



THE RELATIONSHIP BETWEEN THE PRE-SERVICE SCIENCE TEACHERS' SELF-EFFICACY BELIEFS ABOUT SCIENCE TEACHING AND LABORATORY WORKS

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Abstract

The purpose of the present study is to determine the relationship between the pre-service science teachers' perceptions of their self-efficacies in science teaching and laboratory works. The sampling of the study consists of 70 pre-service science teachers grade 4 that have studied in Science Teacher Education Department at Muğla University. Survey method was used in the present study. The pre-service teachers' views of their proficiency in science laboratory works were determined through 18-item "Proficiency Determination Form" developed by Büyük, Demir and Erol (2010). The reliability of the scale was found to be .89. The pre-service teachers' perceptions of "Science Teaching Self-Efficacy (STSE)" were determined by means of 23-item "Science Teaching Efficacy Belief Instrument (STEBIB)" developed by Riggs and Enochs (1990) and adopted to Turkish by Özkan, Tekkaya and Çakıroğlu (2002). According to the results of factor analysis, science teaching self-efficacy perception consists of two dimensions as "personal science teaching efficacy beliefs" and "science teaching outcome expectancy". Alpha reliability coefficient of each dimension was found to be 0.86 and 0.79, respectively. The results of the analyses revealed that there is a significant correlation between science teachers' perceptions' of their self-efficacies in science teaching and science laboratory competencies.

Keywords: Pre-service Science Teacher, Self-Efficacy, Science Laboratory Works, Science Teaching

INTRODUCTION

In science education, students who have a strong belief that they can succeed in science tasks and activities will be more likely to select such tasks and activities, work hard to complete them successfully, persevere in the face of difficulty and etc. (Britner & Parajes, 2006). It is clear that among the factors leading students to have such beliefs is the teacher. Schwartz and Lederman (2002) and Mihladiz (2010) reported that teachers' classroom practices are closely related to their self-efficacy beliefs. According to Bandura (1977), self-efficacy is based on one's previous

experiences and strongly influences behavior. In parallel with this statement, Pajares (1996) claimed that self-efficacy beliefs mediate the effect of other determinants of behavior and that, when these other determinants are controlled, self-efficacy should be an excellent predictor of behavior. Also self-perception of efficacy can affect people's choice of activities, how much effort they expend, how long they will persist in the face of difficulties (Bandura & Schunk, 1981). Teachers' self-efficacy beliefs are very important in terms of decisions regarding classroom management, organizing courses, teaching, motivating the students for learning and communicating with the students effectively (Erdem& Özcan, 2007). Also, one of the most common methods employed in science teaching is laboratory method. Laboratory works are used extensively to develop students' conceptual learning and understanding of science (Garnet, Garnet & Hackling, 1995) and provide suitable environments to develop scientific process skills and problem solving abilities (Hofstein & Mamlok-Naaman, 2007). Through laboratory works, the information, skills, and attitudes desired to be instilled in students mostly determined by teachers' information, skills and attitudes in the related field (Böyük, Demir & Erol, 2010). In this respect, besides science teachers' perceptions of their self-efficacy for science teaching, their perceptions of their self-efficacy for laboratory practices are of great importance. Considering the effect of teachers' self-efficacies, the purpose of the present study is to determine the relationship between the pre-service science teachers' perceptions of their self-efficacies in science teaching and laboratory works.

Rationale

A specific measure of science teaching efficacy beliefs may predict future science teaching success of pre-service teachers and the degree to which they will positively influence student achievement in science in their classrooms (Cantrel, Young & Moore, 2003). In this respect, the present study aims to determine the pre-service teachers' perceptions of their self-efficacy for both science teaching and laboratory works and also investigate the relationship between these two.

METHOD

Model of the Study

In this study, the survey method was used to determine the pre-service teachers' perceptions of their self-efficacy for both science teaching and laboratory works. Related scales were used to elicit the participants' self-efficacy beliefs.

Participants

The sampling of the study consists of 70 pre-service science teachers grade 4 that have studied in Science Teacher Education Department of the Education Faculty at Muğla University. The selection process of the participants was carried out with "purposive sampling" method. In order to minimize the risk for the participants' having low self-efficacy due to missing information about

some topics, four-year students who have already taken most of the undergraduate courses were preferred.

Data Collection Tool

In the present study, as a data collection tool, two different questionnaires aiming to determine the pre-service science teachers' perceptions of self-efficacy for science teaching and laboratory works were used.

The questionnaires were designed in the form of 5-point Likert-type. The pre-service teachers' perceptions of "science teaching self-efficacy beliefs (STSE)" were determined by means of 23-item "Science Teaching Efficacy Belief Instrument (STEBIB)" developed by Riggs and Enochs (1990). STEBI-B is adapted to Turkish by Özkan, Tekkaya and Çakıroğlu (2002). According to the results of factor analysis, STSE perception consists of two dimensions as "personal science teaching efficacy beliefs (PSTE, 13 items)" and "science teaching outcome expectancy (STOE, 10 items)". Alpha reliability coefficient of each dimension was found to be 0.86 and 0.79, respectively. The pre-service science teachers' views of their proficiency in science laboratory works were determined through 18-item "Proficiency Determination Form" developed by Büyük, Demir and Erol (2010). In order to establish the content validity of the questionnaire, subject experts' opinions were sought. The reliability of the scale was found to be .89.

Data Analysis

The pre-service science teachers' self-efficacy scores for science teaching and laboratory works were obtained through the questionnaires administered to the pre-service science teachers. The data were analyzed through SPSS 15.0 program package. The competency scores for science teaching and laboratory works were separately analyzed by using "descriptive statistics". Moreover, the relationship between the pre-service teachers' self-efficacy beliefs about science teaching and laboratory works was analyzed with "Pearson Correlation Coefficient".

FINDINGS

1. Pre-Service Science Teachers' Science Teaching Self Efficacy Beliefs (STSE)

Pre-service science teachers' general STSE mean scores have been given in Table 1. The maximum score that teachers can achieve in the survey of self-efficacies scale is 115 and the minimum score is 23.

Table 1. Descriptive statistics results of the general scores of pre-service science teachers' STSE

N	\bar{X}	SD	Min.	Max.	Med.	Mod.
70	88.70	11.7687	41.00	108.00	90.00	96.00

General mean for the pre-service science teachers' STSE scores was found to be $\bar{x} = 88.70$. When the participants' mean self-efficacy score is investigated for each item, it matches to 3.86 (≈ 4.00 ; agree). While the minimum score obtained by the participants is $\bar{x} = 41.00$, maximum score is $\bar{x} = 108.00$ and also standard deviation value is 11.7687. These results show that the pre-service teachers' STSEs are at the medium level. The descriptive statistics for the scores obtained by the pre-service science teachers PSTE and STOE which are sub-dimensions of STSE, are given in Table 2.

Table 2. Descriptive statistics results of the scores of pre-service science teachers' PSTE and STOE

Sub-dimensions of STSE	N	\bar{x}	SD	Min.	Max.	Med.	Mod.
PSTE	70	50.74	7.6607	23.00	65.00	51.00	51.00
STOE	70	37.97	5.2612	18.00	48.00	38.50	39.00

As can be seen in Table 2., pre-service science teachers' mean PSTE score was found to be $\bar{x} = 50.74$. When the participants' mean PSTE score is evaluated for each item, it matches to 3.90 (≈ 4.00 ; agree) in likert scale. Besides pre-service teachers' mean STOE score was found to be $\bar{x} = 37.97$. When the participants' mean STOE score is evaluated for each item, it matches to 3.80 (≈ 4.00 ; agree) in likert scale. In this respect, it is seen that the participants have medium level of STOE and PSTE.

2. Pre-Service Science Teachers' Laboratory Works Self Efficacy Beliefs

Pre-service science teachers' laboratory works self-efficacies beliefs have been investigated by using 18 items of proficiency form in the study. The maximum score that teachers can achieve in the survey of proficiency form is 90 and the minimum score is 18. Pre-service science teachers' laboratory works self-efficacy beliefs mean scores have been given in Table 3.

Table 3. Descriptive statistics results of the scores of pre-service science teachers' laboratory works self-efficacies

N	\bar{x}	SD	Min.	Max.	Med.	Mod.
70	70.57	9.5789	43.00	88.00	70.00	68.00

General mean for the pre-service science teachers' self-efficacy scores for laboratory works was found to be $\bar{x} = 70.57$. When the pre-service teachers' mean self-efficacy score is evaluated for each item, it matches to 3.92 (≈ 4.00 ; competent) in likert scale. While the minimum score obtained by

the participants is $\bar{x} = 43.00$, maximum score is $\bar{x} = 88.00$ and also standard deviation value is 9.5789. These results show that the pre-service science teachers have medium level of self-efficacy for laboratory works.

3. *The Relationship between Pre-Service Science Teachers' Self Efficacy Beliefs of Science Teaching and Science Laboratory Works*

The pre-service science teachers' scores for self-efficacy beliefs about science teaching (STSE) and its sub-dimensions; PSTE and STOE scores, were separately compared with the participants' self-efficacy scores for laboratory works. The results of Pearson Correlation Coefficient analysis which explains the relationship among variables are presented in Table 4. Correlation is significant at the 0.01 level (2-tailed).

Table 4. Results of the correlation between the pre-service science teachers' STSE, PSTE and STOE scores and their self-efficacy beliefs about laboratory works

		N	r	r ²	P
Laboratory Works Self-Efficacy	STSE	70	.432	0.19	.000
	PSTE	70	.517	0.27	.000
	STOE	70	.215	0.05	.074

As can be seen in Table 4., there is a positive significant relationship between the pre-service science teachers' self-efficacy beliefs about laboratory works and STSE scores ($r = .432$; $p < .01$). Hence, it can be argued that with the increasing level of self-efficacy beliefs about science teaching, their self-efficacy beliefs about laboratory works increase. Yet, when we look at the determination coefficient of this relationship, we can see that it is quite low ($r^2 = 0.19$). Also, there is a positive significant relationship between the pre-service science teachers' self-efficacy beliefs about laboratory works and their PSTE scores ($r = .517$; $p < .01$). Hence, it can be argued that with the increasing personal science teaching efficacy beliefs, their self-efficacy beliefs about laboratory works improve. Yet, when we look at the determination coefficient of this relationship, we can see that it is quite low ($r^2 = 0.27$). In addition to this, in Table 4., it is seen that there is no significant relation between the pre-service teachers' self-efficacy beliefs about laboratory works and STOE scores ($r = .215$; $p > .01$). Hence, it can be argued that the participants' science teaching outcome expectancy and their self-efficacy beliefs about laboratory works do not affect each other.

DISCUSSION

The present study revealed that the pre-service science teachers' mean scores for science teaching self-efficacy beliefs (STSE) and its sub-dimensions, personal science teaching efficacy beliefs (PSTE) and science teaching outcome expectancy (STOE) can be considered adequate level. Also, some researchers (Aydın & Boz, 2010; Gürol, Altunbaş, & Karaaslan, 2010) found that the pre-service

teachers have high self-efficacy scores for these two sub-dimensions. Meriç and Ersoy (2007) stated that pre-service classroom teachers reported their STSE levels between adequate and good, and their perceptions of their self-efficacy levels do not change depending on gender, grade level and average grade point. In the present study, the pre-service teachers' self-efficacy beliefs about laboratory works were compared with their STSE and its sub-dimensions. Positive low level relationships were found between the pre-service teachers' laboratory works self-efficacy beliefs and STSE, also pre-service teachers' laboratory works self-efficacy beliefs and PSTE. In addition to this, there is no significant relationship between the pre-service science teachers' STOE and their laboratory works self-efficacy beliefs. This indicates that pre-service science teachers' STOE and laboratory works self-efficacy beliefs are independent each other. In relation to the sub-categories mentioned here, Ramey-Gassert, Shroyer and Staver (1996) found that pre-service and in-service experiences such as success in high quality science courses and workshops, access to resources and time, and supportive colleagues and administrators influenced PSTE, and to a lesser degree STOE. Çelikkaleli and Akbaş (2007) stated that self-efficacy beliefs explain 39% of the variance seen in the pre-service science teachers' attitudes towards science course. Yet, result expectancy does not significantly affect the pre-service science teachers' attitudes towards science course.

CONCLUSION

In light of the findings of the present study, it is seen that the pre-service science teachers' STSE, PSTE, STOE scores match "agree" option in the questionnaire. In this respect, pre-service teachers consider themselves competent in relation to science teaching. Denizoğlu (2008) found that the pre-service science teachers' self-efficacy scores, personal self-efficacy sub-dimension scores and result expectancy sub-dimension scores are above the average. Moreover, parallel to the findings of the present study, many other studies (Harurluoğlu & Kaya, 2009; Küçükyılmaz & Duban, 2009; Kurtuluş & Çavdar, 2010) found that pre-service teachers' self-efficacy scores for science teaching are quite high. Also, Şahin, Işıksal and Ertepinar (2010) revealed that private school teachers had significantly higher self-efficacy beliefs than public school teachers. In this study, pre-service teachers' laboratory works self-efficacy beliefs were found to be at the medium level. Parallel to the findings of the present study, Akdemir (2006) and Kaya and Büyük (2011) reported that pre-service science teachers consider themselves competent in laboratory works. In addition, Akçöltekin (2008) stated that high majority of the science teachers find themselves competent in laboratory works, but due to lack of laboratory materials, they may exhibit poor performances. Positive low significant relationship was found between the pre-service science teachers' laboratory works self-efficacy scores and their STSE and PSTE scores. Hence, it can be argued that with increasing self-efficacy beliefs in science teaching and personal science teaching beliefs, laboratory works self-efficacy beliefs improve. Yet, no significant relationship was found between the pre-service science teachers' laboratory works self-efficacy belief scores and their STOE scores. This shows that STOE is a weak variable for explained the pre-service science teachers' laboratory works self-efficacies.

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