



Investigation of the relationship between pre-service science teachers' perceived self-efficacy in science teaching and disposition toward reflective thinking

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Abstract

The study aims to examine the relationship between perceived self-efficacy in science teaching and disposition towards reflective thinking in pre-service science teachers based on different variables. For this purpose, the Perceived Self-efficacy Scale for Science Teaching and Disposition Towards Reflective Thinking Scale were conducted in 619 pre-service science teachers attending four public universities in Turkey. The research results suggest a positive significant relationship between perceived self-efficacy in science teaching and disposition towards reflective thinking at medium-level. While perceived self-efficacy in science teaching did not have any significant difference in respect to gender, grade level, type of education, status of giving private lessons or type of high school, the difference based on the universities and sense of academic success of pre-service science teachers was found to be significant. Disposition towards reflective thinking is not significantly different based on grade, type of education, type of high school or status of giving private lesson, whereas significant differences are observed in respect to gender, universities and sense of academic success. A regression equation was devised for the variables that predict disposition towards reflective thinking. The implications were discussed.

Keywords: Self-efficacy, reflective thinking, science teaching, pre-service science teachers

Introduction

Today, students assume an active role in the very center of the questioning process so as to seek a solution to events and existing problems in school and learning life. Existing teaching programs which focus on the constructivist learning theory support this situation and process in terms of content. According to constructivist learning, students restructure information by using their previous knowledge and experience in the process of research and questioning. In this process, the teacher is expected to assume an active role by focusing students on the subject and problem and causing them to construct information through critical questions that stimulate deep thinking dynamically rather than merely being a passive guide asking short-answer questions. This evolution of understanding in education and the need for meaningful learning result in teachers and students acquiring the skills that are among the main components of education to be questioned. Students who construct information should be aware of their own responsibilities in such an active learning environment. They should be able to determine their own learning speed and needs, and should be able to make progress by identifying what is required to generate a resolution to a problem. A similar development and internal questioning mechanism should also apply to teachers and pre-service teachers in the context of qualifications and setting learning-teaching needs.

Reflective Thinking

Reflective thinking, which has been frequently mentioned in education in recent years, is capable of improving several basic skills and needs that should be possessed by students and teachers as well as making several contributions to the educational environment. Ünver (2003) mentions that an education system that embodies reflective thinking gives students the opportunity to set their own learning goals and responsibilities, to correct their own mistakes and to express their opinions freely through self-stimulation thanks to being able to recognize their positive behaviors. On the other hand several institutions and agencies in the USA such as the National Board for Professional Teaching Standards (NBPTS), the National Commission on Teaching & America's Future (NCTAF), the National Foundation for the Improvement of Education (NFIE) and the National Skills Development Center (NSDC), as well as governments and local school administrations perceive reflective thinking as a standard that should be required of all teachers and students (Tok, 2008). Therefore, a large number of countries are presently trying to develop and improve their educational standards. To this end, they include different projects and programs with a potential to influence. Tok (2008) points out that reflective thinking has been determined as one of the general qualification areas for teachers in the scope of the Support to Basic Education Project and that it is important to develop knowledge and attitude towards reflective thinking in teacher training programs so as to ensure that teachers acquire this skill. Also, he is of the opinion that reflective thinking could have a determining role in teacher education

Reflective thinking is a kind of thinking skill for individuals. It has been stated that developing this skill is not generally an easy task for individuals (Kuit, Reay & Freeman, 2001; Lin, Hmelo, Kinzer & Secules, 1999). In conceptual terms, reflection can be identified as the skill to assume responsibility in the realistic preferences and choices of an individual in terms of thinking; it is also an active, purposeful and stable thinking process used while attempting to generate practical solutions to problems (Ross, 1990; cited in Gözütok, 2006; Yorulmaz, 2006). An individual who thinks reflectively takes decisions for the solution of problems and realizes this decision, evaluating the results thereof (Norton, 1994).

According to Kızılkaya and Aşkar (2009), reflective thinking has aspects such as questioning, causation and evaluating, while Loughran (1996) mentions that reflective thinking includes phases such as claim, problem, hypothesis, judgment and testing. From a basic perspective, Dewey (1993) defines reflective thinking as effective, consistent and careful thinking about thought or information. In other words, reflective thinking is actively, continuously and carefully thinking on a subject.

Self efficacy is the judgment of an individual on their own capability to organize events and success in delivering a certain performance. Perceived self-efficacy is addressed at two levels, namely, self-efficacy expectation and result expectation; the former being about the individuals sufficiency to fulfil a work or task while the latter comprises an individual's beliefs on certain results that should arise from actions (Akbulut, 2006). Personal efficacy depends on 4 characteristics as suggested by social learning theory. These are performance skill, indirect experience (learning through modeling or observation), verbal persuasion and psychological state (Bandura, 1997). Therefore, the perceived self-efficacy of individuals is affected by the perceived self-efficacy of other individuals as suggested with indirect experience. As teachers are the most common role-models of students, the perceived self-efficacy of teachers is of great importance for the personality development of students (Bandura, 1997; Kiremit, 2006). Furthermore, teachers with a high sense of self-efficacy put effort into satisfying the learning needs of all of their students. Therefore, it is important to research the self-efficacy development of pre-service teachers (Pendergast, Garvis & Keogh, 2011). Self-efficacy in science teaching can be defined as the judgments and beliefs of teachers about their skills to deliver science teaching in the most effective and efficient manner, and to raise student success (Pajares, 2002; Kurtuluş & Çavdar, 2010). A sense of self-efficacy in teachers is important to achieve the goals of the

teaching program in science lessons. Teachers with a high sense of self-efficacy tend to use different teaching methods, conduct research so as to improve their methods and construct student-centered teaching strategies while teachers with a lower sense of self-efficacy deliver teacher-centered lessons and conduct lessons by using only their course books (Henson, 2001; Plourde, 2001).

Rationale

Teachers, who are among the most important components of learning experiences and a dynamic part of classes that have adopted constructivist learning theory as a principle, should be well-informed in individual and professional perspectives, and should have certain qualifications. Similar to all areas, the status of teachers in respect to reflective teaching and self-efficacy in science teaching is also perceived as important for teacher training programs and the improvement of these. Determining the belief levels of in particular pre-service teachers attending teaching faculties in terms of reflective thinking and self-efficacy could prove important in reviewing the adequacy of current teaching programs and the contents of courses, and to train more competent and qualified teachers in this respect. There are several studies in the literature concerning reflective thinking skills (Bağcıoğlu, 2000; Bayrak & Koçak Usluel, 2011; Duban & Yanpar Yelken, 2010; Ersözlü, 2008; Fallon & Brown, 2002; Gipe & Richards, 1992; Jansen & Spitzer, 2009; Tok, 2008; Tang, 2000; Wenzlaff, 1994; Şahin, 2009; Köksal & Demirel, 2008; Lee, 2005; Mewborn, 1999; Phan, 2007; Töman & Odabaşı Çimer, 2014) and belief in self-efficacy (Aydın & Boz, 2010; Azar, 2010a; Bursal, 2010; Cerit, 2010; Morrell & Carroll, 2003; Pendergast et al., 2011; Tschannen-Moran & Woolfolk Hoy, 2007; Bahçivan & Kapucu, 2014; Bleincher & Lindgren, 2005; Bursal, 2010; Çakiroglu, Cakiroglu & Boone, 2005; Enochs, Scharmann & Riggs, 1995; Gencer & Çakiroğlu, 2007). Some of these studies were conducted in the area of science (Baş, 2013; Dowey, 2013; İlhan & Sünkür, 2013; Sünkür, Arıbaş, Töman & Odabaşı Çimer, 2014; Şahin, 2009; Uluçınar Sağır & Aslan, 2009; Uitto, 2014; Üredi & Üredi, 2006; Wenner, 2001). However, studies which examine both reflective thinking skills and perceived self-efficacy together are scarce. In one of these studies, Phan (2007) examined the relationship among learning approach, perceived self-efficacy, reflective thinking state and the academic performance of students from a causal perspective. The number of such studies should be increased. In terms of teacher training and teacher efficacy to meet this need, teachers who think reflectively and have a certain level of perceived self-efficacy in their area are needed in all areas, as in the case of science teaching. At this point, it is believed that determining the quality of interaction and the relationship between reflective thinking and self-efficacy would contribute greatly to the area and the literature.

Therefore, the main aim of this study is to investigate the relationship between the characteristics of disposition towards reflective thinking and perceived self-efficacy in the science teaching of pre-service science teachers in respect to certain variables.

Method

Research Design.

This research, which examines the relationship between perceived self-efficacy and disposition towards reflective thinking in science teaching in pre-service science teachers, was conducted using a relational survey model. The relational survey model is a research model in which the relationship between two or more variables are examined without any intervention (Creswell, 2003; Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2010). The margins are 2.54 cm from all sides, with no gutter.

Sample

In line with the aim of the research, it was planned to include 3rd year students who did not have any previous experience in schools, teaching practice or special teaching methods I lessons and 4th year students who had started to receive these lessons in the study. The study group was selected through

the purposeful sampling method. Students attending 3rd and 4th years of the science teaching departments at Amasya University (AU), Erciyes University (EU), Necmettin Erbakan University (NEU), and Abant İzzet Baysal University (AIBU) at the end of the 2014-2015 academic year constitute the population. Accessed students represent the sample. The distribution of the sample by universities is given in Table 1. *Headings and Subheadings*. Left justified headings (10pt, bold). No numbering required. Subheadings (10pt, italic) should lead a paragraph as shown.

Table 1. Characteristics of research group

		Gender		Grade		Type of education		Type of high school		
		Female	Male	3	4	Normal	Evening	1	2	3
AU	N	153	60	74	139	138	75	173	18	22
	%	71.8	28.2	34.7	65.3	64.8	35.2	81.2	8.5	10.3
EU	N	102	29	50	81	89	42	104	26	1
	%	77.9	22.1	38.2	61.8	67.9	32.1	79.4	19.8	0.8
NEU	N	122	32	55	99	106	48	111	28	15
	%	79.2	20.8	35.7	64.3	68.8	31.2	72.1	18.1	9.7
AIBU	N	98	23	44	77	87	34	94	19	8
	%	81.0	19.0	36.4	63.6	71.9	28.1	77.7	15.7	6.6
Total	N	475	144	223	396	420	199	482	91	46
	%	76.7	23.3	36.0	64.0	67.9	32.1	77.9	14.7	7.4

1: General high school 2: Anatolian-science-teacher high schools 3: Vocational high schools

Six hundred and nineteen students from 4 universities participated in the research. All of the 3rd year students received normal daytime education while some of the 4th year students received evening education. Upon being asked about the type of high school they had graduated from, 1 student from AU, 3 students from EU and, 3 students from NEU stated they had graduated from science high school; 3 students from AU, 5 students from EU, 1 student from NEU and, 1 student from AIBU stated they had graduated from teacher training high school and they were included in the Anatolian high school group in order to facilitate analysis.

Students were asked whether they gave private lessons; 89 students (14.4%) replied affirmatively while 526 students (85.0%) replied negatively. Students were requested to evaluate themselves academically. Thirty eight (6.1%), 292 (47.2%), 259 (41.8%) and 30 (4.9%) students evaluated themselves as poor, medium, good and very good, respectively.

Instrumentation

In this study, two instruments were applied to the participants respectively: (1) Science Teaching Efficacy Belief Instrument (STEBI) and (2) Disposition Towards Reflective Thinking Scale (STRTS).

Science Teaching Efficacy Belief Instrument (STEBI): This is a 5-point Likert scale with two subdimensions which was developed by Enochs and Riggs (1990), and was adapted to Turkish by Özkan, Tekkaya and Çakıroğlu (2002). It has total of 23 items which consist of 13 positive and 10 negative items. Thirteen items in the scale constitute the "Perceived Self-Efficacy in Science Teaching" dimension while the remaining 10 items constitute the "Result Expectation in Science Teaching" dimension. The Cronbach Alpha reliability values of the subdimensions in the original scale were determined as 0.76 and 0.90, respectively. The reliability of the subdimensions were calculated as 0.77 and 0.86, respectively while the Cronbach Alpha was calculated as 0.79 for the entire scale. The reliability coefficient being higher than 0.75 in educational studies indicates that the measurement tool is within the reliability range (Büyüköztürk et al., 2010).

Disposition Towards Reflective Thinking Scale (STRTS): This 5-point Likert scale which was developed by Semerci (2007) for pre-service teachers comprises seven subdimensions and 35 items. It consists of 20 negative and 15 positive items. The subdimensions and their corresponding numbers of items and the Cronbach Alpha reliability coefficients of the scale are as follows: Continuous and purposeful thinking: 7 items, 0.79; open-mindedness: 6 items, 0.71; questioning and effective thinking: 5 items, 0.75; teaching responsibility and being scientific: 5 items, 0.77; researcher: 6 items, 0.74; being prescient and sincere: 4 items, 0.67; perception of profession: 2 items, 0.35. Reliability was set as 0.905 for the overall scale. In this research, the reliability coefficients of the sub-factors were found as 0.61; 0.75; 0.66; 0.63; 0.68; 0.63; 0.32, respectively while the reliability coefficient was calculated as 0.92 for the overall scale.

Data Analysis

After the student forms that were not completed or provided insufficient data were omitted, the codes were entered as 1: strongly disagree, ... 5: strongly agree in positive items, whereas the codes for negative items were 1: strongly agree, ... 5: strongly disagree. A statistical package program was used for data analysis. Normal distribution of data was checked with the Kolmogorov Smirnov test. In the relevant test, parametric tests are applicable where $p > 0.05$ and the sample is above 30 (Pallant, 2001). Total scores were found to be suitable for analysis through parametric tests. The independent samples t-test was used for comparing pairs and single-factor ANOVA was used for groups higher than two, Pearson correlation analysis was used to determine the relationship among variables and regression analyses were conducted to determine the extent to which independent variables predict dependent variables. The assumptions of relevant tests were controlled. Evaluations were made for a significance level of $p = 0.05$.

Findings

The relationship between perceived self-efficacy in science teaching and disposition towards creative thinking in students was examined through Pearson correlation analysis. The results are given in Table 2.

Table 2. Correlation analysis results

	N	\bar{X}	s	r	p
STEBI	619	85.69	9.43	0.582	0.000
STRTS	619	144.43	17.55		

A positive significant relationship at medium-level was found between perceived self-efficacy in science teaching and disposition towards reflective thinking of the students constituting the sample ($r = 0.582$; $p < 0.05$).

The differentiation of perceived self-efficacy in science teaching of pre-service science teachers was examined through independent samples t-test in respect to gender, grade level, type of education whether they gave private lessons. The results are given in Table 3.

Table 3. Comparison of STEBI scores in respect to different variables: t-test results

		N	\bar{X}	s	T	sd	p
Gender	Female	475	85.95	9.34	1.25	617	0.213
	Male	144	84.83	9.73			
Grade	3	223	84.95	8.67	-1.47	617	0.143
	4	396	86.11	9.82			
Type of education	Normal	198	85.36	9.20	-1.50	394	0.134
	Evening	198	86.84	10.36			
Giving	Yes	89	87.47	10.11	1.83	613	0.067

private lessons	No	526	85.51	9.20
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When the perceived self-efficacy in science teaching of students was compared in respect to gender, it was found that there was no significant difference between the scores of male and female students ($t_{617}=1.25$ $p>0.05$). There was no significant difference between the mean scores of perceived self-efficacy of 3rd and 4th year students according to grade level either ($t_{617}=-1.47$; $p>0.05$). As there was no evening education students in the 3rd year while 4th year students attended to either normal daytime or evening education, only 4th year students were selected to examine the effect of type of education. Again, no significant difference was determined between the mean perceived self-efficacy in science teaching scores ($t_{394}=-1.502$; $p>0.05$). When the subdimensions were examined, a significant difference in perceived self-efficacy in science teaching was not found in respect to gender, grade level or type of education. There was not a significant difference in the perceived self-efficacy of students based on whether students gave private lessons; however, those who gave private lessons had a higher mean score ($t_{613}=1.83$; $p>0.05$). As for the subdimensions, the mean score of perceived self-efficacy in science teaching of the students who delivered private lessons was found as 51.35 whereas that of students who did not give private lessons was 49.64, indicating a significant difference between ($t_{613}=2.236$; $p=0.026<0.05$). The difference was not significant in respect to the dimension of result expectation.

Single-factor variance analyses were conducted in order to examine the perceived self-efficacy in science teaching of students based on the type of high school they had graduated from, the universities they attended and their perception of academic success. The results are given in Table 4.

Table 4. Comparison of STEBI scores in respect to different variables: ANOVA results

		N	\bar{X}	s	F	sd	p	Source of Difference
Type of high school	General	482	85.58	9.37	0.139	3	0.936	
	FLI	77	86.10	9.49		615		
	Vocational	46	86.28	8.83				
	Teacher	14	85.28	13.38				
University	AU	213	85.76	8.81	9.433	3	0.000	AU-EU
	EU	131	82.24	8.96		615		NEU-EU
	NEU	154	87.97	10.36		AIBU-EU		
	AIBU	121	86.38	8.77				
Perception of academic success	Poor	38	82.71	9.30	7.681	3	0.000	Good-medium
	Medium	292	84.53	8.06		615		Very good-poor
	Good	259	91.30	10.10				
	Very good	30	85.70	12.53				

FLI = Foreign language intensive high schools

According to the type of high school they have graduated from, students' perceived self-efficacy in science teaching did not indicate any significant difference in total or in subdimensions ($F_{3-615}=0.139$; $p>0.05$). A significant difference was found in the self-efficacy of students based on receiving education at different universities ($F_{3-615}=9.433$; $p<0.05$). This difference was found between the students at Erciyes University and other universities and was not in favor of the students of Erciyes University. Significant differences were found in the science self-efficacy subdimension $F_{3-615}=8.581$ $p=0.000$; between AU-EU; NEU-EU and AIBU-EU; and in the result expectation subdimension $F_{3-615}=4.234$ $p=0.006$ between NEU-EU. A significant difference also existed in the perception of students towards their own academic success ($F_{3-615}=7.681$; $p<0.05$). A difference was found between those who evaluated their success as good and medium, and those who evaluated it as very good and

poor. A significant difference was found in self-efficacy in the science teaching subdimension ($F_{3-615}=8.565$ $p=0.000$) between the very good-poor/medium and good-low/medium groups.

The t-test results for the variation in disposition towards reflective thinking (STRTS) in students based on gender, grade and type of education are given in Table 5.

Table 5. Comparison of STRTS scores in respect to different variables: t-test results

		N	\bar{X}	s	T	sd	p
Gender	Female	475	145.36	16.82	2.41	617	0.016
	Male	144	141.35	19.48			
Grade	3	223	143.26	17.94	-1.23	617	0.218
	4	396	145.07	17.31			
Type of education	Normal	198	143.91	18.40	-1.340	394	0.181
	Evening	198	146.24	16.09			
Giving private lessons	Yes	89	146.48	17.62	1.162	613	0.246
	No	526	144.15	17.50			

The comparison of disposition towards reflective thinking indicates a significant difference in favor of females ($t_{617}=2.41$; $p<0.05$). Female students more predominantly think in a reflective manner. Upon reviewing the subdimensions, no significant difference was found in the being continuous and purposeful, individual responsibility in education, being a researcher, and being prescient and sincere subdimensions in males and females as opposed to the other dimensions. In the dimension of open-mindedness, the mean scores of females and males were 25.72 and 24.46, respectively ($t_{617}=3.093$; $p=0.002$). In questioning and effective thinking \bar{X} females=21.46 and \bar{X} males=20.61 ($t_{617}=2.580$; $p=0.011$) and in professional perception \bar{X} females=8.13 \bar{X} males=7.71 ($t_{617}=2.388$; $p=0.017$) the results indicate that these significant differences are in favor of female students. No significant difference between 3rd and 4th year students were found in respect to STRTS scores ($t_{617}=-1.23$; $p>0.05$). There were no significant differences in subdimensions either. No significant difference between normal daytime and evening education was found in 4th grade students ($t_{394}=-1.34$; $p>0.05$). Significant differences were identified in certain subdimensions. The mean scores of evening education and normal daytime education were 28.84 and 28.16, respectively in the being continuous and purposeful subdimension ($t_{617}=-2.246$; $p=0.025$); while there were \bar{X} evening= 25.04 and \bar{X} normal=24.45 in the being a researcher subdimension ($t_{617}=-2.034$; $p=0.042$). As to whether they gave private lessons, no difference was found in respect to disposition towards reflective thinking in the subdimensions or in the total score ($t_{613}=1.162$; $p=0.246$).

The results of the ANOVA conducted to compare the disposition of students towards reflective thinking based on graduated high school type, university and perception of academic success are given in Table 6.

Table 6. Comparison of STRTS scores in respect to different variables: ANOVA results

		N	\bar{X}	s	F	sd	p	Source of Difference
Type of high school	General	482	144.15	17.54	0.750	3	0.522	
	FLI	77	144.51	18.37		615		
	Vocational	46	147.95	14.29				
	Teacher	14	142.00	22.80				
University	AU	213	143.34	17.57	19.86	3	0.000	AU-EU
	EU	131	134.93	19.14		615		NEU-EU

	NEU	154	149.76	15.14				AIBU-EU
	AIBU	121	146.30	14.50				
Perception of academic success	Poor	38	139.55	18.57	6.281	3	0.000	Good-medium
						615		Very good-poor
								Very good-medium

According to the type of high school they graduated from, students' disposition towards reflective thinking did not indicate any significant difference ($F_{3-615}=0.750$; $p>0.05$). A significant difference in the subdimension of being prescient and sincere was found between types of high school ($F_{3-615}=2.721$; $p=0.044$). According to the attended university, the disposition of students toward reflective thinking indicated a significant difference ($F_{3-615}=19.86$; $p<0.05$). Erciyes University students had a lower level of disposition towards reflective thinking as compared to other universities. Differences in disposition towards reflective thinking were found in all of the subdimensions according to university ($F_{3-615}=14.137$; $F_{3-615}=19.955$; $F_{3-615}=16.574$; $F_{3-615}=10.812$; $F_{3-615}=15.184$; $F_{3-615}=8.017$; $F_{3-615}=6.382$ $p=0.000$ respectively for all subdimensions). EU results were lower than those of other universities in all of the dimensions. A significant difference between students was found when they were compared based on their perception of academic success ($F_{3-615}=6.281$; $p=0.000$). The differences between those who evaluate themselves as good and medium; and those who evaluate themselves as very good and as low-medium were significant. Significant differences were found in all of the subdimensions except for professional perception. The F values of the subdimensions are respectively as follows: $F_{3-615}=5.356$; $F_{3-615}=5.574$; $F_{3-615}=2.394$; $F_{3-615}=6.198$; $F_{3-615}=5.827$; $F_{3-615}=4.677$ $p<0.05$. Differences were found among the good-medium, very good-medium and very good-poor groups.

The effect of variables that predict the disposition of students towards reflective thinking was examined through multiple regression analysis. The results are given in Table 7.

Table 7. Multiple regression results for the prediction of disposition towards reflective thinking

	B	Std. Error	β	T	p	Binary r	Partial r
Constant	48.072	6.822	-	7.047	0.000		
Grade	0.026	1.391	0.001	0.019	0.985	0.050	0.001
Type of high school	0.516	0.805	0.021	0.640	0.522	0.030	0.026
Academic success ev.	1.645	0.856	0.064	1.922	0.055	0.170	0.077
STEBI	1.057	0.062	0.568	17.014	0.000	0.582	0.566
Type of education	0.755	1.434	0.020	0.527	0.599	0.075	0.021
$R=0.586$ $R^2=0.344$ $F_{(5-613)}=64.192$ $p=0.000$							

Grade level, type of education, type of graduated high school, academic success evaluation and perceived self-efficacy (STEBI) are related to disposition towards reflective thinking at medium level. These variables in total explain 34.4% of the variance in disposition towards reflective thinking. Based on the standardized regression coefficient, the order of importance of predictive variables on STRTS is self-efficacy, academic success evaluation, type of graduated high school and type of education. Based on the t-test results, it could be suggested that only perceived self-efficacy has a significant effect on STRTS. The regression equation could be given as follows:

$$STRTS=48.072+0.026.grade +0.516 \text{ type of high school} + 1.645ac.suc.ev. + 1,057STEBI + 0.755typeofeducation$$

Discussion

Differences in self-efficacy and disposition towards reflective thinking scores according to certain variables were observed in this research, which examined the characteristics of disposition towards reflective thinking and perceived self-efficacy in science teaching of pre-service science teachers in respect to different variables.

A positive significant relationship at medium-level was found between perceived self-efficacy in science teaching and disposition towards reflective thinking in the students constituting the sample. Accordingly, it is seen that the higher the perceived self-efficacy of pre-service teachers in science is, the greater their skills in reflective thinking improve. Similarly, Phan (2007) demonstrated that perceived self-efficacy directly predicts and determines reflective thinking.

When perceived self-efficacy in the science teaching of students was compared in respect to gender, it was observed that there was no significant difference between the scores of male and female students. The finding that perceived self-efficacy does not differ based on genders is parallel to the research findings that found no significant difference between males and females (Milner & Woolfolk-Hoy, 2002; Altunçekiç, Yaman & Koray, 2005; Çetin, 2007; Ekici, 2008; Uluçınar Sağır & Aslan, 2009; Azar, 2010b; Yenice, 2012;) while they conflict with the study findings that suggest a difference between males and females in respect to self-efficacy (Bandura, Schunk, 1981; Jones & Wheatley, 1990; Scholz, Gutierrez-Dona, Sud & Schwarzer, 2002; Morgil, Seçken, & Yücel, 2004; Üredi & Üredi, 2006; Britner & Pajares, 2006). Although the results of studies that examine the perceived self-efficacy of teachers do not align in this context, the fact that no difference was found in the perceived self-efficacy of science teachers in respect to genders could be justified with the evolving role of the traditional woman in Turkish society, women being prominent in society with academic success and a lack of professional restriction in our country in terms of genders.

No significant difference in the mean scores of perceived self-efficacy of students was found according to the grade level variable either. Studies conducted by Berkant and Ekici (2007), Cerit (2010) and Yenice (2012) support this finding. Although it was expected that pre-service teachers would be positively affected by the high number of pedagogic field lessons in the last 2 years of their courses, the fact that perceived self-efficacy did not vary based on the grade levels of students could be interpreted as that the education received by pre-service teachers in the last 2 years did not cause a difference in perceived self-efficacy. The studies conducted by Durdukoca, (2010) and Uluçınar Sağır and Aslan (2009) determined that the perceived self-efficacy of pre-service teachers was directly proportional with increase in grade level. These differences were attributed to the lessons received by pre-service teachers in their respective academic terms.

While no significant difference was observed in the perceived self-efficacy of students based on whether they gave private lessons, and the type of graduated high school, significant differences were found based on the universities attended. The results yielded which were not in favor of Erciyes University, support the findings of research to examine teaching self-efficacy based on questioning of science and technology pre-service teachers conducted by İnaltekin and Akçay (2012), the findings of research to examine the perceived self-efficacy of secondary education mathematics and pre-service science teachers conducted by Azar (2010a), and the results of the research conducted by Akbaş and Çelikaleli (2006) on class pre-service teachers; however they do not support the results of research by Kiremit (2006) which examined the perceived self-efficacy in biology teaching of pre-service science teachers. In spite of the unavailability of any research that examines the perceived self-efficacy of pre-service science teachers attending different universities in the literature review, the difference may be suggested to stem from physical and academic reasons. The effect of the similarity of expectations of pre-service teachers towards their field of teaching and the shared program at university is suggested

as the reason for the lack of a significant difference in perceived self-efficacy of teachers based on graduated high-school (Özdemir, 2008).

Significant differences were observed between the academic success perceptions and perceived self-efficacy scores of students. Significant differences were determined between those who evaluated their success as good and medium, and those who evaluated it as very good and poor. Several researchers analyzed the relationship between perceived self-efficacy and academic success (Andrew, 1998; Spieker & Hinsz, 2004; Lane, Lane & Kyprianou, 2004; Canpolat & Kazak Çetinkalp, 2011), and the yielded result was similar in respect to the effect of perceived self-efficacy of students on increasing their academic success.

A significant difference in favor of female students was observed in the comparison of disposition towards reflective thinking based on the gender variable. Female students more predominantly think in a port this finding. For instance, Duban and Yanpar Yelken (2010) found that female pre-service teachers had a higher level of disposition towards reflective thinking as compared to male pre-service teachers. Again, the research conducted by Hasırcı and Sadık (2011) determined that female teachers have a higher level of reflective thinking than male teachers. The basic reasons for this situation could be that females have a higher level of professional confidence in modern societies and perceive themselves as more sufficient in the teaching profession as compared to males (Akbaş & Çelikkaleli, 2006). The research conducted by Saygılı and Tehneldere (2014) found that the characteristics of the reflective thinking subdimension did not have any significant differences based on the gender of teachers.

No significant difference between 3rd and 4th grades were found in respect to disposition towards reflective thinking scores. Again, no significant difference was observed in disposition towards reflective thinking between students attending normal daytime and evening education. The reason for the lack of difference in reflective thinking characteristics between grade levels could be suggested as the unavailability of sufficient education on reflective thinking delivered at the higher education institutions of the pre-service teachers (Alp & Taşkın, 2012). It could be said that, in particular the lessons delivered at 3rd and 4th grades for science education are not effective in improving students' reflective thinking skills.

The disposition towards reflective thinking did not indicate any significant difference according to the type of high school students graduated from while significant differences were determined based on the universities attended. This result suggests that while lessons received in high school education do not cause any differentiation in disposition towards reflective thinking, the lessons received at different universities and different education faculties cause a differentiation in disposition towards reflective thinking. Accordingly, it is assumed that the forms of teaching practice lessons that are received for field education in the 3rd and 4th grades have a particular effect. The most important responsibility here belongs to the academic staff that lectures in the faculties of education (Duban & Yanpar Yelken, 2010). The development of reflective thinking skill could be supported by using diaries and videos in lessons such as school experience and teaching practice (Şahin, 2009). Moreover, Norton (1997) revealed a positive relationship between effective teaching and reflective thinking in his research.

Significant differences were found in the disposition of pre-service science teachers towards reflective thinking based on their levels of academic success. This situation indicates that an increase in the academic success of pre-service teachers can also cause a differentiation in disposition towards reflective thinking. Baş (2013) determined that reflective thinking skills for problem solving constitute a significant predictor of academic success in science and technology lessons in his research conducted on the relationship between the reflective thinking skills of elementary students for

problem solving and their academic success scores obtained from science and technology lessons. The improved reflective thinking skills of students lead to students who question more and spend more time on problems (Kızılkaya, 2009). A study conducted by Tok (2008) found that students who received education through activities that support reflective thinking had increased success in science lessons.

It was determined that the highest variable for predicting the disposition of students towards reflective thinking is their perceived self-efficacy. Similar results were obtained by Sarı Uzun, Sezen Yüksel and Dost (2013) in their study carried out with mathematics pre-service teachers.

Conclusion and Suggestions

There is a positive significant relationship at medium-level between perceived self-efficacy in science teaching and disposition towards reflective thinking in pre-service science teachers. Perceived self-efficacy in science teaching does not have any significant difference in respect to gender, grade level, type of education, giving private lessons or type of high school. However, the difference based on the universities and sense of academic success of pre-service teachers was found to be significant. Disposition towards reflective thinking is not significantly different based on grade, type of education, type of high school or giving private lessons. Nonetheless, significant differences are observed in respect to gender, universities and sense of academic success. Grade level, type of education, type of high school, perception of success and perceived self-efficacy together explain 34.4% of the variance in disposition toward reflective thinking.

The suggestions given below are made based on the research results:

- Attention should be focused on practices to improve the self-efficacy of pre-service teachers in respect to science teaching.
- Activities that improve reflective thinking may be used to help pre-service teachers to improve their reflective thinking skills. Academic staff should be encouraged to create such environments.
- In addition to determining the reflective thinking skills of pre-service teachers, studies that aim at determining whether or not the education delivered in education faculties instills reflective teacher characteristics in various areas should be conducted.
- According to this study, studies should be carried out in order to reveal the basic reasons for the differences between universities in respect to perceived self-efficacy in science teaching and reflective thinking disposition, and to eliminate these differences.
- In the framework of the research result indicating that female pre-service teachers have a higher level of disposition towards reflective thinking as compared to male pre-service teachers, activities should be carried out so as to enhance the disposition of male pre-service teachers towards reflective thinking.
- The relationship between perceived self-efficacy and disposition towards reflective thinking of pre-service teachers from different fields could be studied.

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