

*Full Length Research Paper*

# **In-service and pre-service secondary science teachers' self-efficacy beliefs about science teaching**

**Ali Azar**

Department of Secondary Science and Mathematics, Zonguldak Karaelmas University, Zonguldak, Turkey.  
E-mail: [aaazar@karaelmas.edu.tr](mailto:aaazar@karaelmas.edu.tr). Tel: 0372-319 1950. Fax: 0372-319 1955.

Accepted 29 December, 2009

**The purpose of this study was to compare the levels of pre-service and in-service secondary science teachers' self efficacy beliefs relating to science teaching and to analyze the change of these beliefs according to their demographic characteristics such as gender, the graduate school type, teaching experience and major. The study was conducted with 50 pre-service secondary science teachers and 75 secondary science teachers. As the data collection instrument, the "science teaching efficacy belief scale" (STEBS) was used in this study. According to the research results, there was no significant difference between in-service and pre-service secondary science teachers' personal self efficacy beliefs and outcome expectations about science teaching at level  $\alpha = 0.05$ . Moreover, these self efficacy beliefs and outcome expectations did not changed relating to their gender, teaching experience, but they changed relating to their graduate school type and major.**

**Key words:** Self-efficacy, science teaching, science teacher.

## **INTRODUCTION**

The main objective of recent reform studies in the field of Science Teaching is the preparation of individuals for the rapidly changing and developing era of science and technology and to enable them to become literate both scientifically and technologically. This objective is also accepted as one of the main objectives of Science Teaching by the American Association for the Advancement of Science: (AAAS) (AAAS, 1990, 1993). The success of these reform studies depends on the self confidence of teachers for reflecting the innovations as laid out by these programs to their classroom activities. In other words, it depends on the development of an influential self efficacy amongst teachers (Czerniak, 1990; Cronin-Jones, 1991; Levit, 2001).

The Holmes Group (1990) primarily points out to the importance of teacher training for a qualified science teaching that aims achievement of the student (Baki et al., 1996). Studies emphasize that the first step to be taken in order to enhance the quality of the education should be comprehension of the values and beliefs of the people who take an active role in this process (Carter and Norwood, 1997). Brousseau, Book and Byers (1988)

indicated that the self efficacy and ideas acquired throughout the educational life of the in-service and pre-service teachers are affected by the teacher training institutions and this should be taken into consideration. In other words, self-efficacy belief affects the teaching qualification and sustainability of pre-service teachers and this bilateral interaction becomes a guide in regulating the educational process. Dushchl (1983) indicated that professional experience and the personal features of the teachers have a significant effect on science learning and teaching. In short, the self-efficacy belief which is reflected in classroom activities has an important effect for providing a quality education (Lortie, 1975; Tobin, Tipin and Gallard, 1994) and the positive effect of self-efficacy belief on student achievement has gained more importance today (Ashton, 1984; Wolfolk and Hoy, 1990; Tschannen-Moran and Hoy, 2001).

## **LITERATURE REVIEW**

Self-efficacy, one of the main concepts of Bandura's (1988) social learning theory is the thoughts about the

individual's own capacity and positive or negative judgments about himself. In other words, rather than a function of the skills of an individual, self-efficacy is the result of the judgments of an individual about his achievements by using his skill(s). According to Bandura, self-efficacy is the belief in one's capabilities to deal with different situations and to perform a certain task required to produce given attainments and this belief is dependent on individual's belief in his abilities. This belief is also necessary for organizing a certain behavior and realizing that behavior to reach a certain goal.

Self-efficacy, which is defined as the belief of an individual for successfully fulfilling the expected behaviors for reaching a goal by Bandura (1997), is also expressed as "self-efficacy perception", "self-efficacy belief" or "self-efficacy judgment" (Emmer and Hickman, 1991; Pajares, 1996; Wolfolk-Hoy and Hoy, 1998; Savran and Çakıroğlu, 2001; Akbaş and Çelikkaleli, 2006; Saracaloğlu and Yenice, 2009). Friedman and Kass (2001) define self-efficacy and beliefs of the teachers as the effects on the behaviors of the students, the academic achievement of the student, the learning motives of students who learn slowly and with difficulties. According to Armor and Bandura (2001), self-efficacy belief of a teacher is the judgment that his abilities would be effective for the achievement and learning of students, especially the ones who have difficulty with motivation (Tschannen-Mooren and Hoy, 2001).

Bandura (1997) emphasizes that self-efficacy belief depends on four inter-related sources and this belief occupies an important place in human life. Bandura summarizes the sources as follows:

- Performance achievements (achieved works and reached goals): It is directly related to the individual's own experiences, the success of an individual is the indicator of future successes.
- Vicarious experiences (experiences of other people): Many expectations result from the experiences of other people. Observing the achievements of other people bears the expectation for the individual's own success.
- Verbal persuasion (external support): The expressions of and advice from other people towards the successful realization of a behavior change encourage the individual and can contribute to changes in self-efficacy.
- Motivation processes (emotional state): The mental and physical well-being of a person affects their potential for the expected behavior.

According to Bandura, the self-efficacy belief can be analyzed in two dimensions as: "personal self-efficacy" and "outcome expectancy". Personal self-efficacy is the judgment about the individual's own values and beliefs in terms of personal competencies affecting an assigned

responsibility. Outcome expectancy is a judgment about the individual's belief in a performance to be realized in a specific task. Gibson and Dembo (1984) indicated that personal self-efficacy and outcome expectancy are different and if the individuals believe that they cannot perform specific activities, they do not perform the necessary behavior or they will not be insistent if they perform that behavior. On the other hand, according to Savran and Çakıroğlu (2001) personal self-efficacy is the belief and judgments of the teachers in terms of performing necessary behaviors for an effective teaching; outcome expectation which is the second dimension is the belief and judgments of the teachers for enhancing the achievement of the students with effective teaching methods.

Self-efficacy belief assists people in how much effort they will exert against difficult situations, how long they will exert efforts in facing difficulties and how they will pull themselves together (Bandura, 1977:194; Pajares, 2002: 10). Therefore, according to Bandura (1986) the belief of the people is a factor which is as important as skills, ability and knowledge in determining their achievement and behaviors. High level of self-efficacy belief leads to higher objectives and consistency in decisions of the individual; provides high levels of cognitive process and motivation (Locke and Latham, 1990).

Many researchers have conducted studies in order to measure teacher self-efficacy which affects the behaviors and attitudes of the teachers and the achievement of the students (Gibson and Dembo, 1984; Riggs and Enochs, 1990; Wolfolk, Rosoff and Hoy, 1990; Soodak and Podell, 1993; Guskey and Passaro, 1994; Cannon and Scharmann, 1996). A review of the literature suggests that the self-efficacy perception of the teachers has been analyzed in terms of student achievement (Moore and Esselman, 1992; Alinder, 1994; Tschannen-Moran and Hoy, 2001), classroom management and time management strategies (Gibson and Dembo, 1984). There has been an increase in the number of studies about the self-perception of teachers in Turkey also (Yavuzer and Koç, 2002; Yılmaz, Köseoğlu, Gerçek and Soran, 2004; Ekici, 2005).

Gibson and Dembo (1984) developed a "Teacher Efficacy Scale" which reliably measures the two sub-dimensions of self-efficacy belief defined by Bandura (1977) and indicated that self-efficacy can affect many classroom activities after they had administered the scale to 208 classroom teachers. Riggs and Enochs (1990) developed "The Science Teaching Efficacy Belief Instrument" for primary education in-service and pre-service teachers using "Teacher Efficacy Scale" scale. According to the results of this instrument people who spend more time for science teaching are the teachers with the highest level of self-efficacy. Savran and

Çakıroğlu (2001) adapted this instrument to Turkish and administered the scale to 29 biology teachers; they concluded that participants had high levels of self-efficacy.

The necessity for establishing the relation between the self-efficacy belief which gains importance gradually and the application of the teachers in the field of education is indicated by the researchers (Ambimbola, 1983; Pajares, 1992; Pomeroy, 1993). According to Levit (2001) the success of the reforms in the field of science education is related to the program to be administered, program materials and especially the self-efficacy belief of the teachers. In their report, Cronin-Jones (1991) indicated that the self-efficacy belief of the teachers has effects on the successful application of the programs which are developed. Tobin, Tipin and Gallard (1994) associated the sense of self-efficacy with successful teaching. The studies on the beliefs of teachers like self-efficacy are based on the fact that the belief of teachers in relation to education-teaching are related with planning, decision making and classroom activities. Accordingly, in problem solving and organizing the knowledge, beliefs are more effective than the knowledge itself (Pajares, 1996). In this context, there is a close relation between classroom application, strategies and methods for motivating the students and the self-efficacy of the teachers. For instance, according to Czerniak (1990), the teachers with a high level of self-efficacy adopt investigative and student-centered strategies; while the teachers with a low level of self-efficacy generally adopt teacher-centered strategies.

The relationship between the self-efficacy belief of teachers and the achievement of the students has been analyzed in many studies (Ashton, 1984; Gibson and Dembo, 1984; Ramey-Gassert and Shroyer, 1992). It has been established that the self-efficacy of the teacher positively affects the achievement and attitude of the student; it has also been found to be directly related to the classroom behaviors of the teacher, involving openness to new ideas and the development of positive attitudes towards teaching (Wolfolk and Hoy, 1990; Tschannen-Moran and Hoy, 2001).

According to Ashton (1984), none of the teacher features is consistent with the achievement of the student more than the self-efficacy of the teacher. Significant differences have arisen between teachers who have a high level of self-efficacy and the teachers with a low level of self-efficacy in terms of classroom behaviors (order of classroom, feedback given to students with learning difficulty by the teachers) and this leads to differences in the achievements of the students (Küçükylmaz and Duban, 2006). According to Bandura, self-efficacy belief is affected by experiences, models in the outside world therefore; the self-efficacy belief of the teachers affects the self-efficacy belief of the students as well as the

achievement of the students. For instance, students with a high level of self-efficacy approach teaching activities more willingly, exert greater efforts, use more effective strategies by endeavoring to overcome difficulties over a longer period of time and they exhibit a higher level of performance than the students with low levels of self-efficacy (Eggen and Kauchak, 1999:403). Consequently, the self-efficacy belief which has an important effect on active teaching via classroom applications in a teaching program and on enhancing the achievement of the student should be investigated for the teacher training. Self-efficacy belief has been analyzed by many researchers according to different variables.

In the study of Küçükylmaz and Duban (2006) on the variables affecting the pre-service classroom teachers' self-efficacy beliefs towards science teaching, it was established that there is not a difference in self-efficacy according to age or type of school graduated from, however teachers who consider themselves more competent in field information have high levels of self-efficacy belief. In addition, it was emphasized that personal features (teaching experience, communication with the students) and the technological facilities of the school can be effective on the self-efficacy belief of the teachers. The study of Tobin and Mc Robbie (1997) indicated that teachers who work in a poor region use traditional methods more than the teachers who work in a wealthy region. Also, it was declared that one of the factors affecting classroom application of the teachers according to the self-efficacy belief in terms of science teaching is the constraints from the students, parents and the other personnel in the school. Furthermore the following results have been emphasized in the studies: the hierarchical structure of the school and organization culture have an important effect on the formation of the self-efficacy belief of the teachers, as does the constructive support of the deputy school head. Teaching materials, having required time for lesson planning and preparation of the teachers, the presence of necessary laboratory (experiment) equipment and the position of the school also affect the self-efficacy belief of the teachers. The study of Gerçek et al. (2006) on detecting the self-efficacy levels of the pre-service teachers in Biology Education revealed that gender, age, type of high school graduated from, settlement, monthly income and achievement variables do not affect the self-efficacy belief of the teachers relation with teaching. Similarly, Wilson and Tan (2004) analyzed the change in general and personal self-efficacy in terms of gender, age, type of school graduated from, the level of the classroom and professional experience. According to the results of the study, professional experience only affects the general teaching self-efficacy of the teachers.

According to literature review, the self-efficacy belief of pre-service and in-service teachers are analyzed

separately according to different variables but the studies about the difference between the two teacher groups in terms of these variables are limited. The studies also investigate the self-efficacy beliefs of the classroom teachers, mathematics and chemistry in-service and pre-service teachers; however the dimensions in which the self-efficacy of the pre-service teachers and in-service teachers differ are not analyzed.

Therefore, the aim of the present study is to compare the levels of self-efficacy beliefs in pre-service and in-service science teachers who are executives of reforms in the field of science education according to different variables.

## THE PROBLEM OF THE STUDY AND SUB-PROBLEMS

### The problem

What is the level of self-efficacy belief in pre-service and in-service secondary science teachers relating to science teaching, how does the self-efficacy belief differ according to gender, the type of school graduated from, teaching experience and the subject major?

### Sub-problems

What is the level of self-efficacy perception relating to science teaching in pre-service and in-service secondary science teachers?

Do pre-service and in-service secondary science teachers' scores acquired from the sub-dimension of science teaching efficacy belief scale differ according to gender?

Do pre-service and in-service secondary science teachers' scores acquired from the sub-dimension of science teaching efficacy belief scale differ according to type of school graduated from?

Do pre-service and in-service secondary science teachers' scores acquired from the sub-dimension of science teaching efficacy belief scale differ according to teaching experience?

Do pre-service and in-service secondary science teachers' Scores acquired from the sub-dimension of science teaching efficacy belief scale differ according to their major?

## METHOD

Studies aiming to detect the presence and the scope of difference between two or more variables are recommended to use relationship survey (Karasar, 2003: 80). Therefore, the present

study investigated the relation between "science teaching self-efficacy beliefs" of pre-service and in-service science teachers and personal features (gender, teaching experience, the type of school graduated from, major) with relationship survey.

## Sampling and data collection instrument

The sample of the present study was composed of 50 pre-service teachers who graduated from Secondary Education Science and Mathematics departments, Biology, Physics and Chemistry programs of Zonguldak Karaelmas University, Ereğli Faculty of Education and Karadeniz Technical University, Fatih Faculty of Education and 75 in-service teachers who work in majors of Biology, Physics and Chemistry in high schools in Zonguldak and Trabzon, a total of 125 people. The distribution of pre-service teachers was as follows: 10 Biology, 12 Physics and 28 Chemistry teachers. The distribution of in-service teachers was as follows: 25 Biology, 13 Physics and 37 Chemistry teachers. Of the pre-service teachers 58% were males and 42% were females, 56% of the teachers were males and 44% were females.

The "Science Teaching Efficacy Belief Scale" (STEBS) developed by Riggs and Enochs (1990) and adapted in Turkish by Hazır-Bıkmaz (2002) and Kiremit (2006) was used in order to detect the science teaching (biology, physics and chemistry) and related self-efficacy in the present study. In the Turkish version of the scale adapted by Kiremit (2006) the term "natural study" replaced "natural sciences" and personal questions such as gender, school graduated from, subject major and teaching experience were added, scale was prepared as one form for pre-service and in-service teachers. The scale encompassed 25 items with five-point Likert type. The answers to items were as follows: strongly agree, agree undecided, disagree, and strongly disagree.

The opinions of the experts were taken for the validity and reliability of the scale and in line with their recommendations, pre-testing scale was copied and it was administered to a sub-group of the sample. Following necessary revision, construct validity of STEBS was made via "main components analysis" a type of factor analysis (Kerlinger, 1973; Tabachnick and Fidell, 1989). Kaiser – Meyer- Olkin (KMO) coefficient and Barlett Sphericity test were used for the factor analysis of the data. Since the KMO was higher than 0.60 and the result of Barlett test was significant, data of the study was convenient for the factor analysis. According to this factor analysis result, the scale was composed of two sub-factors. The first sub-factor was personal self-efficacy of pre-service and in-service science teachers (PSEST) and the second sub-factor was outcome expectancy of pre-service and in-service science teachers (OES). The result of the correlation between two factors was high on the level of 0.001 ( $r=0.77$ ) and Cronbach Alpha internal consistency coefficient was calculated as 0.84.

The scale was five-point Likert type and positive statements were coded as 5-4-3-2-1, and negative statement were coded as 1-2-3-4-5. Accordingly, negative question items 3, 6, 8, 10, 13, 17, 19, 20, 21 and 23 were scored inversely. Following the factor analysis, items of 20 and 25 were excluded from the scale and the number of items decreased to 23. Items of 2, 3, 5, 6, 12, 16, 17, 18, 19, 20, 21, 22 and 23 belonged to PSEST sub-factor; items of 1, 4, 7, 8, 9, 10, 11, 13, 14 and 15 belonged to OES sub-factor. Scores acquired from the each sub-factor of the scale indicate the belief level in science teaching about that factor. As a result, high score indicates high level of self-efficacy and low score indicates low level of self-efficacy. The minimum score of the scale was 23 the maximum score was 115.

The analyses of the scale were made with SPSS 13.0 package

program. Two-way MANOVA and Tukey test were used according to convenience of the data in order to analyze the differences to be formed with the effect of the independent variables as well as descriptive statistical tests. The significance level for statistical analyses was accepted as  $\alpha = 0.05$ .

## RESULTS

Data acquired from the present study was analyzed separately according to sub-problems and presented in tables. Average and standard deviation of the scores acquired from STEBS in terms of the first sub-problem of the study (What is the level of self-efficacy perception relating to science teaching in pre-service and in-service secondary science teachers?) by pre-service and in-service science teachers were presented in Table 1. When the self-efficacy scores of secondary education in-service and pre-service science teachers were analyzed, it was observed that their self-efficacy was neither low nor high with the average of 3.00.

Analysis results for the second problem of the study (Do pre-service and in-service secondary science teachers' scores acquired from the sub-dimension of science teaching efficacy belief scale differ according to gender?) were presented in Tables 2 and 3.

When Table 2 was analyzed, the average score of female pre-service teachers acquired from the PSEST sub-factor of STEBS was  $\bar{X}=3.02$ , the average of the males was  $\bar{X}=3.31$ ; the average score of the female in-service teachers was  $\bar{X}=3.08$ , the average of the males was  $\bar{X}=3.08$ . The average score of the female pre-service teachers acquired from OES factor was  $\bar{X}=3.19$ , the average of the males was  $\bar{X}=3.45$ ; the average score of female in-service teachers was  $\bar{X}=3.23$ , the average score of the males was  $\bar{X}=3.25$ . In both groups, the score acquired from the sub-factors of STEBS was higher in the males than in females. Whether the difference between pre-service and in-service teachers was significant according to gender was given in Table 3 as statistical results. As indicated in Table 3, when the scores acquired from sub-factors of STEBS by pre-service and in-service teachers were analyzed according to gender, two-way MANOVA results indicated that there was no significant difference between pre-service and in-service teachers according to gender. Wilks' Lambda ( $\Lambda$ ) = 0.983, for PSEST  $F_1 = 1.823$ ,  $p > .05$ ; for OES  $F_2 = 1.355$ ,  $p > .05$ . According to this result, there was not a difference between pre-service and in-service teachers in the scores acquired from the two sub-factors of the scale.

Analysis results concerning the third sub-problem of the study (Do pre-service and in-service secondary science teachers' scores acquired from the sub-dimension of science teaching efficacy belief scale differ according to graduated school type?) were presented in Tables 4, 5

and 6.

When the scores acquired from the PSEST and OES sub-factors by in-service and pre-service science teachers were analyzed, the average PSEST score of pre-service teachers who graduated from the faculty of education was  $\bar{X}=3.58$ , average OES score was  $\bar{X}=3.60$ ; the average PSEST score of in-service teachers was  $\bar{X}=3.46$  and average OES score was  $\bar{X}=3.63$ . The scores of pre-service and in-service teachers who graduated from faculties of science and letters, faculties of engineering and other faculties were lower than the faculties of education. Two-way MANOVA analysis was made in order to detect whether the difference was significant and the results were given in Table 5.

When the Table 5 was analyzed, the two-way MANOVA results of scores acquired from the PSEST and OES sub-factors indicated that there was a significant difference between in-service and pre-service teachers according to graduated school type. Wilks' Lambda ( $\Lambda$ ) = .929, for PSEST of the scale  $F_1 = 4.306$ ,  $p < .05$ ; for OES  $F_2 = 3.778$ ,  $p < .05$ . According to these results, there was a difference between in-service and pre-service teachers in terms of the scores acquired from the two sub-factors of the scale in terms of graduated school type. The results of Tukey test which was made in order to investigate the reason of this difference were given in Table 6.

When Table 6 was analyzed, the PSEST and OES scores of pre-service and in-service teachers who graduated from faculties of education were higher than the pre-service and in-service teachers who graduated from faculties of engineering and other faculties and faculties of science and letters. According to Tukey test, the difference resulted from the graduates of faculties of education.

Findings for the fourth sub-problem (Do pre-service and in-service secondary science teachers' scores acquired from sub-dimension of science teaching efficacy belief scale differ according to teaching experience?) were given in Tables 7 and 8.

When the average PSEST and OES scores of in-service and pre-service teachers were analyzed according to their teaching experience in Table 7, it was found that the scores of pre-service teachers who did not have experience and in-service teachers who had 2 - 7 years of experience or 8 - 11 years of experience were quite similar. For instance, the average of PSEST scores of pre-service teachers was  $\bar{X}=3.14$ , average OES score was  $\bar{X}=3.30$ . Similarly, PSEST scores of in-service teachers with 2 - 7 years of experience was on the same level with teachers who had 8 - 11 years of experience ( $\bar{X}=3.08$ ). Furthermore, scores acquired from OES in terms of teaching experience were similar. According to two-way MANOVA results of the scores acquired from

**Table 1.** Average and standard deviation of the scores acquired from STEBS in terms of the first sub-problem of the study by pre-service and in-service science teachers

Items	Description	P/N	Pre-service		In-service	
			$\bar{X}$	SD	$\bar{X}$	SD
1	When a student does better than usual in sciences, it is often because the teacher exerted a little extra effort.	N	2.58	1.26	2.32	1.19
2	I will continually find better ways to teach science	p	2.70	1.09	3.02	1.21
3	Even if I try very hard, I will not teach science as well as I will most subjects.	P	3.14	1.05	2.89	1.22
4	When the sciences grades of students improve, it is often due to their teacher having found a more effective teaching approach.	N	3.12	1.10	3.07	1.22
5	I know the steps necessary to teach science concepts effectively.	P	3.14	1.21	2.84	1.27
6	I will not be very effective in monitoring science experiments.	N	2.70	1.39	2.55	1.33
7	If students are underachieving in science, it is most likely due to ineffective science teaching.	P	3.18	0.87	3.43	1.20
8	I will generally teach science ineffectively	N	3.34	1.15	3.42	1.06
9	The inadequacy of a student's science background can be overcome by good teaching.	P	3.24	1.13	3.28	1.12
10	The low science achievement of some students cannot generally be blamed on their teachers.	N	3.70	0.91	3.81	0.63
11	When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher.	P	3.96	0.19	3.93	0.25
12	I understand science concepts well enough to be effective in teaching science.	P	3.60	0.98	3.69	0.79
13	Increased effort in science teaching produces little change in some students' science achievement.	N	3.22	1.28	3.44	1.03
14	The teacher is generally responsible for the achievement of students in science.	P	3.56	0.99	3.61	0.94
15	Students' achievement is directly related to their teacher's effectiveness in science teaching.	P	3.10	1.25	3.21	1.18
16	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of child's teacher.	P	3.36	1.05	3.34	1.06
17	I will find it difficult to explain to students why science experiments work.	N	2.40	1.31	2.63	1.23
18	I will typically be able to answer students' science questions.	P	3.40	1.05	3.51	0.99
19	I wonder if I will have the necessary skills to teach science.	N	3.72	0.75	3.51	1.03
20	Given a choice, I will not invite the principal to evaluate my science teaching.	N	3.04	1.77	2.88	1.15
21	When a student has difficulty understanding a science concept, I will usually be at loss as to how to help the student understand it better.	N	3.58	0.78	3.53	0.95
22	When teaching sciences, I will usually welcome student questions.	P	2.98	1.15	2.80	1.21
23	I do not know what to do turn students on to science.	N	3.08	1.24	2.80	1.30

PSEST and OES the sub-factors of STEBS (Table 8), self-efficacy scores of in-service teachers differed significantly according to teaching experience. Wilks' Lambda ( $\Lambda$ ) =0.999, for PSEST  $F_1=0.052$ ,  $p>0.05$ ; for OES  $F_2=0.65$ ,  $p >0.05$ ]. Results about the last sub-problem of the study (Do pre-service and in-service secondary science teachers' scores acquired from sub-dimension of science teaching efficacy belief scale differ according to their major?) were given in Table 9.

When the Table 9 was analyzed, it was found out those in-service and pre-service teachers whose major was biology had higher scores of self-efficacy when compared with the major of physics and chemistry. Average PSEST score of biology pre-service teachers was  $\bar{X}=3.14$ , average OES score was  $\bar{X}=3.40$ ; average PSEST score

of biology in-service teachers was  $\bar{X}=3.24$ , average OES score was  $\bar{X}=3.38$ .

When two-way MANOVA results of the scores acquired from PSEST and OES sub-factors of STEBS were analyzed in Table 10, self-efficacy scores of in-service teachers significantly differed according to their major in the PSEST factor; but significantly differ in OES factor. Wilks' Lambda ( $\Lambda$ )=0.986, for PSEST  $F_1=3.363$ ,  $p<.05$ ; for OES  $F_2=2.136$ ,  $p >.05$ ].

## DISCUSSION

In the present study, the self-efficacy beliefs of in-service and pre-service Secondary Science teachers were

**Table 2.** Average and standard deviation of the scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers

Variables	Group	Gender	$\bar{X}$	Sd	n	
PSEST	Prospective teacher	Female	3.02	.614	29	
		Male	3.31	.439	21	
		Total	3.14	.561	50	
	In-service teacher	Female	3.08	.574	42	
		Male	3.08	.711	33	
		Total	3.08	.633	75	
		Total	Female	3.05	.588	71
			Male	3.16	.626	54
			Total	3.10	.604	125
	OES	Prospective teacher	Female	3.19	.636	29
			Male	3.46	.481	21
			Total	3.30	.586	50
In-service teacher		Female	3.23	.568	42	
		Male	3.25	.531	33	
		Total	3.24	.549	75	
		Total	Female	3.22	.593	71
			Male	3.33	.517	54
			Total	3.26	.563	125

**Table 3.** MANOVA results about the differences in scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to gender.

Source	Dependent variable	Type III sum of squares	$\lambda$	df	Mean square	F	Sig.	Partial Eta squared
Corrected model	PSEST	1.172 <sup>a</sup>		3	.391	1.071	.364	.026
	OES	.999 <sup>b</sup>		3	.333	1.054	.371	.025
Intercept	PSEST	1144.633	.033	1	1144.633	3.138E3	.000	.963
	OES	1265.613		1	1265.613	4.004E3	.000	.971
Group	PSEST	.207	.995	1	.207	.568	.453	.005
	OES	.197		1	.197	.622	.432	.005
Gender	PSEST	.617	.983	1	.617	1.692	.196	.014
	OES	.632		1	.632	2.000	.160	.016
Group * Gender	PSEST	.665	.985	1	.665	1.823	.179	.015
	OES	.428		1	.428	1.355	.247	.011
Error	PSEST	44.133		121	.365			
	OES	38.246		121	.316			
Total	PSEST	1249.657		125				
	OES	1371.610		125				
Corrected total	PSEST	45.305		124				
	OES	39.245		124				

investigated according to PSEST and OES sub-factors. Furthermore, change of these PSEST and OES scores according to their demographic characteristics (gender, the type of school graduated from, teaching experience and major) was analyzed.

When the scores of self-efficacy beliefs of in-service and pre-service Secondary Science teachers were analyzed, it was found that the average PSEST score of pre-service teachers was  $\bar{X}=3.14$ , the average score of in-service teachers was  $\bar{X}=3.08$ . Similarly, the average

**Table 4.** Average and standard deviation of the scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to faculties.

Group		School	$\bar{X}$	Sd	N
PSEST	Prospective science teacher	Science and mathematics	3.01	.65	24
		Engineering	3.19	.45	21
		Education faculty	3.58	.22	5
		Total	3.14	.56	50
	Science teacher	Science and Mathematics	2.99	.63	33
		Engineering	3.03	.63	30
		Education faculty	3.46	.56	12
		Total	3.08	.63	75
	Total	Engineering	3.00	.64	57
		Science and Mathematics	3.08	.56	51
		Education faculty	3.49	.48	17
		Total	3.10	.61	125
	OES	Prospective science teacher	Science and Letters	3.18	.59
Engineering			3.36	.62	21
Education faculty			3.60	.16	5
Total			3.30	.59	50
Science teacher		Science and letters	3.14	.56	33
		Engineering	3.18	.55	30
		Education faculty	3.63	.34	12
		Total	3.24	.55	75
Total		Science and letters	3.16	.57	57
		Engineering	3.25	.58	51
		Education faculty	3.62	.29	17
		Total	3.26	.56	125

**Table 5.** MANOVA results about the differences in scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to faculties.

Source	Dependent variable	Type III sum of squares	$\lambda$	df	Mean square	F	Sig.	Partial Eta squared
Corrected model	PSEST	3.589 <sup>a</sup>		5	.718	2.048	.077	.079
	OES	3.186 <sup>b</sup>		5	.637	2.103	.070	.081
Intercept	PSEST	849.518	.037	1	849.518	2.423E3	.000	.953
	OES	927.456		1	927.456	3.061E3	.000	.963
Group	PSEST	.213	.994	1	.213	.606	.438	.005
	OES	.078		1	.078	.256	.614	.002
Faculty	PSEST	3.019	.929	2	1.510	4.306	.016	.067
	OES	2.290		2	1.145	3.778	.026	.060
Group * Faculty	PSEST	.169	.989	2	.085	.241	.786	.004
	OES	.175		2	.088	.289	.749	.005
Error	PSEST	41.716		119	.351			
	OES	36.059		119	.303			
Total	PSEST	1249.657		125				
	OES	1371.610		125				
	PSEST	45.305		124				
Corrected total	OES	39.245		124				



**Table 6.** Tukey test results about the significance of the difference between PSEST and OES scores of in-service and pre-service teachers according to faculties.

Dependent variable	(I) Faculty	(J) Faculty	Mean difference (I-J)	Sig.
PSEST	Science and letters	Engineering and other	-.09	.723
	Engineering and other	Education	-.49*	.009
		Science and letters	.08	.723
OES	Engineering and other education	Education	-.40*	.043
		Science and letters	.49*	.009
	Education science and letters	Engineering and other	.40*	.043
		Engineering and other	-.09	.640
	Engineering and other	Education	-.46*	.008
		Science and letters	.09	.640
	Engineering and other education	Education	-.36	.051
Science and letters		.46*	.008	
Education	Engineering and other	.36	.051	

**Table 7.** Average and standard deviation of the scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to teaching experience.

Group	Seniority	$\bar{X}$	Sd	n		
PSEST	Prospective science teacher	Prospective science teacher	3.14	.562	50	
	Science teacher	Total	3.14	.562	50	
		2 - 7 years	3.09	.638	32	
		8 - 11 years	3.07	.638	43	
	Total	Total	3.08	.634	75	
	OES	Prospective science teacher	Prospective science teacher	3.14	.562	50
			Total	3.09	.638	32
		Science teacher	8 - 11 years	3.07	.638	43
			Total	3.10	.604	125
		OES	Prospective science teacher	Prospective science teacher	3.30	.587
Total				3.30	.586	50
Science teacher			2 - 7 years	3.25	.594	32
	8 - 11 years		3.22	.515	43	
Total	Total		3.25	.549	75	
Total	Prospective science teacher		3.30	.586	50	
	2 - 7 years	3.26	.599	32		
	8 - 11 years	3.22	.515	43		
	Total	3.27	.563	125		

OES score of the pre-service teachers was  $\bar{X}=3.30$ , the average score of in-service teachers was  $\bar{X}=3.24$ . According to this data, it can be stated that the level of self-efficacy belief of in-service and pre-service teachers are the same. When the literature about the comparison of in-service and pre-service teachers in terms of self-efficacy beliefs was reviewed, only the study of Wenner (2001) on science and mathematics in-service and pre-service teachers was found. According to the result of

this study, the personal self-efficacy of in-service teachers was higher than that of the pre-service teachers.

Two-way MANOVA analysis test was used in order to determine the difference between male and female in-service and pre-service teachers in terms of science teachers; but, there was a statistically significant difference in pre-service teachers in favor of male teachers. Some studies also found that there was not a statistically significant difference in the self - efficacy beliefs of the

**Table 8.** MANOVA results about the differences in scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to teaching experience.

Source	Dependent variable	Type III sum of squares	$\lambda$	df	Mean square	F	Sig.	Partial Eta squared
Corrected model	PSEST	.127 <sup>a</sup>		2	.064	.172	.842	.003
	OES	.136 <sup>b</sup>		2	.068	.213	.809	.003
Intercept	PSEST	1189.764	.029	1	1189.764	3.213E3	.000	.963
	OES	1316.217		1	1316.217	4.106E3	.000	.971
Group	PSEST	.000	1.00	0	.	.	.	.000
	OES	.000		0	.	.	.	.000
Teaching experience	PSEST	.019	.999	1	.019	.052	.820	.000
	OES	.021		1	.021	.065	.799	.001
Group* Teaching experience	PSEST	.000	1.00	0	.	.	.	.000
	OES	.000		0	.	.	.	.000
Error	PSEST	45.178		122	.370			
	OES	39.109		122	.321			
Total	PSEST	1249.657		125				
	OES	1371.610		125				
Corrected total	PSEST	45.305		124				
	OES	39.245		124				

**Table 9.** Average and standard deviation of the scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to major.

	Group	Major	$\bar{X}$	Sd	n
PSEST	Prospective teacher	Physics	3.10	.55	10
		Chemistry	2.92	.53	12
		Biology	3.24	.56	28
		Total	3.14	.56	50
	Teacher	Physics	2.91	.667	25
		Chemistry	2.91	.776	13
		Biology	3.24	.52	37
		Total	3.08	.63	75
	Total	Physics	2.97	.64	35
		Chemistry	2.91	.66	25
		Biology	3.24	.54	65
		Total	3.10	.60	125
OES	Prospective teacher	Physics	3.18	.53	10
		Chemistry	3.17	.58	12
		Biology	3.40	.60	28
		Total	3.30	.58	50
	Teacher	Physics	3.08	.60	25
		Chemistry	3.23	.61	13
		Biology	3.35	.47	37
		Total	3.24	.54	75
	Total	Physics	3.11	.57	35
		Chemistry	3.21	.59	25
		Biology	3.38	.53	65
		Total	3.26	.57	125

**Table 10.** MANOVA results about the differences in scores acquired from PSEST and OES sub-factors of STEBS by pre-service and in-service science teachers according to major.

Source	Dependent variable	Type III sum of squares	$\lambda$	df	Mean square	F	Sig.	Partial Eta squared
Corrected model	PSEST	3.087 <sup>a</sup>		5	.617	1.740	.131	.068
	OES	1.803 <sup>b</sup>	.034	5	.361	1.146	.340	.046
Intercept	PSEST	927.911		1	927.911	2.616E3	.000	.956
	OES	1039.176	.996	1	1039.176	3.303E3	.000	.965
Group	PSEST	.108		1	.108	.303	.583	.003
	OES	.021	.921	1	.021	.068	.795	.001
Major	PSEST	2.386		2	1.193	3.363	.038	.054
	OES	1.344		2	.672	2.136	.123	.035
Group *	PSEST	.198	.986	2	.099	.280	.757	.005
Major	OES	.095		2	.047	.150	.861	.003
Error	PSEST	42.218		119	.355			
	OES	37.442		119	.315			
Total	PSEST	1249.657		125				
	OES	1371.610		125				
Corrected total	PSEST	45.305		124				
	OES	39,245		124				

pre-service teachers according to gender (Çakıroğlu, Çakıroğlu and Bone, 2005; Akbaş and Çelikkaleli, 2006; Arsal, 2006; Özçelik and Kurt, 2007). The study by Mulhollve, Dorman and Odgers, "The Evaluation of Science Teaching Efficacy of Pre-Service Science Teachers in Australia University" (2004) concluded that gender does not have any effect on science teaching self-efficacy. Similarly, the studies of Hoy and Woolfolk, 1993; Brennan and Robison, 1995; Sun, 1995; Tschannen-Moran and Woolfolk Hoy, 2001; Milner and Woolfolk Hoy, 2002; Joseph, 2003; Zengin, 2003; Saracaloğlu et al., 2006; Akbaş and Çelikkaleli, 2006; Küçükylmaz and Duban, 2006; Egger, 2006, indicated that gender does not cause an important difference in science teaching self-efficacy and outcome expectancy.

However, some studies indicate that there is a statistically significant difference in the self-efficacy perception of pre-service teachers according to gender (Ekici, 2005; Britner and Pajares, 2006). The study of Shahid and Thompson (2001) on the comparison of teacher efficacy according to gender emphasized that there is a positive relation between self-efficacy and gender and females have a higher level of teaching competency than that of males. Accordingly, the study of Edwards et al. (1996) indicated that there is a relation between gender and efficacy belief and the self-efficacy belief of the females is higher than that of males. The study of Garret (1977) compared the self-efficacy belief and genders of 373 female and male teachers and consequently indicated that self-efficacy belief of the female teachers is higher than that of male teachers.

Riggs (1991) concluded that science teaching self-efficacy of male teachers in primary education is higher than that of the female teachers in the elementary education. When the results of the studies are analyzed, it is observed that there is not clarity about whether the self-efficacy differs according to gender. The difference in the results of the studies may result from cultural differences.

According to the results of the present study, the science teaching self-efficacy belief of pre-service and in-service secondary science teachers significantly differed according to the type of school graduated from in the sub-dimension of the scale. Graduates of the faculty of education had higher levels of self-efficacy than the graduates of the faculty of sciences and letters. Similarly, the study of Azar and Akıncı, "The Investigation of the Relation between Self-Efficacy Belief and Academic Success of the Pre-Service Teachers" (2009) found that the self-efficacy perception scores of pre-service teachers who graduated from the department of Turkish Language Teaching in the faculty of education are higher when compared with other units/departments (Social Studies Education and Primary School Education).

There was not a significant difference in science teaching self-efficacy scale between in-service and pre-service science teachers according to subject major. However, the finding which indicates that the self-efficacy belief scores of pre - service teachers significantly differ according to major variables was present in the studies of Çapri and Çelikkaleli (2006), Erişen and Çeliköz (2003). When other studies about the difference

of self-efficacy belief according to teaching experience are reviewed, the studies of Gökçe (1999); Zengin (2003); Ay (2005) found that the efficacy, self-efficacy and outcome expectancy scores of teachers rise in line with the increase in teaching experience. However the study of Saracaloğlu et al. (2006) emphasized that there is not a relation between teaching experience and efficacy, self-efficacy and outcome expectancy. When the teaching experience is taken into consideration, science teaching self-efficacy of secondary science teachers does not significantly differ in PSEST and OES factors. It can be pointed out that the self-efficacy belief of the teachers does not differ according to the teaching experience variable. From this perspective, the data of the present study is similar to that in the study of Saracaloğlu et al. (2006). In the study of Egger (2006), it was indicated that there is not a relation between the teaching experience and the efficacy beliefs of the teachers.

Furthermore, Tschannen-Moran and Hoy (2007) emphasized that personal features of the teachers do not have a strong effect on their self-efficacy beliefs, the self-efficacy belief of the teachers are highly affected from the intra-school variables rather than personal features.

### Conclusion and Recommendations

The conclusions reached from the findings of the present study can be summarized as follows: The self-efficacy and outcome expectancy scores of Secondary Science in-service and pre-service teachers are equal. Outcome expectancy scores of Secondary Science in-service and pre-service teachers do not differ according to gender. Outcome expectancy scores of Secondary Science in-service and pre-service teachers do not differ according to the type of school graduated from. Outcome expectancy scores of Secondary Science in-service and pre-service teachers do not differ according to teaching experience.

Personal self-efficacy scores of Secondary Science in-service and pre-service teachers differ according to subject major, the highest level of self-efficacy belonged to those majoring in biology however there is not difference between in-service and pre-service teachers in terms of outcome expectancy scores. Although the literature has many studies about the teacher's self-efficacy belief, one of the factors for the success of the student at the level of primary education science teaching, there is not a comprehensive study on secondary in-service and pre-service teachers of sciences. In this context, future studies could compare the self-efficacy belief of the experience of in-service teachers and pre-service teachers with a wider sampling, in the case of physics teaching for

example.

Since the training of the pre-service teachers has an important effect on their self-efficacy beliefs, the self-efficacy belief of the students who receive training in the faculties of education should be monitored periodically by the educators and activities designed for enhancing their self-efficacy should be intensified in the teacher training programs.

### REFERENCES

- Akbaş A, Çelikkaleli Ö (2006). Sınıf öğretmeni adaylarının fen öğretimi öz-yeterlik inançlarının cinsiyet. Öğrenim türünün üniversitelerine göre incelenmesi. *Journal of Education Faculty of University of Mersin* 2 (1): 98-110.
- Ambimbola I (1983). The relevance of the new philosophy of science for the science curriculum. *Science and Mathematics* 83(3):181-193.
- American Association for the Advancement of Science (1990). *Science for all Americans*. New York: Oxford University Press.
- American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy: A Project 2061 Report*. New York: Oxford University Press.
- Arsal Z (2006). Self-efficacy beliefs of teacher validates on using a computer in teaching. *The Annual Meeting of the 6th International Educational Technologies Conference*, Cyprus.
- Ashton PT (1984). Teacher efficacy: A motivational paradigm for effective teacher. *Educ. J. Teacher Educ.* 35 (5): 28-32.
- Ay M (2005). Sınıf öğretmenlerinin matematik öğretimine ilişkin öz yeterlik algıları. Unpublished Master Thesis, University of Hacettepe, Ankara.
- Azar A, Akıncı M (2009). Öğretmen adaylarının öğretmen öz-yeterlik inancı, akademik başarı, kpss başarıları arasındaki ilişkinin çeşitli değişkenler açısından yordanması. 7. Ulusal Fen ve Matematik Eğitimi Kongresi, Gazi Üniversitesi, Ankara.
- Baki A, Çepni S, Akdeniz AV, Ayaz AP (1996). Türkiye'de eğitim fakültelerinin yeniden yapılandırılması. YÖK' e sunulan Komisyon Raporu.
- Bandura A (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* 84: 191-215.
- Bandura A (1988). Perceived self-efficacy: Exercise of control through self-belief. In JP Dauwalder, M Perrez, V Hobi (Eds) *Annual series of European research in behavior therapy*. Amsterdam/Lisse, Netherlands 2:27-59.
- Bandura A (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Britner SL, Pajares F (2006). Sources of science self-efficacy beliefs of middle school students. *J. Res. Sci. Teaching.* 43 (5): 485-499.
- Brousseau BA, Book C, Byers JL (1988). Teacher beliefs and the cultures of teaching. *J. Teacher Educ.* 39(6): 33-39.
- Cannon JR, Scharmann LC (1996). Influence of a cooperative early field experience on pre-service elementary teachers' science self-efficacy. *Science Education.* 80: 419-436.
- Carter G, Norwood KS (1997). The relationship between teacher and student beliefs about mathematics. *School Science and Mathematics* 97(2): 62-67.
- Cronin-Jones LL (1991). Science teacher beliefs and their influence on curriculum implementation: Two case studies. *J. Res. Sci. Teaching* 28:235-250.
- Czerniak CM (1990). A study of self-efficacy anxiety and science knowledge in pre-service elementary teachers. Paper presented at the Meeting of the National Association for Research in Science Teaching, Atlanta GA.
- Çakıroğlu J, Çakıroğlu E, Bone WJ (2005). Pre-service teacher self-efficacy beliefs regarding science teaching: A comparison of pre-service teachers in Turkey and the USA. *Science Educator*, 14(1):

31-40.

- Çapri B, Çelikkaleli Ö (2008). Öğretmen adaylarının öğretmenliğe ilişkin tutum, mesleki yeterlik inançlarını cinsiyet ve program fakültelerine göre incelenmesi. *J. Educ. Faculty of University of İnönü* 9(15): 33-53.
- Duschl RA (1983). The elementary level science methods course: breeding ground of apprehension toward science: a case study. *J. Res. Sci. Teaching* 20(8): 745-754.
- Eggen P, Kauchak D (1999). *Educational psychology (4<sup>th</sup> Ed.)*. New Jersey: Printice-Hall Inc.
- Egger KJ (2006). An exploration of the relationships among teacher efficacy collective teacher efficacy and teacher demographic characteristics in conservation Christian schools. Unpublished Doctorate Thesis, University Of North Texas.
- Edwards JL et al. (1996). Teacher efficacy and school and teacher characteristics. Annual Meeting of the American Educational Research Association. New York.
- Ekcici G (2005). Eğitim fakültesi öğrencilerinin öğretmenlik öz-yeterlik inançlarını etkileyen faktörler. XIV Ulusal Eğitim Bilimleri Kongresi Pamukkale Üniversitesi Eğitim Fakültesi, Denizli.
- Emmer E, Hickman J (1990). Teacher decision making as a function of efficacy attribution and reasoned action. Paper presented at the Annual Meeting of the American Educational Research Association, Boston MA.
- Erişen Y, Çeliköz N (2003). Öğretmen adaylarının genel öğretmenlik davranışları açısından kendilerine yönelik yeterlilik algıları. *Türk Eğitim Bilimleri Dergisi*. 1 (4): 427-439.
- Friedman IA, Kass E (2002). Teacher self-efficacy: a classroom-organization conceptualization. *Teaching and Teacher Educ.* 18: 675-686.
- Garret G (1977). The effect of sex as a variable in teacher perception technical report. Gender Comparison of Teachers' Sense of Efficacy Technical Report. Eastern New Mexico University.
- Gerçek C, Yılmaz M, Köseoğlu P, Soran H (2006). Biyoloji eğitimi öğretmen adaylarının öğretiminde öz-yeterlik inançları. *J. Educ. Faculty of University of Ankara* 39(1): 57-73.
- Gibson S, Dembo M (1984). Teacher efficacy: A construct validation. *J. Educ. Psychol.* 76: 569-582.
- Gökçe E (1999). İlköğretim öğretmenlerinin yeterlikleri. Unpublished Master Thesis, University of Ankara, Ankara.
- Graham S, Harris KR, Fink B, McArthur CA (2001). Teacher efficacy in writing: a construct validation with primary grade teachers. *Scientific Studies of Reading* 5(2): 177-203.
- Guskey TR, Passaro PD (1994). Teacher efficacy: A study constructs dimensions. *American Educational Research J.* 31: 627-643.
- Hazır-Bıkmaz F (2002). Fen öğretiminde öz-yeterlik inancı ölçeği. *Eğitim Bilimleri Uygulama Dergisi* 1(2): 197-210.
- Hoy WK, Woolfolk AE (1993). Teachers' sense of efficacy and the organizational healthy of schools. *Elementary School J.* 93:356-372.
- Joseph J (2003). Science teaching efficacy belief of science majors and non-majors: Implications for elementary teacher preparation. World Congress of the International Council for Education of Teachers, Australia.
- Karasar N (2003). Bilimsel araştırma yöntemi-kavramlar ilkeler teknikler (7<sup>th</sup> Ed.). Ankara.
- Kerlinger FN (1973). *Foundations of Behavioral Research (2<sup>nd</sup> Ed.)*. New York.
- Kiremit HÖ (2006). Fen Bilgisi Öğretmenliği Örgencilerinin Biyoloji ile İlgili Öz-Yeterlik İnançlarının Karşılaştırılması. PhD dissertation, University of Dokuz Eylül, İzmir.
- Küçükylmaz A, Duban N (2006). Sınıf öğretmeni adaylarının fen öğretimi öz-yeterlik inançlarının artırılabilmesi için alınacak önlemlere ilişkin görüşleri. *J. Educ. Faculty of University of Yüzüncü Yıl* 3(2):1-23.
- Levit KE (2001). An analysis of elementary teachers' beliefs regarding the teaching and learning of science. *Science education.* 86(1): 1-22.
- Locke EA, Latham GP (1990). A theory of goal setting and task performance. Englewood cliffs NJ: Prentice Hall.
- Lortie D (1975). *School teacher*. Chicago: University of Chicago Press
- Milner HR, Woolfolk Hoy A (2002). Respect social support and teacher efficacy: A case study. Paper presented at the annual meeting of the American Educational Research Association Session 2665: Knowledge of self in the development of teacher expertise, April 3 2002, New Orleans.
- Moore LAW, Esselman M (1992). Teacher efficacy power school climate and achievement: A desegregating district's experience. Paper presented at the annual meeting of the American Educational Research Association San Francisco.
- Mulholl J, Dorman JP, Odgers BM (2004). Assessment of science teaching efficacy of pre-service teachers in an Australian. *University J. Sci. Teacher Educ.* 15(4): 313-331.
- Özçelik H, Kurt AA (2007). İlköğretim öğretmenlerinin bilgisayar öz-yeterlikleri: balıkesir ili örneği. *İlköğretim Online.* 6 (3): 441-451.
- Pajares MF (1992). Teachers' beliefs and educational research: cleaning up a messy construct. *Review of Educational Research.* 62(3):307-332.
- Pajares F (1996). Self-Efficacy beliefs in achievement settings *Review of Educational Research.* 66: 543-578.
- Pajares F (2002). Overview of Social Cognitive Theory and of Self-Efficacy Retrived January 11 2004 from <http://wwwemoryedu/EDUCATION/mfp/effhtml>
- Pomeroy D (1993). Implications of teachers' beliefs about the nature of science: comparison of the beliefs of scientists' secondary teachers and elementary teachers. *Science Education.* 77(3):261-278.
- Ramey-Gassert L, Shroyer MG (1992). Enhancing science teaching self-efficacy in pre-service elementary teachers. *J. Elementary Sci. Educ.* 4: 26-34.
- Riggs L, Enochs L (1990). Toward the development of an elementary education teachers' science teaching efficacy belief instrument *Science Education.* 74: 625-637.
- Riggs IM (1991). Gender differences in elementary science teacher self-efficacy. Paper presented at the annual meeting of the American Educational Research Association Chicago IL, 3-7 April 1991 (ERIC document ED 340705).
- Saracoğlu AS, Yenice N (2009). Investigating the self efficacy beliefs of science and elementary teachers with respect to some variables. *J. Theory Practice Educ.* 5(2):244-260.
- Saracoğlu SA, Aslantürk E, Çengel M (2006). Aydın ili ilköğretim okulu öğretmenlerinin mesleki bireysel yeteneklerinin çeşitli değişkenler açısından incelenmesi. *Ulusal Sınıf Öğretmenliği Kongresi Ankara: Gazi Üniversitesi* 14-16 Nisan.
- Savran A, Çakıroğlu J (2001). Pre-service biology teachers' perceived efficacy beliefs in teaching biology. *J. Educ. Faculty of University of Hacettepe* 21:105-112.
- Savran A, Çakıroğlu J (2003). Differences between elementary and secondary teachers and pre-service teachers' perceived efficacy beliefs vs their classroom management beliefs. *The Turkish Online J. Educ. Technol.* 2(4): 3-9.
- Soodak LC, Podell DM (1993). Teacher Efficacy and Student Problem as Factors in Special Education Referral. *J. Special Educ.* 27: 66-81.
- Sun CL (1995). A study of elementary teachers' sense of efficacy. *J. Educ. Psychol.* 18: 165-192.
- Shahid J, Thompson D (2001). Teacher efficacy: A research synthesis. Annual Meeting of the American Educational Research Association Seattle.
- Şeker H, Deniz S, Görgeç İ (2005). Tezsiz yüksek lisans öğretmen adaylarının öğretmenlik yeterlikleri üzerine değerlendirmeleri. *Kuram Uygulamada Eğitim Yönetimi Dergisi.* 42: 237-253.
- Tabachnick BG, Fidell LS (1989). *Using Multivariate Statistics (2<sup>nd</sup> Ed.)*. Cambridge: Harper & Row.
- Tobin K, Tippin DJ, Gallard AJ (1994). Research on instructional strategies for teaching science. In DL Gabel (Ed). *Handbook of research on science teaching and learning*. New York: National

- Science Teachers Association.
- Tschannen-Moran M, Hoy AW (2001). Teacher efficacy: capturing an elusive construct. *Teaching and Teacher Education*. 17(7): 783-805.
- Tschannen - Moran M, Woolfolk Hoy A (2007). The differential antecedents of self-efficacy beliefs of vice and experienced teachers. *Teaching and Teacher Education*. 23: 944-956.
- Veerson AM, Dragsted S, Evans RH, Sorensen H (2004). The relationship between changes in teachers' self-efficacy beliefs and the science teaching environment of Danish first-year elementary teachers. *J. Teacher Educ.* 15:25-38.
- Wenner G (2001). Science and mathematics efficacy beliefs held by practicing and prospective teachers: a 5-year perspective. *J. Sci. Educ. Technol.* 10(2): 181-187.
- Wilson P, Tan GI (2004). Singapore teachers' personal and general efficacy for teaching primary social studies. *International Research in Geographical and Environmental Education*. 13(3): 209-222.
- Woolfolk AE, Hoy WK (1990). Prospective teachers' sense of efficacy and beliefs about control. *J. Educ. Psychol.* 82(1):81-91.
- Woolfolk AE, Rosoff B, Hoy WK (1990). Teachers' sense of efficacy and their beliefs about managing students. *Teaching and Teacher Education* 6(2):137-148.
- Yavuzer Y, Koç M (2002). Eğitim fakültesi öğrencilerinin öğretmen yetkinlikleri üzerinde bir değerlendirme. *J. Faculty of Education of Niğde University*. 1(1): 35-43.
- Yılmaz M, Köseoğlu P, Gerçek C, Soran H (2004). Öğretmen öz-yeterlik inancı. *J. Faculty of Education of Hacettepe University*. 58(5).
- Zengin KU (2003). İlköğretim öğretmenlerinin öz-yeterlilik algıları sınıf-ıçi iletişim örüntüleri. Unpublished Master Thesis, University of Dokuz Eylül, İzmir.