



## Pre-Service Elementary Science Teachers' Science Teaching Efficacy Beliefs and Their Sources

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**ABSTRACT:** The purposes of this study were to measure science teaching self-efficacy beliefs of pre-service teachers, and to determine whether there is a difference between the grades of pre-service science teachers in terms of self-efficacy in science teaching as well as sources of their self-efficacy beliefs. The sample of the research included 492 pre-service elementary science teachers. Science Teaching Efficacy Beliefs (STEBI-B) and semi-structured interviews were used to collect data. Results showed that self-efficacy beliefs of pre-service teachers are generally high for both subscales that are Personal Science Teaching Efficacy (PSTE) (M = 51.42, SD = 6.88) and Science Teaching Outcome Expectancy (STOE) (M = 36.69, SD = 5.35). Moreover, Multivariate Analysis of Variance (MANOVA) showed that pre-service teachers in the final year had significantly higher self-efficacy beliefs.

**Key words:** self-efficacy, pre-service teachers, science teaching efficacy beliefs,

### INTRODUCTION

In the last twenty five years, teachers' efficacy beliefs, their relation with teachers' instruction and students' learning were analyzed in many studies (Allinder, 1994; Cakiroglu, Cakiroglu & Boone, 2005; Gencer & Cakiroglu, 2007; Tschannen- Moran & Woolfolk Hoy, 2007). Bandura describes self-efficacy as "People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Efficacy beliefs determine to what extent people will try to cope with the situation as well as how much time they will spend on the action. People have a tendency to choose careers about which they have high self-efficacy beliefs (Bandura, 1994). In other words, people's self-efficacy beliefs help us to predict their motivation and choice. Similarly, teachers' efficacy beliefs related to their teaching affect their action in class. Therefore, it is important to determine pre-service teachers' self-efficacy beliefs in teaching due to the fact that they will be a teacher in the future (Cakiroglu, et al., 2005). Before planning suitable activities to enhance pre-service teachers' efficacy beliefs in teacher education programs, data should be gathered to determine whether their self-efficacy is low or not. Furthermore, it is difficult to make changes in self-efficacy after the establishment of beliefs (Bandura, 1997); therefore, pre-service teachers' self-efficacy beliefs should be examined.

### THEORETICAL BACKGROUND

Self-efficacy is grounded in a larger theoretical framework, which is the Social Cognitive Theory asserted by Bandura. Efficacy expectations and outcome expectations are components of self efficacy (Bandura, 1977). "An outcome expectancy is defined as a person's estimate that a given behavior will lead to certain outcomes. An efficacy expectation is the conviction that one can successfully execute the behavior required to produce the outcomes" (p.193).

Research on teachers' self-efficacy beliefs provided essential information related to importance of teachers' efficacy beliefs which influence their behaviors in class, students' achievement and motivation (Tschannen- Moran & Woolfolk Hoy, 2007), their perception about their roles and interaction with students (Allinder, 1994), and management orientations (Gencer & Cakiroglu, 2007). Allinder (1994) found that teachers with high teaching efficacy beliefs had a

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tendency to implement diverse methods in their instruction. Furthermore, the higher the teachers' teaching self-efficacy is, the more confidence they had in their instruction. In addition to that, the result of Allinder (1994), Woolfolk and Hoy (1990) indicated that there was a significant negative correlation between teaching self-efficacy and student control ideology. Teachers who had high teaching efficacy had more humanistic orientation in controlling students whereas teachers with low teaching efficacy had a rigid control over students. Similar result was confirmed by Enochs, Scharman and Riggs (1995). In addition to association between teaching efficacy and classroom management orientation, the relation between teaching efficacy and commitment to teaching was found in Coladarci (1992). The results of the research pointed out that the higher the general and personal self-efficacy the teachers had the more commitment to teaching they had. All these studies have indicated the importance of teachers' teaching efficacy beliefs which was also summarized very well by Tschannen- Moran and Woolfolk Hoy (2001): "Clearly the study of this construct has borne much fruit in the field of education" (p.784).

### **Sources of Self-Efficacy**

Mastery experiences, vicarious experiences, social persuasion, and physiological and emotional states are the four basic sources of self-efficacy. Mastery experiences, in other words, one's own performance experiences, are the most powerful source of self-efficacy (Bandura, 1997). In light of the early experiences, one may think that s/he is proficient to do or not to do a task. The interpretation of the previous experiences determines the self-efficacy beliefs (Bandura, 1994).

Although Bandura indicated mastery experience as the most important factor for self-efficacy beliefs, three other sources may be more significant when the mastery experience is not adequate (Tschannen- Moran & Woolfolk Hoy, 2007). Self-efficacy beliefs are also influenced by vicarious experiences which refer to observation of the behaviour of others and the results of that behaviour. While vicarious experiences provided by social models have weaker effects on self-efficacy than mastery experiences, observing the successful behaviour of a model can raise observers' self-efficacy (Bandura, 1997). Moreover, the characteristics of the model influence the impact of modelling on self-efficacy. These characteristics are competence, perceived similarity, credibility, and enthusiasm. The more competent, similar, credible and enthusiastic the model is, the more influence the model has on the observer (Schunk, 2000).

Social persuasion of people around us is the third source of self-efficacy beliefs. Peers, parents, teachers and other people provide messages to us either verbally or nonverbally. Although this source typically has less impact on self-efficacy beliefs than other sources, young people's self-efficacy beliefs are much more affected by opinions of other people around them (Pajares, 2002).

People's mood, stress, and pains, have effects on one's self-efficacy beliefs (Bandura, 1997; Pajares, 2002). Generally, positive emotions increase self-efficacy beliefs while negative ones weaken them. The important point is not the strength of negative feeling but the interpretation of it by the individual (Schunk & Zimmerman, 2008).

### **Teaching Self-Efficacy**

Ashton (1984) described teaching efficacy as "the extent to which teachers believe that they have the capacity to affect student performance" (p. 28). Guskey and Passaro (1994) defined the construct as "teachers' belief or conviction that they can influence how well students learn, even those who may be difficult or unmotivated" (p.628). Bandura (1977) indicated that teaching efficacy is one of the important research areas. Teachers' self-efficacy beliefs may not be same for different subjects. In other words, it is subject-specific (Bandura, 1997).

In the literature there are different studies related to teachers' self-efficacy beliefs, for instance, the comparison of pre-service and in-service teachers' teaching self-efficacy beliefs (Tschannen- Moran & Woolfolk Hoy, 2007), the correlation between teaching self-efficacy beliefs and number of misconceptions that pre-service teachers have (Schoon & Boone, 1998; Tekkaya, Cakiroglu & Ozkan, 2002) and comparison of teaching self-efficacy beliefs of teachers in different countries (Campbell, 1996; Cakiroglu, et al., 2005). In addition, in many studies, correlation between self-efficacy beliefs and other constructs such as classroom management orientations (Enochs, et al.,1995;

Gencer & Cakiroglu, 2007), attitude toward teaching (Sarıkaya, 2004), commitment to teaching (Coladarci, 1992), and instructional variables (Allinder, 1994) were explored.

For example, Tschannen-Moran and Woolfolk Hoy (2007) compared novice ( $n = 74$ ) and experienced teachers' ( $n=181$ ) self-efficacy beliefs by using Teacher Sense of Efficacy Scale (TSES). In addition, the relation between the contextual variables and self-efficacy beliefs were investigated in the study. Results showed that experienced teachers' efficacy beliefs for instructional strategy and efficacy for classroom management were higher than those of novice teachers. The researchers indicated that the difference between them might be explained by the difference in the amount of mastery experience they had. Moreover, experienced teachers indicated that they had more teaching resources and support from administrators.

In another study, the relationship between pre-service elementary science teachers' ( $n=619$ ) self-efficacy beliefs and their alternative conceptions was examined by Schoon and Boone (1998). Results revealed that pre-service teachers who got higher scores in the achievement test had a tendency to get high Personal Science Teaching Self-efficacy (PSTE) score from STEBI-B. Similarly, the relation between pre-service elementary science teachers' ( $n = 299$ ) understanding of science and self-efficacy in science teaching was examined by Tekkaya, et al., (2002). STEBI-B and Science Concept Test (SCT) were used in the study. Results showed that SCT scores ( $M = 16.96$ ) were low for 40 items whereas their teaching self-efficacy beliefs were high in both subscales PSTE and STOE, ( $M = 49.3$ ,  $SD = 7.4$ ) ( $M = 36.3$ ,  $SD = 5.5$ ), respectively.

Moreover, Enochs, et al., (1995) studied 73 pre-service elementary teachers, who were at the last semester of teacher education program. STEBI-B and Pupil Control Ideology (PCI) were administered. Results revealed that teachers with high self-efficacy had a tendency to adopt humanistic orientation for classroom management. Another study about the relation between teachers' self-efficacy beliefs and their class management orientations was carried out by Gencer and Cakiroglu (2007). STEBI-B and Turkish version of Attitudes and Beliefs on Class Control (ABCC) inventory were utilized. No significant differences between neither gender nor grade in terms of self-efficacy beliefs and classroom management orientations were found. Additionally, positive correlations were found between PSTE scores and instructional management scores of participants, and between STOE and instructional management. However, a significant negative correlation was found between PSTE and people management.

In addition to class management orientations, attitude toward teaching was another variable whose relation with self-efficacy of teachers was investigated. To investigate pre-service elementary science teachers' scientific knowledge, attitude toward science teaching and self-efficacy beliefs in science teaching, Sarıkaya (2004) administered three instruments to 750 pre-service teachers. STEBI-B for self-efficacy, Science Achievement Test (SAT) for scientific knowledge and Science Teaching Attitude Scale (SCAT) for teaching attitude were used. Results revealed that participants' self-efficacy beliefs in science teaching were moderate. Mean score of PSTE was  $M = 45.22$  and of STOE was  $M = 36.34$ . Moreover, there was no significant difference between males and females on the both PSTE and STOE. Additionally, there was a significant positive correlation between PSTE and the number of pedagogical courses taken. Results of the Multiple Regression Correlation (MRC) indicated that science knowledge and attitude toward science teaching were significant predictors of PSTE. The model including science achievement and attitude explained 40% of the variation in PSTE. For STOE, 4% of the variance was explained by the model and each variable had significant contribution to the variance in STOE.

Yet another construct was commitment to teaching whose relation between self-efficacy was investigated. Coladarci (1992) examined the relation between teachers' self-efficacy and their commitment to teaching. TES, developed by Gibson and Dembo (1984), was utilized to measure commitment to teaching. The data were gathered from 170 in-service teachers. In light of the results, it can be concluded that there was a significant and positive correlation between personal efficacy and commitment, and between general efficacy and commitment. Moreover, regression analysis revealed that personal and general efficacy were significant predictors of commitment to teaching.

Research in the related literature also showed that teachers' self-efficacy beliefs and their actions in classroom have a significant correlation. Correlations between teachers' teaching self-efficacy and students' achievement (Ross, 1992), perception about their roles and relations with students (Allinder, 1994), and management orientations (Gencer & Cakiroglu, 2007) were found.

In addition, some research studies were conducted about the effect of teacher education programs on pre-service teachers' teaching efficacy beliefs. Some of the studies in the literature indicated that pre-service teachers' teaching efficacy beliefs increased during the teacher education programs (Hoy & Woolfolk, 1990; Gorrell & Hwang, 1995; Mulholland, Dorman & Odgers, 2004). The researchers explained the difference with mastery experience in teaching practices of pre-service teachers as well as other courses such as method courses, observing successful models and learning environments encouraging pre-service teachers (Ramey-Gassert & Shroyer, 1992; Scharmann & Hampton, 1995; Huinker & Madison, 1997). On the contrary, some of the studies showed decline or no change in the pre-service teachers' self-efficacy beliefs (Romi & Daniel, as cited in Woolfolk Hoy & Burke-Spero, 2005; Lin & Gorrell, 2001). The researchers attributed the decrease to realization of the difficulties in teaching. Therefore, there is no consensus on the effect of teacher education programs on pre-service teachers' self-efficacy beliefs.

### **Significance of the Study**

Although there have been many studies about correlation between teaching self-efficacy and different constructs such as understanding of science about the difference between in-service and pre-service teachers' teaching self-efficacy beliefs, and about the difference between pre-service teachers' self-efficacy beliefs in different countries, as mentioned above, research focusing on pre-service teachers' self-efficacy beliefs and qualitative analysis of their sources has been limited. Therefore, in light of the literature mentioned above, the purposes of the current research were threefold. The first purpose of the study was to determine the level of pre-service elementary science teachers' self-efficacy beliefs, which were suggested by Enochs and Riggs (1990), Bandura (1997), and Cakiroglu et al., (2005). To examine whether there is a difference, in terms of teaching self-efficacy, between the pre-service teachers who are at different grades was the second purpose of the study. Finally, to examine the sources of pre-service science teachers' self-efficacy beliefs in detail was the third purpose of the research. The results of the study are hoped to provide valuable information about how pre-service science teachers feel themselves in terms of science teaching efficacy, whether it is different for pre-service teachers who are at different grades, and what the sources of their science teaching efficacy beliefs are. Specifically, qualitative part of the study will enrich the related literature in terms of helpful and useful sources for pre-service teachers' self-efficacy beliefs which is an important construct as summarized in the literature review part. Owing to results of the study, teacher education programs may make changes or additions to the program. Moreover, they can give feedback related to the teaching practices in elementary schools, and mentors in practice schools and in faculty because they are the probable sources of teaching efficacy beliefs of pre-service teachers. Additionally, the results of the study will supply information which is inadequate in the literature.

### **Research Questions**

1. What are pre-service elementary science teachers' self-efficacy beliefs about science teaching?
2. Is there a significant difference between science teaching self-efficacy beliefs of pre-service science teachers with respect to grade levels?
3. What are the sources of pre-service science teachers' science teaching efficacy beliefs?

## **METHOD**

### **Sample**

Science Teaching Efficacy Belief Instrument (STEBI-B) was administered to pre-service elementary science teachers in three different universities in Ankara and Van ( $N = 492$ ,  $n = 276$  females and  $n = 216$  males). Convenience sampling was used in sampling procedure. Due to the fact that the first author is a research assistant at Yuzuncu Yil University, and she is doing PhD at another university in Ankara, data were gathered from Ankara and Van. Two of the universities are in the capital city of Turkey, Ankara. The other university is at the east part of the Turkey. Pre-service elementary science teachers are educated through four-year undergraduate programs. For subject matter knowledge,

general physics, chemistry, calculus, biology and advanced courses such as molecular biology, evolution, and optics courses are provided. In addition, method courses for teaching science, introduction to teaching profession, classroom management, educational psychology, instructional planning and evaluation, school experience and teaching practice are some of the courses for pedagogical knowledge. In the school experience course, pre-service teachers only observe mentors whereas in the teaching practice course they teach in real classroom context. Finally, the scale was administered to all grades, from first grade to fourth grade, in the universities.

## **Instruments**

### ***Science Teaching Efficacy Belief Instrument (STEBI-B)***

The instrument was developed by Enochs and Riggs (1990). Personal Science Teaching Efficacy (PSTE) and Science Teaching Outcome Expectancy (STOE) are two sub-scales of the STEBI-B. It is a five-point Likert type instrument ranging from 1 meaning “strongly disagree” to 5 meaning “strongly agree”. PSTE has 13 items while STOE has 10 items. The scales include some negative items, so they must be reversed. After reversing the negative items, high score in PSTE indicates high self-efficacy in science teaching. Similarly, high score in STOE means high outcome expectancy for science teaching. Scores in PSTE are between 13 and 65 whereas the scores for STOE range from 10 to 50. “*If students are underachieving in science, it is most likely due to ineffective science teaching*”, “*The teacher is generally responsible for the achievement of students in science*” and “*The inadequacy of a student’s science background can be overcome by good teaching*” are example items from STOE subscale while “*I know the steps necessary to teach science concepts effectively*” and “*I understand science concepts well enough to be effective in teaching science*” are items from PSTE subscale. Enochs and Riggs (1990) informed of the Cronbach’s Alpha coefficients as .90 and .76 for PSTE and STOE, respectively. The instrument translated and adapted into Turkish by Tekkaya, et al., (2002). They reported reliability coefficients as .86 and .79 for PSTE and STOE, respectively. As in the original, the Turkish version has two sub-dimensions which are PSTE and STOE.

In the present study, the Cronbach’s alpha for PSTE is .84 and for STOE is .68. The reliability coefficient should be at least .70 (Frankel & Wallen, 2006). Therefore, reliability of STOE sub-dimension is a bit problematic; however, studies which used STEBI-B got approximately the same reliability for the sub-scale, for example, Gencer and Cakiroglu (2007). The reliability of STOE in that study was found to be .71.

### ***Semi-Structured Interviews***

After administration of STEBI-B to the participants, to analyze the sources of the self-efficacy beliefs, semi-structured interviews were conducted with 14 of the participants who are at different grades from 1 to 4. The participants with low, medium and high self efficacy beliefs for both PSTE and STOE were selected according to their scale scores. As stated in Thompson and Soyibo (2002), participants with the scores which were at least one standard deviation above the mean were labelled as high self efficacy beliefs whereas participants with scores within one standard deviation below and above the mean were considered as having moderate self efficacy and at least one standard deviation below the mean were regarded as low self efficacy beliefs. Moreover, participants at different grade levels were included in the selection process. Each interview was tape-recorded; and they were all transcribed for further analysis.

## **RESULTS**

In order to summarize pre-service teachers’ science teaching efficacy beliefs, descriptive statistics was conducted. Results showed that self-efficacy beliefs of pre-service teachers are generally high for PSTE ( $M = 51.42$ ,  $SD = 6.88$ ) and STOE ( $M = 36.69$ ,  $SD = 5.35$ ). Table-1 shows the means of the PSTE and STOE subscales of the pre-service teachers at different grades. In the PSTE subscale, freshmen, sophomores and juniors had almost the same PSTE mean whereas seniors had the highest mean. In contrast to PSTE subscale, there has been a different tendency in the mean of STOE subscale. Freshmen had a STOE mean which was very close to that of seniors. In sophomores, there was a decrease in the mean while in juniors’ mean a slight increase was observed.

In order to examine whether there is a difference between the pre-service teachers who are at different grades in terms of teaching self-efficacy beliefs, multivariate analysis of variance (MANOVA) was used in order to explain the effect of grade on pre-service teachers teaching efficacy beliefs because the instrument, STEBI-B, has two sub-dimensions which are PSTE and STOE.

Table 1: Descriptive Statistics

	Value Label	N	Mean PSTE	Mean STOE
Freshmen	Grade 1	114	51.01	37.58
Sophomores	Grade 2	109	50.91	35.80
Juniors	Grade 3	123	50.50	36.13
Seniors	Grade 4	100	53.84	37.76

After checking the assumptions, *multivariate normality, homogeneity of covariance matrices* ( $F(9,2574486)=4,760, p=.000$ ) and *independency*, multivariate analysis of variance (MANOVA) was used for the data analysis (Palland, 2001). The Box's test should not be significant, however, in this analysis it was. "If the Box's test is significant with equal  $n$ 's, then, although Type I error rate will be only slightly affected, power will be attenuated to some extent." (Stevens, 2002, p, 278). Moreover," it is very unlikely that the equal covariance matrices assumption would ever literally be satisfied in practice" (p. 270). We can say that there are not large differences in number of students who are at different grades.

In terms of the grades, the analysis showed that there was a significant mean difference between self-efficacy beliefs of pre-service teachers at different grades ( $F(6, 439)= 3.53, p<. 05$ ). The effect size was small,  $\eta^2 = .025$ . The observed power was .98. To determine whether there was a difference in both sub-scales or not, tests of between subject effects results were examined. There were significant differences between self-efficacy of pre-service teachers at different grade in both PSTE ( $F(3, 442)= 5.31, p <.05$ ) and STOE, ( $F(3, 442)= 3.28, p<.05$ ).

Post hoc analysis showed that there were significant mean differences between freshmen and seniors, sophomores and seniors, and juniors and seniors. Seniors had the highest PSTE mean ( $M=53.84, SD = 5.62$ ). The lowest PSTE mean belonged to juniors ( $M=50.50, SD = 7.73$ ). For STOE sub-dimension, the only significant mean difference was between sophomores and seniors. As in the PSTE sub-scale, seniors had the highest mean ( $M= 37.76, SD =4.73$ ) in STOE. The lowest STOE mean belonged to sophomores ( $M=35.80, SD = 5.50$ ).

### Sources of Teaching Efficacy Beliefs

In the qualitative part of the study, sources of science teaching self-efficacy beliefs were examined. As mentioned in method part, the participants with low, medium and high self-efficacy beliefs for both PSTE and STOE were selected according to their scale scores as stated in Thompson and Soyibo (2002). For the analysis of the interview, categories were constructed according to the four sources mentioned in the Bandura's theory. Answers were independently evaluated by two researchers one of whom was the first author and the other was her colleague. After discussions on the answers, agreements were adopted. Table 2 shows the sources of self-efficacy mentioned by the participants during the interviews. One interviewee might mention more than one source.

Table 2: Sources of Science Teaching Self-efficacy

Sources of self-efficacy	Number of interviewees
Mastery Experience	10
Vicarious Experience	8
Social Persuasion	1
Physiological and Emotional states	0

As in Bandura's theory, mastery experience was mentioned as the most important source of self-efficacy beliefs. Teaching at school experience course, giving a private course, teaching to their

peers and sisters/brothers as well as other sources (teaching during summer camp, graduating from high school related to training teacher) were the types of the mastery experience encountered in this study. For example, one of the senior pre-service teachers explained his mastery experience as;

R<sup>3</sup>: You agreed strongly the item that “I will continually find better ways to teach science  
“Can you explain why you think so?

P<sup>4</sup>: Yes, I think I can because I have had some experience in the practice teaching courses.

R: You mean you taught at school.

P: Yes, I taught many times at school.

R: How was your teaching? What do you think?

P: In my first classes, I realized that my students were getting bored while I am teaching. Therefore, in my later classes, I tried to give different examples and teach differently. Then, when I asked them questions, I saw that all of them were enthusiastic.”

Similarly, another senior pre-service teacher shared her experience:

R: You stated that you disagreed strongly the item that “I wonder if I will have necessary skills to teach science”. Why do you think so?

P: I think so because in light of my experience. I have given private courses. I tried to use different materials, for example, I built castles by using ashtrays to teach friction. I observed the student’s interests to attract his attention.

Another example of the mastery experience of the participants was related to experience in a summer camp:

“I participated in a summer camp last summer. In that camp we tried to teach different science topics to the children. I had a chance to observe which topic they could not understand or how they learned the concepts so I believe that I know the necessary steps to teach science concepts effectively.”

Although mastery experience is stronger than vicarious experience as a source of self-efficacy, eight of the interviewees pointed out vicarious experience. They mentioned that their teachers who taught them in the past had an impact on their beliefs such as:

“I used to like my science teachers the most. They had good nature and behaved fatherly. I might be affected by them. They used to teach very well. For example, one of them was a biologist but he learnt heat and temperature topic for us. He was genuine and hard-working; he used to do everything for us.”

Furthermore, observations conducted in the school experience course were the kind of vicarious experience stated by interviewees:

“I observed that when a student does better than usual in science, it is often because the teacher exerted a little extra effort in the schools for my school experience courses. According to my observations, if the teacher does not teach well, the students can only learn by their attempts. However, they do not learn much in class.”

In addition to observations done during school experience course, participants also mentioned their school year observations:

R: You agreed that “When a student does better than usual in science, it is often because the teacher exerted a little extra effort”. Why? Can you explain it in detail, please?

P: I thought my school years; when I was more interested in any field than the others, the teacher was the key factor. His extra effort caused it. Therefore, I think, teachers’ effort and direction are important. For example, I had a biology teacher who taught very systematically. She had vital impact on our learning. Therefore, the teacher got successful results.

Although vicarious experience is an important source of self-efficacy, three of the participants thought that observations carried out in the school experience course did not contribute anything to them.

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<sup>3</sup> R: Researcher

<sup>4</sup> P: Participant

“The school experience course did not contribute at all. We only observed the teacher and class environment and did not teach. It was not useful.”

Finally, one of them underlined the effect of social persuasion on his self-efficacy in science teaching:

“When I teach my friends, my friends tell me that I teach better than the instructor. Because I try to make the topic more concrete by means of figures and models, this increases my friends’ understanding.”

## CONCLUSION and DISCUSSION

In order to determine pre-service elementary science teachers’ self-efficacy beliefs about science teaching, whether there is a significant difference between science teaching self-efficacy beliefs of pre-service elementary teachers who are at different grades and to determine the sources of their science teaching efficacy beliefs STEBI-B was administered to pre-service elementary science teachers. Moreover, semi-structured interviews related to sources of science teaching efficacy beliefs were carried out with some of the participants who were selected in a purposeful way. Descriptive statistics showed that pre-service science teachers’ self-efficacy beliefs were high for both PSTE and STOE as in Tekkaya et al. (2002). In terms of grade, there were differences both in PSTE and STOE. The mean of the fourth graders were the highest for both PSTE and STOE. The reason for the increase in seniors’ self-efficacy beliefs may be due to the fact that the teaching experience course and other courses taken at the last year of the program may provide more experience to them as stated in Hoy and Woolfolk (1990), Gorrell and Hwang, (1995), and Mulholland, et al., (2004). These courses may provide rich experience related to teaching in real classroom context to pre-service teachers with little experience. Moreover, interview results also confirmed mastery experiences as being the most influential source, thereby stressing the effect of both pedagogical and teaching experience courses in real classroom on their self efficacy beliefs, which was also stated by Wenner (2001). On the contrary, some of the studies showed no change or a decrease in teaching efficacy belief (Ginns & Tulip, as cited in Gencer & Cakiroglu, 2007; Lin & Gorrell, 2001). The researchers attributed the decrease to realization of the difficulties in teaching. Similarly, in the present study, as results showed that freshmen had very high PSTE and STOE scores. However, sophomores and juniors have fewer score on the both PSTE and STOE than the freshmen, which can be explained with the same explanation that is realizing the difficulties of teaching. Hoy and Woolfolk (1990) also stated that pre-service teachers’ general teaching efficacy beliefs decrease with starting to teach. “...student teaching suggesting that the optimism of young teachers may be somewhat tarnished when confronted with the realities and complexities of teaching task” (Tschannen-Moran, Hoy, & Hoy, 1998, p.23).

The present study has some implications for teacher education programs. To clarify, pre-service teachers’ teaching self-efficacy beliefs should increased by providing effective activities in both faculty and field experience. Since most pre-service science teachers in this study mentioned mastery experiences they got in the school experience courses as the most influential source for their science teaching self-efficacy beliefs, the effectiveness of the school experience and teaching experience courses should be enhanced. “Teacher preparation programs need to give pre-service teachers more opportunities for actual experiences with instructing and managing children in a variety of context with increasing levels of complexity and challenge to provide mastery experiences and specific feedbacks” (Tschannen-Moran, Hoy, & Hoy, 1998, p.24). Unfortunately, pre-service teachers do not have enough chance to teach in real classrooms. Precautions should be taken to prevent these shortcomings in teaching experience course provided at senior level. Moreover, observations conducted during school experience courses can be made more effective if they could have the chance to discuss these observations with their mentors, peers and instructors in the university. Enochs, et al., (1995) suggested that in method courses to increase pre-service teachers’ self-efficacy beliefs, activities which were organized before might be implemented. Moreover, pre-service teachers should be given more chance to teach in a real context. In addition, as being another importance source of self-efficacy beliefs, vicarious experiences were mentioned by some participants. Therefore, teachers who would be a good role model for pre-service teachers should be chosen as mentors with whom pre-service teachers would study during the semester.

Researchers studying teachers' teaching efficacy recommended longitudinal study on both pre-service teachers' self-efficacy beliefs (Bleicher, 2004; Gencer & Cakiroglu, 2007) and in-service teachers' self-efficacy beliefs (Tschannen- Moran & Woolfolk Hoy, 2007). Therefore, as a future study, longitudinal studies can be carried out to reveal how pre-service and in-service teachers' efficacy beliefs develop by the time and which factors affect this development.

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# İlköğretim Fen Bilgisi Öğretmen adaylarının Fen Öğretimi ile İlgili Özyeterlik İnançları ve Özyeterlik İnançlarının Kaynakları

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**ÖZ:** Bu çalışmanın amaçları fen bilgisi öğretmen adaylarının fen öğretimine yönelik özyeterlik inançlarını ölçmek, öğretmen adaylarının özyeterlik inançlarında sınıf seviyesi açısından bir fark olup olmadığını tespit etmek ve katılımcıların özyeterlik inançlarının kaynaklarını belirlemektir. Çalışmanın örneklemi 492 fen bilgisi öğretmen adayından oluşmaktadır. Fen Öğretimi Özyeterlik İnancı (FÖÖİ) anketi ve yarı yapılandırılmış görüşmeler kullanılarak veriler toplanmıştır. Sonuçlar öğretmen adaylarının kişisel fen öğretimi özyeterliliği (personal science teaching efficacy) ( $\bar{X} = 51.42$ ,  $SS = 6.88$ ) ve fen öğretimi sonuç beklentisi (science teaching outcome expectancy) ( $\bar{X} = 36.69$ ,  $SS = 5.35$ ) alt boyutlarında yüksek ortalamalara sahip olduğunu göstermektedir. MANOVA sonuçları ışığında son sınıfta bulunan öğretmen adaylarının diğer sınıflarda bulunan adaylardan istatistiksel olarak anlamlı bir şekilde her iki alt boyutta da daha yüksek ortalamalara sahip oldukları ortaya çıkmıştır.

**Anahtar kelimeler:** özyeterlik, öğretmen adayları, fen öğretimi özyeterlik inançları

## ÖZET

**Amaç ve önem:** Bu çalışmanın amaçları fen bilgisi öğretmen adaylarının fen öğretimine yönelik özyeterlik inançlarını ölçmek, öğretmen adaylarının özyeterlik inançlarında sınıf seviyesi açısından bir fark olup olmadığını tespit etmek ve öğretmen adaylarının özyeterlik inançlarının kaynaklarını belirlemektir. İlgili alanyazında öğretmen adayı ve öğretmenlerin özyeterlik inançları ile farklı kavramların arasındaki ilişki araştırılmış, farklı ülkelerdeki öğretmen adaylarının özyeterlik inançları karşılaştırılmış olmasına rağmen öğretmen adaylarının fen öğretimine yönelik özyeterlik inançlarının belirlenmesine ve bu inançların kaynağının incelenmesine yönelik çalışma sınırlı sayıdadır. Enochs ve Riggs (1990), Bandura (1997), ve Cakiroglu ve diğerleri (2005) öğretmen adaylarının fen öğretimine yönelik özyeterlik inançlarının belirlenmesinin önemine işaret etmiştir.

**Yöntem:** Çalışmanın örneklemi üç farklı üniversitede öğrenim gören 492 fen bilgisi öğretmen adayından oluşmaktadır. Fen Öğretimi Özyeterlik İnancı (FÖÖİ) ölçeği ve yarı yapılandırılmış görüşmeler kullanılarak veriler toplanmıştır. ( $N = 492$ ,  $n = 276$  bayan ve  $n = 216$  erkek) Ölçek Enochs ve Riggs (1990) tarafından oluşturulmuş olup Tekkaya, Cakiroglu ve Ozkan (2002) tarafından Türkçeye adapte edilmiştir. Ölçek beşli Likert tipi olup kişisel fen öğretimi özyeterliliği (personal science teaching efficacy) ve fen öğretimi sonuç beklentisi (science teaching outcome expectancy) alt boyutlarından oluşmaktadır. Ölçeğin örnekleme uygulanmasından sonra 14 katılımcı ile yarı yapılandırılmış görüşmeler gerçekleştirilmiştir.

**Sonuçlar:** Sonuçlar öğretmen adaylarının kişisel fen öğretimi özyeterliliği (personal science teaching efficacy) ( $\bar{X} = 51.42$ ,  $SS = 6.88$ ) ve fen öğretimi sonuç beklentisi (science teaching outcome expectancy) alt boyutlarında yüksek ortalamalara sahip olduğunu göstermektedir. ( $\bar{X} = 36.69$ ,  $SS = 5.35$ ). Sınıflar arasında fark olup olmadığına bakıldığında MANOVA sonuçları her iki alt boyutta da istatistiksel olarak anlamlı farklar olduğunu göstermiştir. ( $F(6, 439) = 3.53$ ,  $p < .05$ ). Bu fark kişisel fen öğretimi özyeterliliği alt boyutu açısından incelendiğinde; 1. ve 4., 2. ve 4. ve de 3. ve 4. sınıflar arasında olduğu ortaya çıkmıştır. Fen öğretimi sonuç beklentisi alt boyutuna bakıldığında ise sadece 2. ve 4. sınıflar arasındaki farkın istatistiksel olarak anlamlı olduğu görülmüştür. Ortalamalara bakıldığında her iki alt boyutta da 4. sınıf öğrencilerinin en yüksek ortalamalara sahip olduğu anlaşılmıştır. Görüşmelerde, 10 öğretmen adayı özyeterlik inancının kaynağı olarak kendi ders anlatma deneyimlerini işaret etmişlerdir. 8 katılımcı ise kaynak olarak yaptığı gözlemleri belirtmiştir. Buna karşılık sadece bir öğrenci çevrenin etkisinden bahsetmiştir.

**Tartışma, Sonuç ve Öneriler:** Betimsel istatistik sonuçlarına göre öğretmen adayları yüksek özyeterlik ortalamalarına sahiptir. Sınıf seviyesi açısından ise her iki alt boyutta da sınıflar arası farklar bulunmuştur. Ayrıca son sınıf öğrencileri istatistiksel olarak anlamlı bir şekilde diğer sınıflardan daha yüksek ortalamalara sahiptir. Bu durumun sebebi Hoy ve Woolfolk (1990), Gorrell ve Hwang, (1995), ve Mulholland, ve diğerlerinin de (2004) belirttiği gibi son sınıfta alınan ve öğretmen adaylarına gerçek ve zengin öğretmenlik deneyimi şansı veren staj dersleri olabilir. Adaylarla yapılan görüşmeler de bu sonucu işaret etmektedir. Bu çalışmanın diğer ilginç sonucu ise 1. sınıfta bulunan öğretmen adaylarının özyeterlik skorlarının yüksek olmasıdır. Hoy ve Woolfolk (1990) bu durumu öğrencilerin zamanla öğretmenlik mesleğinin zorluklarının farkına varmasıyla açıklamışlardır. Son olarak bazı öğretmen adayları staj derslerinde yeterince öğretmenlik deneyimi yaşayamadığından yakınmışlardır. Tschannen-Moran, Hoy, ve Hoy (1998)' un da belirttiği gibi öğretmen adaylarına daha fazla öğretmenlik deneyimi fırsatı sunulmalıdır.

**Acknowledgements:** The authors thank to Prof Dr Hayrettin OKUT, Research Assistant Remziye Arzu ZABUN, and Research Assistant Aysegül Tarkin for their valuable support.

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