 2017). For example, when students ask questions about the material being taught to pre-service teachers, learning will run smoothly if they can answer questions correctly, increasing their self-efficacy. This result is in line with d'Alessio (2018), Gray (2017), and Haryanto et al. (2024), which states that content mastery is one factor that significantly influences self-efficacy.

The study's results in Figure 2 show mastery experiences are the most influential factor in teaching self-efficacy. This is consistent with Bandura et al. (1999), who state that mastery experiences are essential to a person's self-efficacy. Pre-service teachers can achieve the success of the teaching experience with a lot of learning, teaching practice, reflection, guidance, and motivation from the lecturers. Based on the research results, pre-service teachers stated that reflection activities can decrease their self-efficacy in teaching when they realize that their teaching experience still has many drawbacks. After the reflection activity, they need support and motivation from the lecturer to increase their self-efficacy again. Reflection and motivation from lecturers contribute to the self-efficacy of teaching pre-service teachers (Seung et al., 2019)

Teaching practice for pre-service teachers is usually done through microteaching and field orientation courses. On campus, teaching experience can be provided to pre-service teachers through microteaching courses (Haryanto et al., 2021). The Field Orientation course is usually an opportunity for pre-service teachers to practice teaching in schools. The policy currently implemented in some teacher education institutions is that the duration of pre-service teachers doing Field Orientation is reduced from about three months to about 1.5 months. In addition, teaching practice activities previously mandatory for Field orientation are no longer required, so students only observe and assist teachers in teaching. The current policy is based on the premise that to become a teacher, pre-service teachers need to take a teaching profession program for one year, and teaching practice activities will be trained in that program.

Enriching the teaching experience can improve the teaching skills of pre-service teachers (Efwinda & Mannan, 2021). Experience needs to be given as much to pre-service teachers because the number of teaching practices contributes to mastery of content, ultimately increasing their self-efficacy (Gray, 2017). Current policy is also contrary to pre-service teachers' expectations; they hope teacher education institutions can facilitate improving their self-efficacy. For example, continuing to provide teaching practice opportunities through Field Orientation can be carried out in earlier semesters, as well as increasing the number of teaching practices on campus and at school. Motivation, support,

and reinforcement by lecturers are also very much needed by pre-service teachers to improve their self-efficacy.

Therefore, we recommend that universities and faculties increase the number and length of teaching practices for pre-service teachers—study program policies to integrate the development of self-efficacy in courses, especially courses related to teaching practice. In addition, the study program also needs to make rules or guidelines for lecturers, especially lecturers who teach subjects related to teaching practice courses, to provide feedback and reflection and strengthen teaching practice activities for pre-service teachers.

## CONCLUSION

Based on the data and results of the study, it can be concluded that From the perspective of student teachers, self-efficacy in teaching is one of the factors that can affect their teaching practice performance. Therefore, universities and faculties of education must increase the number and length of teaching practice activities for prospective teachers. In addition, the study program also needs to make rules or guidelines for lecturers, especially lecturers who teach subjects related to teaching practice courses, to provide feedback and reflection and strengthen teaching practice activities for pre-service teachers. This study's limitation is that the research participants only came from 1 faculty of teacher education in Indonesia. Therefore, it cannot fully describe prospective teachers' perceptions of teaching self-efficacy and the recommendations needed. Thus, future research needs to collect data from a broader range of research participants so that it is representative of the recommendations needed for prospective teachers, especially physics teacher candidates in Indonesia.

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