

*Developing Self-efficacy of Pre-service Science Teachers Through Teacher Professional Development Program*

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**Abstract**

This research aimed to develop a self-efficacy of pre-service science teachers. The participants were 18 science pre-service teachers who were in the first year of general science program. The teacher professional development program in this study employed 3 strategies to develop pre-service teacher's self-efficacy including curriculum topic study, content course, and immersion in science inquiry. The research instruments comprised of a questionnaire (SOSESC-P) and a semi-structured interview. Before and after participating in the program, all participants completed a questionnaire and 6 participants were interviewed. Data were analyzed through mean, standard deviation, and content analysis, which was divided into four aspects including performance accomplishment (PA), vicarious learning (VL), social persuasion (SP), and emotional arousal (EA). The result indicated statistically significant gains in participants' self-efficacy in every aspect at 0.05 level. Data from the interviews showed that the main influences in developing self-efficacy included hands on activities, good interaction between teachers and students, supports from classmates, and questioning.

Keyword: Self-Efficacy, Pre-Service Science Teachers, Teacher Professional Development Program

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## **Introduction**

Self-efficacy is a factor influencing a person's actions. Self-efficacy affects decision-making. People who know they are very capable will try to show that behavior. For teacher, based on relevant research studies, self-efficacy reflects confidence in the knowledge and ability of teachers to perform their duties. This makes them feel that they can perform their duties effectively. It is also a motivation for teachers to practice or change the behavior about their expressions. Self-efficacy influences teachers' decision-making in their future teaching (Bandura, 1997; Hoy & Spero, 2005; Wang & Liu, 2008). Rice and Roychoudhury (2003) studied self-efficacy of pre-service teachers and discovered that the preparation of the pre-service teacher in terms of the concept of science had some impacts on self-efficacy beliefs, while Appleton and Kindt (2002) studied the perception of competency of the pre-service teacher also found that the pre-service teacher had low confidence and always taught science through lecture, which showed low self-efficacy. According to Kazempour & Sadler (2015), the beliefs of the pre-service teacher in the power of self-efficacy directly influenced their teaching ability in the future.

In terms of the guidelines for the development of self-efficacy for the pre-service teachers according to the research study, it was found that there were factors related to development, namely practice courses and content subjects. The differences between practical courses and content courses are the purposes of the course. The practical courses focus on teaching and the skills required to teach science, teaching strategies, assessments of student learning, classroom management. Meanwhile the content courses have the goals of teaching science concepts, the content development of the course which contains research that discusses the practices. The content course must also have a demonstration activities (Hands-on) and discussions to expand awareness which both practices are key factors in the development of one's competence (Bleicher & Lindgren, 2005; Schoon & Boone, 1998). The self-competency development program in content course are content courses. There are 3 types of teaching such as collaboration, clear teaching practice, and participatory learning (Lucia Zundans-Fraser and Julie Lancaster, 2012) which will find that designing a program to develop one's competence should be used in a way that focuses on students, teachers, actions and collaboration as well as having discussions together. Purpose of the Study were to develop a self-efficacy of pre-service science teachers.

## **Methodology**

This research employed a qualitative research methodology for studying self-efficacy of science pre-service teachers. It took place over a period of 10 weeks in the second semester of academic year 2019. According to Loucks-Horsley, S., Hewson, P. W., Love, N., & Stiles, K. E. (1998), the teacher professional development program in this study consisted of three strategies for developing self-efficacy: curriculum topic study, content course, and Immersion in science inquiry.

## **Participants**

The participants of this study were 18 science pre-service teachers who were first year students in general science program at Rajabhat University. These students enrolled in physics for teacher subject. Six participants were purposively selected for interview based on data from a self-efficacy questionnaire. In this research, the researcher has assigned the teacher student code as A, B, C, D, E and F.

## **Instruments**

The research instruments for studying self-efficacy of science pre-service teachers were a self-efficacy questionnaire and a semi-structured interview. The details of each research instruments were described as follows.

### **1. Self-efficacy questionnaire**

This questionnaire was adapted from the sources of self-efficacy in science Course-Physics (SOSESC-P) questionnaire which was developed by Heidi Fencl and Karen Scheel (2004). This questionnaire consisted of 33 questions with a five-point Likert scale ranging from “strongly agree” to “strongly disagree.” There were 33 questions with 5 level questions that were positive and negative questions. The self-efficacy in this questionnaire was measured in 4 aspects as following:

1. Performance Accomplishment (PA) is the success that increases one's abilities; it requires the need to train people so that they acquire some skills that will be sufficient to be successful simultaneously. This makes a person perceive that he has the ability to act in such ways such as asking for a request, rejecting, complimenting, showing some gestures. This will allow students to use the skills they acquire most effectively.
2. Vicarious Learning (VL) means observing from other people's experiences then acting in similar behavior which will make an individual notice the perception of his/her own abilities.
3. Social Persuasion (SP) is the use of speech to explain knowledge, advice, and encourage the learners to believe in order to achieve internal motivation.
4. Emotional Arousal (EA) is the normalization of physical and emotional states that are not fluctuating so that students recognize the power and competencies of themselves.

This questionnaire collects information before and after participating in teacher professional development program between 3 Dec 2019 -18 Feb 2020. The data were analyzed by using basic statistics including mean, standard deviation.

### **2. Semi-Structured Interviews**

The semi-structured interview was developed based on a model by Heidi Fencl and Karen Scheel (200), which consisted of four main points: 1) Personal Accomplishments (PA), 2) Vicarious Learning (VL), 3). Social Persuasion (SP), and

4) Emotional Arousal (EA). The researchers interviewed 6 participants by focus group method. There were 4 main questions as follows:

Question 1: How will students be able to achieve their personal goals for studying physics? (Personal Accomplishments (PA))

Question 2: “When you see that your friend is studying or working in physics for teachers. You think you can do it too.” What do you think of the above sentence? (Vicarious Learning (VL))

Question 3: How do the professor(s) influence the learning of physics for the student teacher? (Social Persuasion (SP))

Question 4: What factors affect students' perceptions of studies in physics?(Emotional Arousal (EA))

This interview collects information after participating in teacher professional development program. The data from the interview was analyzed using content analysis.

## Results

The results of this study can be shown as follows.

### **The results of self-efficacy from questionnaire before and after participating in teacher professional development program.**

The researchers analyzed the data from self-efficacy questionnaire. The researchers performed an analysis with a positive inverted score and analyzed them together. The results are as shown in Figure 1 as follows:

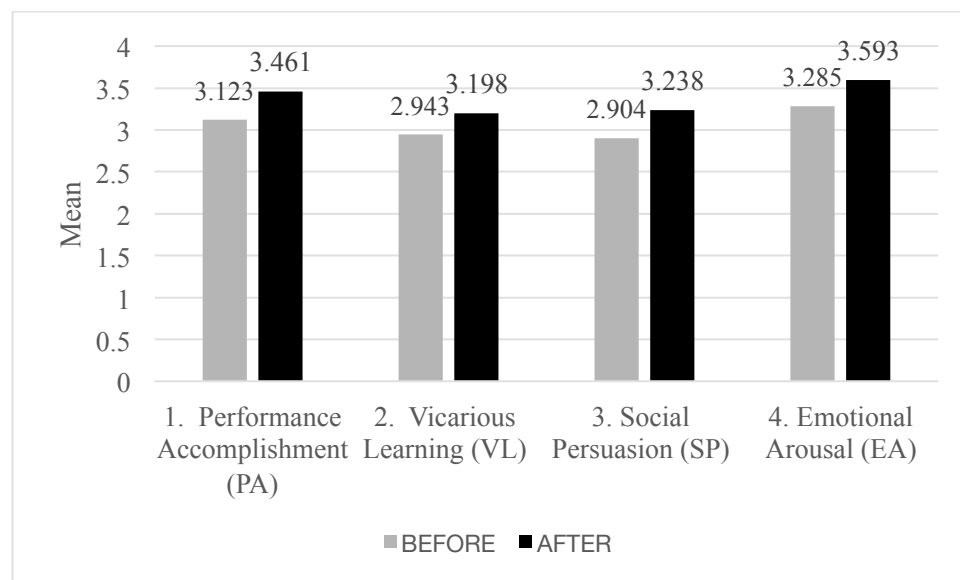


Figure 1: This is an image shows the results of the analysis of self-efficacy

From Figure 1, the results of the analysis of the level of opinions in 4 aspects from the overall, the level of opinions before applying before and after participating in teacher professional development program for pre-service teachers in terms self-efficacy was at the mean of 3.10 and after participating teacher professional development program

for pre-service teachers in terms of self-efficacy, the mean value was at 3.37. When considered individually, developing one's own ideas and competencies, the aspect with the most evaluated results was the 4<sup>th</sup> aspect which had a mean of 3.28, followed by the 1<sup>st</sup> aspect with a mean of 3.12, and the 3<sup>rd</sup> with a mean of 2.97, and the 2<sup>nd</sup> aspect with a mean of 2.94. Also, when considered after using the in teacher professional development program guideline for self-efficacy teachers to develop their own self-efficacy, the aspect with the most evaluated results was the 4<sup>th</sup> aspect with a mean of 3.59, followed by the 1<sup>st</sup> aspect with a mean of 3.46, the 2<sup>nd</sup> aspect with a mean of 3.20, and the 3<sup>rd</sup> aspects with a mean of 3.13.

The researcher compared of self-efficacy before and after participating in teacher professional development program by using t-test comparison, the results are as shown in Table 1.

**Table 1. Shows the comparison of self-efficacy before and after learning management**

Type	Before/After	N	$\bar{X}$	S.D.	t	Sig
1. Performance Accomplishment (PA)	Before	10	3.123	0.542	-3.368*	.008
	After	10	3.461	0.721		
2. Vicarious Learning (VL)	Before	7	2.943	0.606	-2.854*	.029
	After	7	3.198	0.527		
3. Social Persuasion (SP)	Before	7	2.904	0.831	-4.745*	.003
	After	7	3.238	0.828		
4. Emotional Arousal (EA)	Before	9	3.285	0.378	-2.944*	.019
	After	9	3.593	0.451		
<b>Average Mean</b>	Before	33	3.096	0.569	-5.164*	0.000
	After	33	3.370	0.669		

Significant at .05 level

From Table 1, the result indicated statistically significant gains in participants' self-efficacy in every aspect at 0.05 level.

### **The results of self-efficacy from semi-structured interview after participating in teacher professional development program.**

The results from each interview question with 6 participants about their self-efficacy are shown as follows:

1. How will students be able to achieve their personal goals for studying physics (Personal Accomplishments (PA))?

The researchers found that most of the pre-service teacher thought physics was a difficult subject and required computational skills. Therefore, the thing that would make it successful in studying physics would be to have to practice doing a lot of problems and practice a lot of exercises. The students' answers could be displayed in 4 groups as follows:

Group 1: Student A, B, D and E commented that physics was a difficult subject and requires computational skills. Therefore, the thing that would make it successful in studying physics would be to have to practice doing a lot of problems and practice a lot of exercises. Example answers can be shown as follows:

“Physics is a difficult subject and requires mathematical calculation. Learners have to practice doing exercises.”(Participant A)

Group 2: Student C, E and F commented that in their opinions, physics was difficult. Also, according to past high school experiences, they were unable to understand the content. Therefore, students would try to study from the Internet media for their studies. Example answers can be shown as follows:

“If you don't understand from the classroom, students try to get media on the internet to help them learn. ”( Participant F)

Group 3 Student F commented that when they did not understand the content. However, since physics for teachers is a major that must be studied. They would try to study and focus more because they believed that if putting some effort everything would go well. Example answers can be shown as follows:

"Try to make it successful in studying. If you don't understand from the classroom, students try to get media on the internet to help them learn. ”( Participant F)

Group 4: Student B and E commented that in their studies, they did not study alone and they had friends to study with. Also, the professor(s) could give advice. So, they hoped that they would succeed in studying physics as they believed that if they tried hard, things would go well. Example answers can be shown as follows:

“Physics is difficult for students, but I know I can ask my friends. If a friend cannot explain to understand, he will ask the teacher" (Participant B)

2. “When you see that your friend is studying or working in physics for teachers. You think you can do it too.” What do you think of the above sentence (Vicarious Learning (VL))?

The researchers found that the students agreed with the sentence because the key factor in the students' learning was friends. Especially when working, student groups observe their peers who are good and able to do their jobs. This makes students want to be like friends. The students’ answers could be displayed in 2 groups as follows:

Group 1: Student B, C, D, E, and F commented that they agreed with the sentence because the key factor in the students' learning was friends. Especially when working, student groups observed their peers who were good and able to do their jobs. It made them want to be like their friends. Example answers can be shown as follows:

“I agree because my friend helped me complete the task in the group. Sometimes seeing a friend can do work I want to be like them. ”( Participant B)

Group 2: Student A commented that he/she did not agree with the sentence because sometimes he/she could work on his/her own without paying attention to his/her friends. Therefore, friends did not influence his/her work. Example answers can be shown as follows:

"Friends do not have an influence on study or work for me. Because I can take care of myself. "( Participant A)

3. How do the professor(s) influence the learning of physics for the pre-service teacher (Social Persuasion (SP))?

The researchers found that the students were of the opinion that the professor(s) had a great influence on the students' learning. Especially for the teaching and learning activities provided to students, they would feel enthusiastic about learning activities they did. This would allow students to understand more of the subject matter. Moreover, group teaching allowed students to interact with peers which helped with work and study. The students' answers could be displayed in 5 groups as follows:

Group 1 Student A, B, C, D, E and F commented that Teachers have a great influence on students' learning. Especially by using words to encourage students The teacher does not use words to hurt the students' minds. Example answers can be shown as follows:

“The teachers influence the learning of the students. The instructor often asks and encourages words such as "it's not difficult," "think slowly," don't worry, "and never use words that make you feel bad or discourage your studies. There is constant discussion between students and friends.” ( Participant B)

Group 2: Student A, B, C, D, E, and F further commented that the group teaching allowed them to interact with peers which helped with work and study. Example answers can be shown as follows:

"Teachers cultivate students to help each other work. Create good interactions within the group "(Participant E)

Group 3: Student A, B, and C commented that the Q&A session encouraged them to think about the questions the professor(s) had asked and to check whether they actually understood correctly. Example answers can be shown as follows:

“Teachers often use questioning methods to encourage students to think. Which allows learners to think together with the instructor "(Participant C)

4. What factors affect students' perceptions of studies in physics (Emotional Arousal (EA))?

The researchers found that the students were of the opinion that they felt good that the professor(s) created group activities and classroom activities which were focused on practices so that they were not bored. The students' answers could be displayed in 5 groups as follows:

Group 1: Student A, B, C, D, E, and F commented that it was good that the professor(s) gave them group activities. Example answers can be shown as follows:

"The instructor does group activities because it is not boring. I feel good when my teachers assign group work. I don't like my teachers to use questions individually because I feel pressured.” (Participant A)

Group 2: Student A, B, C, D, E, and F commented that it was good that the classroom activities were pragmatic and not boring. Example answers can be shown as follows:

“I love doing experimental activities, group activities, I feel comfortable doing group activities because of having a friend to help me” (Participant B)

Group 3: Student B, C, D, E and F commented that during the teaching practice activities, they had to prepare and understand the content more. However, when they went out to do an experiment to teach their friends, they found that they were excited and nervous, causing them to forget the content. If students had the opportunity to redo and fix their mistakes, they thought they could do better. The first thing to improve for them was to understand more about the content and to focus on teaching more. Example answers can be shown as follows:

“The practice of teaching makes me aware of my flaws and is ready to improve myself especially on the subject matter. Because I do not understand the subject matter, it affects confidence in the practice.” (Participant F)

Group 4: Student C, D, E and F commented that the problem of studying physics was that they cannot solve physics problems which made them feel discouraged. Example answers can be shown as follows:

“Studying physics sometimes when I have a difficult problem I feel discouraged” (Participant F)

Group 5: Student A, B, and C commented that the professor(s) sometimes asked questions individually, putting the students in a lot of pressure. Instead, asking in group questions or asking everyone in the room. Example answers can be shown as follows:

“Feels good when teachers assign group work I don't like my teachers to use questions individually because I feel pressured.” (Participant A)

## **Conclusion**

The results of developing the self-efficacy of pre-service science teachers in physics were found that when comparing the self-efficacy before and after learning management, it showed that the self-efficacy results after learning management were higher than before learning management in all aspects at statically significant level of 0.05. Data from the interviews showed that the main influences in developing self-efficacy included teacher, good interaction between teachers and students, supports from classmates, work group, hands on activities, and questioning. In accordance with Deepika Menon and Troy D. Sadler, (2017) the research found that the inquiry-based science courses positively influenced their self-efficacy for science and science teaching of pre-service teacher. It made in a majority of pre-service teacher's conceptual understanding of science, understanding of the science process and scientific research, confidence with science and science teaching. Mulholland & Wallace (2001) found that the content knowledge and pedagogical content knowledge is important roles in the development of a science teacher's self-efficacy beliefs.



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