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Effects of Self-regulatory Strategy on Prospective Science Teachers' Chemistry Self Efficacy According to Class Level and Gender

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Abstract

This study aimed at determining the self-regulatory strategies and the chemistry self-efficacies of a total of one hundred and eighty-nine prospective science teachers in a state university in Turkey while studying the chemistry lesson according to the class level and gender factors. An additional goal was to examine the relationship level between the self-regulatory strategies and their chemistry self-efficacies of prospective science teachers. In the study, "Self-Regulatory Strategies Scale" and "Chemistry Self-Efficacy Scale" were used. As a result of the study, it was observed that these strategies used by prospective science teachers while studying for chemistry lesson and their chemistry self-efficacies changed according to the class level and gender factors. It was observed also at the end of the study that the significant of the relationship between self-regulatory strategies and chemistry self-efficacy levels differed depending on the class level.

Keywords: chemistry self-efficacy, class level, gender, prospective science teacher, self-regulatory strategies

1. Introduction

One of the problems mostly encountered by the students while studying is that they are not aware what they are learning or doing while studying (Kadıoğlu, Uzuntiryaki & ÇapaAydın, 2011). Students have many difficulties such as time management, choosing effective learning strategies, taking notes and preparing for the tests (Zimmerman, Bonner & Kovach, 1996). Development of learning should include not only the improvement of content information but also the development of studying skills, social skills and desired motivational orientations in order to help students being independent, life-long learners (Kadıoğlu, Uzuntiryaki & Çapa-Aydın, 2011). According to them, studies carried out in the recent years give priority to "how individuals learn" and "how individuals regulate themselves in order to learn", in more general terms, to self-regulation. Various researches include empirical findings regarding the relation between self-regulation strategies and academic success, motivational orientation and self-efficacy beliefs (Haşlaman & Aşkar, 2007; Orhan, 2008; Pintrich & De Groot, 1990; Yükseltürk & Bulut, 2009; Zimmerman & Martinez-Pons, 1990; Zusho, Pintrich, & Coppalo, 2003). Therefore, self-regulation is one of the most important structures in education. It is considered that all students use self-regulatory strategies within limits. Therefore, it is not appropriate to mention the absence of self-regulation or students without self-regulation (Winne, 1997).

It has been determined that there is various definition of the "self-regulated learning" concept. According to Zimmerman, SRL is defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adopted to the attainment of personal goals" (Zimmerman, 2000, p.14). Self-regulation is an important component of learning for college students (Pintrich, 1995). Self-regulated learning has been the focus of much attention during the last decade (Zimmerman & Schunk, 1989; Pintrich, 1995; Garcia, 1996). According to Boekaerts (1999), SRL is viewed as a key to success in a career. According to a recent definition (Zeidner, Boekaerts & Pintrich, 2000), self-regulation is conceived of as an overarching construct covering aspects such as self-regulated learning, the regulation of one's health and stress management, which in turn cover lower level activities such as strategy use, self-observation and automaticity. It has been defined as the ability to actively monitor and regulate one's learning via the use of a variety of cognitive, metacognitive, and behavioral strategies, including exerting effort, managing resources, organizing and processing information, and self-testing (Boekaerts 1999; Boekaerts & Cascallar, 2006; Webster & Hadwin, 2014; Zimmerman 2000; 2008).

Self-regulated learners possess the ability to evaluate their own progress in relation to the goals they have set and to adjust their subsequent behavior in the light of those self-evaluations (Olaussen & Bråten, 1999; Purdie, Hattie, & Douglas, 1996). It has been classified these strategies as self-evaluation, organizing and transforming, goal-setting and

planning, help-seeking, keeping records and monitoring, environmental structuring, rehearsing and memorizing, seeking social assistance, and reviewing records (Zimmerman, 1990). According to Schloemer and Brenan (2006), there are the key elements of SRL; (a) goal setting, (b) self-monitoring and (c) modifying learning strategies. In addition, Puustinen and Pulkkinen (2001) are emphasize that among the different skills needed to become a self-regulated learner, various theorists have considered the strategies of self-evaluation and monitoring to be vital to success. According to Panadero and Romero (2014), these skills are needed for students to be able to judge their own work. These learners engage in productive self-regulated learning (SRL) by setting high-quality goals, selecting appropriate tactics to achieve those goals, monitoring progress and adapting as necessary (Winne & Hadwin, 2008).

Social cognitive theories emphasize the importance of motivational beliefs such as self efficacy in students during periodical stages of self-regulation (Schunk& Zimmerman, 1998). Through the self-regulatory learning, belief of students in their own capabilities is defined as self-efficacy belief (Zimmerman, Bandura & Martinez-Pons, 1992) Those who have high self-efficacy in science tend to be interested in science and related courses and activities, they try very hard to succeed and they do not easily give up when they face a challenge (Andrew, 1998; Bandura, 1997; Britner & Pajares, 2001; Lau &Roeser, 2002). According to the findings of studies which examine students' self-efficacy in science, compared to such factors as race, gender or family environment, self-efficacy in science is a better determiner of the wish to deal with science and science-related activities and a better predictor of academic achievement (Lau &Roeser, 2002; Lodewyk & Winne, 2005; Pajares, 2002; Pintrich & De Groot, 1990; Wolters & Pintrich, 1998). Researchers of self-efficacy usually think that students' belief in their ability to succeed in science-related tasks, courses or activities or their sense of self-efficacy has a great effect in their selecting activities related to science, in the efforts they make to realize these activities, in their eventual success after their tenacity and experience (Bandura, 1997; Britner & Pajares, 2001; Britner, 2008; Zeldin & Pajares, 2000). This case also explains why students with similar abilities have different academic performances (Pajares, 1996). Moreover, it was also determined that self-efficacy is a better determiner for selecting science-related professions (Gwilliam & Betz, 2001). Although self-efficacy has an important role in science education, it is also reported that there is an increase in the number of students who have no interest in science or belief in themselves when it comes to science (Pell & Jarvis, 2001). Thus, it is important to find ways to increase students' self-efficacy. In addition to many quantitative studies that target determining the factors that affect prospective teachers' self efficacy beliefs, there are also qualitative studies (Büyükduman, 2006; Carrier, 2009; EkinciVural & Hamurcu, 2008; Gibson & Dembo, 1984; İşler, 2008; Ritter, Boone & Rubba, 2001).

There are many definitions for chemistry self-efficacy in literature, which is defined as "a student's belief in his or her success in a college chemistry class" (Dalgety, Coll & Jones, 2003). According to Çapa-Aydın and Uzuntiryaki (2009), chemistry self-efficacy is one's belief in his or her own ability to accomplish chemistry-related tasks. According to Summers (2009), chemistry self-efficacy is the belief to have the ability to act or realize the tasks related to chemistry theory and skills. Chemistry self-efficacy is accepted to be an important emotional part of chemistry learning. Therefore, self-efficacy plays an important role in enhancing students' motivation and especially as an in-class teaching methodology (Garcia, 2010). The first study on chemistry self-efficacy was done by Kerns (1981) in which he examined students' chemistry and mathematics self-efficacy. In later years, Boyd (1990) conducted a study, which examined students' chemistry self-efficacy and their anxiety.

When studies which examine chemistry self-efficacy and several factors affecting this self-efficacy are taken into consideration, it is seen that mostly there are studies on the general state of self-efficacy in students/prospective teachers or in existing teachers, on achievement in chemistry, on chemistry motivation, and on their relationship with self-regulatory learning strategies (Andrew 1998; Britner & Pajares, 2001; Dalgety & Coll, 2006; Kan & Akbaş, 2006; Larose, Ratelle, Guay, Senécal, & Harvey, 2006; Lent, Lopez, & Bieschke, 1991; Quimby & O'Brien, 2004; Scott & Mallinckrodt, 2005; Smist, 1993; Zeldin & Pajares, 2000). The concept of self-regulated learning has become increasingly important in higher education. Contrary to primary and secondary schooling, university education imposes distinctive demands on students, which requires them to be proactive and self-disciplined learners capable of controlling their own learning via self-monitoring and self-evaluation (Ning & Downing, 2014).

1.1 Aim of this Study

Accordingly, in this study the levels of the self-regulatory strategies used by Turkish prospective science teachers while studying the chemistry lesson and the levels of their chemistry self-efficacy were determined. The specific problems of this study are as follows:

- How are the levels of the self-regulatory strategies used by Turkish prospective science teachers attending the same class between 1^{st}-4^{th} classes of university while studying for the chemistry lesson?
- How are the levels of the chemistry self-efficacy of Turkish prospective science teachers attending the same class between 1^{st}-4^{th} classes of university?

- Are there significantly differences in the levels of the self-regulatory strategies used by Turkish prospective science teachers while studying for the chemistry lesson and the levels of their chemistry self-efficacy attending the same class between 1st-4th classes of university change according to gender?
- Are there significantly differences in the levels of the self-regulatory strategies used by Turkish prospective science teachers while studying for the chemistry lesson and the levels of their chemistry self-efficacy attending the same class between 1st-4th classes of university change according to the class level?
- Are there a significantly difference in the relationship level between the self-regulatory strategies and the chemistry self-efficacies of 189 Turkish prospective science teachers?

2. Research Methodology

2.1 Research Design

In this study, relational screening model, which aims at determining the existence or degree of a covariance between two or more variables, of the screening model which is one of the research approaches aiming at defining a situation that existed in the past or still exists as it was or it is. While using the relational screening model, correlation type way was adopted in relational analysis. In correlation type relation searching, whether the variables co-vary and if there are co-variations, how this happens are tried to be learned (Karasar, 2005).

2.2 Respondents

A total of one hundred and eighty-nine university students attending the Department of Science Education (1st, 2nd, 3rdand 4th classes) of a university in Turkey who have taken General Chemistry course in university level participated in this study. Mean age was 20.6 years (range 18-22 years). Distributions of prospective teachers in the research group according to gender and class level are given in Table 1.

Table 1. Research group

Class Level	Male		Female		Total
	f	Frequence %	F	Frequence %	F
Class 1	26	51.00%	25	49.00%	51
Class 2	22	50.00%	22	50.00%	44
Class 3	28	56.00%	22	44.00%	50
Class 4	23	52.30%	21	47.70%	44
Total	99	52.40%	90	47.60%	189

It is seen that the prospective teachers in the research group have a balanced distribution in terms of gender (Male= 52.40% and Female=47.60%) and class level.

2.3 Instruments

2.3.1Self-Regulatory Strategies Scale (SRSS)

Cronbach's alpha internal reliability coefficient of eight-factor scale developed by Kadıoğlu, Uzuntiryaki and Çapa-Aydın (2011) was used to measure the self-regulatory strategies used by high school students while studying for chemistry lesson varied in the interval of .68-.82. As the original target group of the scale was high school students, this scale was applied for 192 undergraduate students who have taken general chemistry course prior to this study. As a result of confirmatory factor analysis, all relations of sub-scales with each other and with scale point were found to be meaningful. That the sub-scales of the scale indicated a high level relation in positive direction with scale point supported the structure validity of the scale in positive direction. Also, the fact that correlation values among the factors varied between .61 and .72 indicated that the factor structure of the scale was consistent. Cronbach's alpha value, which was estimated in order to examine the reliability of the scale, was in total .89.

2.3.2 Chemistry Self-Efficacy Scale (CSES)

The original Chemistry Self-Efficacy Scale used of this study consisted of 17 positive items of 7-likert type (I am not sure at all-I am very sure) and has two sections (Dalgety, Coll & Jones, 2003). The first section is about "chemistry knowledge" and it has two factors: Self Efficacy in Learning of Chemistry Theory – SLCT (3 items) and Self-Efficacy in Applying of Chemistry Theory – SACT (7 items). The other section is about "chemistry skills" and it has two factors: Self Efficacy in Learning Chemistry Skills – SLCS (3 items) and Self Efficacy in Applying Chemistry Skills – SACS (4 items). As a result of the factor analysis done in the chemistry self efficacy scale of the original questionnaire (CAEQ), it was seen that there is a high correlation between factor and that KMO value is .85. Reliability analysis showed that the calculated total alpha value is .95 ($p<.\alpha$).

In order for the scale to be used for prospective science teachers who have taken general chemistry course, adaptation to Turkish was done (Güngör Seyhan & Eyceyurt Türk, 2015). To this end, the original scale, which consisted of 17 positive items, was translated into Turkish, and after the statistical analyses, it was seen that it gave reliable measuring

results both at the factor level and at the scale level. The scale was applied to 496 university students for reliability and validity analyses. Alpha value calculated for CSES is .88 (17 items), alpha values for SLCT, SACT, SLCS, and SACS factors are .50; .76; .55 and .69, respectively. According to these findings, it can be said that CSES has a high internal consistency and that it gives reliable measuring results. While the original scale is a 7-likert type, it was decided that it should be a 5-likert type (I am not sure at all – I am very sure) when adapting it to Turkish.

2.4 Procedure

Data obtained within the scope of the study were collected voluntarily in the course hours of prospective teachers by the researcher. The implementation of these scales took approximately 10 minutes.

2.5 Data Analysis

For the first and second research problems of the study, descriptive statistics of all answers were produced according to class levels in order to determine the general status of the self-regulatory strategies and their chemistry self-efficacies of prospective teachers while studying for the chemistry lesson. For the third research problem of the study, Mann-Whitney U test was applied in order to examine the significant of the difference between the answers given to SRSS and CSES items by female and male prospective teachers. If the dependent variable must be as least ordinal scaled, there are some references stating that Mann-Whitney U test can be applied (Fay & Proschan, 2010; Freed, Hess & Ryan, 2002; Winter & Dodou, 2010). For the fourth research problem of the study, Kruskal-Wallis H test was used in order to examine the meaningfulness of the differences among the self-regulatory strategies and their chemistry self-efficacies of the prospective teachers according to all class levels in all item level. For this purpose, Chi-quare values are calculated for each item in order to compare the differences between the class levels. There are many references supporting this kind of calculation. (Dalgety, Coll & Jones, 2003; Fay & Proschan, 2010;Freed, Hess & Ryan, 2002; Winter & Dodou, 2010; http://www.ats.ucla.edu/stat/stata/whatstat/whatstat.htm). For the fifth research problem of the study, correlation matrix was arranged as the prospective teachers included in the research group were in different class levels. Multiple regression analysis was used to examine the predictive power and level of self-regulatory strategies of prospective teachers for their chemistry self-efficacies. These analyses were carried out via SPSS 15.0.

3. Results

3.1 Descriptive Statistics of SRSS According to Class Levels

In order to determine the self-regulatory strategies of prospective teachers, SRSS was used. For the scale consisted of eight sub-dimensions in total, which are motivation regulation, effort regulation, planning, attention focusing, summary strategy, highlighting strategy, using additional resources, and self-instruction, descriptive statistics of answers given to each item according to class levels are given in Table 2.

Table 2. Descriptive statistics of SRSS item scores according to class levels

	Items		Class 1		Class 2		Class 3		Class 4	
			$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
F1	Item 1	While studying for a topic, I give a break when I don't understand something.	4.14	1.37	4.64	1.16	4.56	1.23	4.61	1.40
	Item 2	While studying, I quit if I am bored.	4.18	1.41	4.64	1.18	3.80	1.46	4.52	1.28
	Item 3	I quit studying if I don't understand the topic.	3.67	1.42	3.82	1.33	3.50	1.52	4.16	1.54
	Item 4	On my desk, I only keep resources required for studying (books, notebooks etc.)	4.59	1.33	4.20	1.44	4.80	1.23	4.66	1.31
F2	Item 5	I switch off the television in order to concentrate while studying.	4.80	1.44	4.91	1.48	5.04	1.37	4.59	1.60
	Item 6	I try to remove the things, which distract me while studying.	4.63	1.28	4.95	1.24	5.00	1.28	4.43	1.42
	Item 7	Before starting to study, I organize the environment in which I will study.	4.88	1.14	4.68	1.27	5.02	1.24	4.91	1.20
	Item 8	I study in a quiet environment in order to concentrate.	4.76	1.39	4.98	1.17	5.00	1.39	4.77	1.48
F3	Item 9	I study the topic using different resources.	3.78	1.27	3.57	1.23	3.76	1.35	4.32	1.25
	Item 10	While studying for a topic, I combine the information I gather from different resources.	4.47	1.35	4.11	1.28	3.86	1.58	4.73	1.04
	Item 11	While studying for a topic, I solve questions from test books other than course books.	3.57	1.40	3.77	1.54	3.50	1.61	4.55	1.47
	Item 12	While studying, I remind myself that the topic will be necessary in my future life.	3.57	1.32	3.27	1.42	3.38	1.40	3.98	1.41
F4	Item 13	I motive myself to study more thinking that I will get a high grade.	4.51	1.36	4.41	1.21	4.64	1.35	4.34	1.41
	Item 14	I motive myself to study in order to be loved by my teacher.	3.71	1.66	3.25	1.54	2.74	1.58	3.09	1.64
	Item 15	I persuade myself that I need to study hard in order to learn the topic.	4.76	1.19	4.36	1.35	4.58	1.31	4.50	1.39
	Item 16	While studying, I remind myself how important getting a good grade is.	4.53	1.33	4.50	1.23	4.48	1.45	4.32	1.55
F5	Item 17	While studying, I summarize the topic by drawing schemas.	3.47	1.39	3.45	1.49	3.34	1.32	3.98	1.52
	Item 18	While studying, I summarize using my own sentences.	4.63	1.39	4.34	1.08	4.24	1.38	4.89	1.20
F6	Item 19	I list the concepts, which I do not understand.	4.14	1.31	3.82	1.48	4.08	1.47	4.07	1.35
	Item 20	I explain myself the way I used while solving a question.	4.31	1.45	4.43	1.37	4.34	1.33	4.57	1.15
	Item 21	While studying for a topic, I explain the topic to myself.	4.29	1.43	4.70	1.25	4.20	1.44	4.57	1.09
	Item 22	I ask myself questions in order to be sure that I understand the topic I study.	3.88	1.16	4.41	1.11	4.08	1.41	4.34	1.20
F7	Item 23	I make a study plan before starting to study.	3.67	1.32	3.14	1.19	3.80	1.29	3.84	1.49
	Item 24	I list what I should do before starting to study.	4.00	1.55	3.91	1.46	3.72	1.41	4.05	1.64
	Item 25	Before starting a study, I determine what I should learn.	3.86	1.11	3.70	1.37	4.10	1.37	4.34	1.27
	Item 26	Before starting to study, I determine the way I will follow during study.	3.96	1.36	4.05	1.40	3.86	1.51	4.23	1.29
F8	Item 27	While studying I write down the definitions of important concepts.	4.14	1.44	4.55	1.23	4.98	1.25	4.93	1.25
	Item 28	While studying for a topic, I underline the important points.	4.94	1.19	5.05	1.03	5.04	1.03	5.18	0.99
	Item 29	While studying for a topic, I mark the important point with color markers.	4.25	1.56	4.75	1.37	4.64	1.48	4.93	1.07

F1: Effort Regulation, F2: Attention Focusing, F3: Using Additional Resource, F4: Motivation Regulation, F5: Summary Strategy, F6: Self-Instruction, F7: Planning, F8: Highlighting Strategy.

When Table 2 is examined, it is seen that when answers of prospective teachers to the items in "effort regulation" dimension are examined, 3rd class prospective teachers indicated lower participation compared to the prospective teachers in other class levels, the prospective teachers who indicated the highest effort were the 4th class prospective teachers. However; when the items in "attention focusing" dimension are examined, it is seen that the 3rd class prospective teachers have a very slightly participation compared to the prospective teachers in other classes. When answers of prospective teachers in "using additional resource" dimension are examined, it is seen that the 4th class prospective teachers are differently higher than the other class levels. The situation is similar in terms of prospective teachers in other class levels. When "motivation regulation" dimension is examined, it is seen that the prospective teachers with the highest motivation were 1st class prospective teachers. When "summary strategy" and "highlighting strategy" dimensions are examined, it is seen that the 4th class prospective teachers particularly adopt the behaviors of diagram drawing, using their own sentences, underlining the important parts more than the prospective teachers in other class levels. In "planning" dimension, it is seen that when the class level is higher, planning behavior increases.

Kruskal-Wallis H test was used in order to examine the item level significant of differences among self-regulatory

strategies of prospective teachers according to class levels and results are given in Table 3.

Table 3. Kruskal-Wallis H test results of SRSS according to class levels

Items			Chi-square	df	*p*	Difference
F1	Item 1	While studying for a topic, I give a break when I don't understand something.	4.631	3	0.201	-
	Item 2	While studying, I quit if I am bored.	9.524	3	0.023	2-3, 3-4
	Item 3	I quit studying if I don't understand the topic.	5.427	3	0.143	-
F2	Item 4	On my desk, I only keep resources required for studying (books, notebooks etc.)	4.437	3	0.218	-
	Item 5	I switch off the television in order to concentrate while studying.	2.597	3	0.458	-
	Item 6	I try to remove the things, which distract me while studying.	6.997	3	0.072	-
	Item 7	Before starting to study, I organize the environment in which I will study.	2.431	3	0.488	-
	Item 8	I study in a quiet environment in order to concentrate.	1.287	3	0.732	-
F3	Item 9	I study the topic using different resources.	8.408	3	0.038	-
	Item 10	While studying for a topic, I combine the information I gather from different resources.	9.599	3	0.022	2-4, 3-4
	Item 11	While studying for a topic, I solve questions from test books other than course books.	14.469	3	0.002	1-4, 2-4. 3-4
F4	Item 12	While studying, I remind myself that the topic will be necessary in my future life.	7.073	3	0.070	-
	Item 13	I motive myself to study more thinking that I will get a high grade.	1.777	3	0.620	-
	Item 14	I motive myself to study in order to be loved by my teacher.	9.152	3	0.027	-
	Item 15	I persuade myself that I need to study hard in order to learn the topic.	2.330	3	0.507	-
	Item 16	While studying, I remind myself how important getting a good grade is.	0.301	3	0.960	-
F5	Item 17	While studying, I summarize the topic by drawing schemas.	5.315	3	0.150	-
	Item 18	While studying, I summarize using my own sentences.	8.361	3	0.039	-
	Item 19	I list the concepts, which I do not understand.	1.297	3	0.730	-
F6	Item 20	I explain myself the way I used while solving a question.	0.799	3	0.850	-
	Item 21	While studying for a topic, I explain the topic to myself.	3.495	3	0.321	-
	Item 22	I ask myself questions in order to be sure that I understand the topic I study.	5.866	3	0.118	-
F7	Item 23	I make a study plan before starting to study.	6.750	3	0.080	-
	Item 24	I list what I should do before starting to study.	1.708	3	0.635	-
	Item 25	Before starting a study, I determine what I should learn.	8.157	3	0.043	1-4, 2-4
	Item 26	Before starting to study, I determine the way I will follow during study.	1.597	3	0.660	-
F8	Item 27	While studying I write down the definitions of important concepts.	13.585	3	0.004	1-3, 1-4
	Item 28	While studying for a topic, I underline the important points.	0.875	3	0.832	-
	Item 29	While studying for a topic, I mark the important point with color markers.	4.253	3	0.235	-

F1: Effort Regulation, F2: Attention Focusing, F3: Using Additional Resource, F4: Motivation Regulation, F5: Summary Strategy, F6: Self-Instruction, F7: Planning, F8: Highlighting Strategy.

When Table 3 is examined, it is seen that the difference among the responses given by the prospective teachers to I2, I10, I11, I25 and I27 items are significantly according to the class level. Findings obtained by examining the contents of items given in Table 3 and difference groups and descriptive statistics given Table 2 together are as follows;

When the answers given to I2 item in the "effort regulation" dimension are examined, it is seen that 3rd class prospective teachers are more inclined to quit studying when they are bored than 2nd class and 4th class prospective teachers. When the answers given to I10 and I11 items in the dimension of "using additional resource", it is seen that the 4th class prospective teachers prefer combining information gathered from different resources in a significantly higher level that the 2nd and 3rd class prospective teachers. Also they are more meaningfully inclined to benefit from test books other than course books that all other class levels. When I25 item in "planning" dimension is examined, it is seen that the 4th class prospective teachers prefer determining what should be learned before starting a study more than 1st and 2nd class prospective teachers. This situation indicates that the planning skills of 4th class prospective teachers are higher than those of 1st and 2nd class prospective teachers. When "highlighting strategy" dimension is examined, it is seen that 3rd and 4th class prospective teachers prefer defining important concepts more than 1st class prospective

teachers do.

3.2 Descriptive Statistics of CSES According to Class Levels

For the CSES that consists of four sub-dimensions, namely, SLCT, SACT, SLCS and SACS, descriptive statistics of answers given to each item according to class level is given in Table 4.

Table 4. Descriptive statistics of CSES item scores according to class level

Items			Class 1		Class 2		Class 3		Class 4	
			$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
SACT	Item 1	Applying a set of chemistry rules to different elements of the periodic table	2.33	0.91	3.77	0.68	3.68	0.77	4.30	0.67
	Item 2	Tutoring another student in a first year chemistry course	2.61	1.04	3.93	0.70	3.92	0.60	4.09	0.74
	Item 3	Explaining something that you learning in this chemistry course to another person	3.29	0.97	4.02	0.70	4.18	0.60	4.11	0.69
	Item 4	Choosing an appropriate formula to solve a chemistry problem	3.94	0.73	4.11	0.65	4.04	0.70	4.14	0.67
	Item 5	After reading an article about a chemistry experiment, you writing a summary of the main points	2.71	0.88	3.98	0.70	4.16	0.62	3.86	0.46
	Item 6	After watching a television documentary dealing with some aspect of chemistry experiment, writing a summary of its main points	2.61	0.83	3.61	0.72	4.06	0.74	3.80	0.59
	Item 7	After listening to a public lecture regarding some chemistry topic, explaining its main ideas to another person	2.31	0.84	4.14	0.77	4.10	0.65	3.82	0.50
SLCT	Item 8	Achieving a passing grade in a chemical hazards course	2.45	0.88	4.11	0.58	3.98	0.71	4.11	0.69
	Item 9	Learning chemistry theory	3.67	0.52	4.11	0.72	4.12	0.52	3.89	0.58
	Item 10	Achieving a passing grade in a Part Two chemistry course	3.57	0.57	3.93	0.73	4.16	0.58	4.34	0.61
SACS	Item 11	Proposing a meaningful question that could be answered experimentally	3.04	0.80	3.64	0.78	3.86	0.76	3.66	0.48
	Item 12	Knowing how to convert the data obtained in a chemistry experiment to get a result	3.71	0.58	4.27	0.69	4.08	0.63	4.18	0.72
	Item 13	Writing up the experimental procedures in a laboratory report	3.20	0.75	3.95	0.57	4.16	0.65	4.30	0.73
	Item 14	Writing up the results section in a laboratory report	2.16	0.90	4.18	0.66	4.10	0.51	3.75	0.53
SLCS	Item 15	Ensuring that data obtained from an experiment is accurate	3.02	0.86	3.57	0.90	3.72	0.67	4.02	0.63
	Item 16	Determining the appropriate units for a value determined using a Formula	3.53	0.64	4.02	0.63	3.78	0.71	3.86	0.46
	Item 17	Applying theory learning in a lecture for a laboratory experiment	3.71	0.54	3.86	0.67	3.90	0.65	3.82	0.50

SACT: Self-Efficacy in Applying of Chemistry Theory, SLCT: Self Efficacy in Learning of Chemistry Theory, SACS: Self Efficacy in Applying Chemistry Skills, SLCS: Self Efficacy in Learning Chemistry Skills

When Table 4 is examined, the self-efficacy of the 1st class prospective teachers regarding learning the theory of chemistry and particularly for the sub self-efficacy for implementing the chemistry theory is quite low compared to the other class levels. It was determined in the SACT sub self-efficacy of CSES that for item "after listening to a public lecture regarding some chemistry topic, explaining its main ideas to another person", especially 2nd and 3rd class prospective teachers feel quite confident. Again in the same sub self-efficacy, for item "applying a set of chemistry rules to different elements of the periodic table", 1st class prospective teachers don't feel any self-efficacy compared to the members of other class levels. In SLCT sub self-efficacy of CSES, for self-efficacy regarding the learning the theory of a lesson which includes basic knowledge and acquirements about the subject of "chemical hazards"; it was observed that 1st class prospective teachers don't feel self-efficacy. When the table is examined for the responses given by prospective teachers to the item "writing up the results section in a laboratory report" in implementing chemistry skills self-efficacy, it was observed that the 1st class prospective teachers felt self-efficacy in a very low level compared to the prospective teachers in other class levels.

In order to examine the significantly of the difference between prospective teachers' reaction to items of CSES according to class level, Kruskal-Wallis H test results are given in Table 5.

Table 5. Kruskal-Wallis H test results of CSES according to class level

	Items		Chi-square	Df	*p*	Difference
SACT	Item 1	Applying a set of chemistry rules to different elements of the periodic table	86.306	3	0.000	1-2, 1-3, 1-4, 2-4, 3-4
	Item 2	Tutoring another student in a first year chemistry course	61.179	3	0.000	1-2, 1-3, 1-4
	Item 3	Explaining something that you learning in this chemistry course to another person	32.745	3	0.000	1-2, 1-3, 1-4
	Item 4	Choosing an appropriate formula to solve a chemistry problem	1.818	3	0.611	-
	Item 5	After reading an article about a chemistry experiment, you writing a summary of the main points	73.761	3	0.000	3-4
	Item 6	After watching a television documentary dealing with some aspect of chemistry experiment, writing a summary of its main points	69.788	3	0.000	2-3
	Item 7	After listening to a public lecture regarding some chemistry topic, explaining its main ideas to another person	96.378	3	0.000	2-4, 3-4
SLCT	Item 8	Achieving a passing grade in a chemical hazards course	85.034	3	0.000	1-2, 1-3, 1-4
	Item 9	Learning chemistry theory	17.616	3	0.001	1-2, 1-3, 1-4, 3-4
	Item 10	Achieving a passing grade in a Part Two chemistry course	33.623	3	0.000	1-2, 1-3, 1-4, 2-4
SACS	Item 11	Proposing a meaningful question that could be answered experimentally	26.456	3	0.000	1-2, 1-3, 1-4
	Item 12	Knowing how to convert the data obtained in a chemistry experiment to get a result	19.038	3	0.000	1-2, 1-3, 1-4
	Item 13	Writing up the experimental procedures in a laboratory report	51.146	3	0.000	1-2, 1-3, 1-4, 2-4
	Item 14	Writing up the results section in a laboratory report	107.11	3	0.000	1-2, 1-3, 1-4, 2-4, 3-4
SLCS	Item 15	Ensuring that data obtained from an experiment is accurate	32.657	3	0.000	1-2, 1-3, 1-4, 2-4, 3-4
	Item 16	Determining the appropriate units for a value determined using a Formula	12.557	3	0.006	1-2, 1-3, 1-4
	Item 17	Applying theory learning in a lecture for a laboratory experiment	2.173	3	0.537	-

When Table 5 was examined, it was seen that there is a significantly difference in the answers of prospective teachers from different class levels for all items except I4 and I17 items ($p<.\alpha$). Kruskal-Wallis H test was done in order to determine at what class level the different occurs, and difference groups were determined as a result of this test. When Table 4 and Table 5 are examined together, the findings are as follows:

It was seen that prospective teachers in the 1st class (freshman) have a significantly lower self efficacy compared to those in the 2nd (sophomore), 3st (junior) and 4th (senior) classes in all items of CSES except of I4 item (GPA [freshman]: 3.94; [sophomore]: 4.11; [junior]: 4.04; [senior]: 4.14), I5 item (GPA [freshman]: 2.71; [sophomore]: 3.98; [junior]: 4.16; [senior]: 3.86), I6 item (GPA [freshman]: 2.61; [sophomore]: 3.61; [junior]: 4.06; [senior]: 3.80), I7 item (GPA [freshman]: 2.31; [sophomore]: 4.14; [junior]: 4.10; [senior]: 3.82) and I17 item (GPA [freshman]: 3.71; [sophomore]: 3.86; [junior]: 3.90; [senior]: 3.82). It was seen that sophomores have a significantly lower self-efficacy at I6 item of CSES compared to juniors: (GPA [sophomore]: 3.61; [junior]: 4.06). No significantly difference could be observed for this item at other class levels. It was observed that sophomore prospective teachers have a significantly lower self efficacy compared to senior prospective teachers at I1 item of CSES (GPA [sophomore]: 3.77; [senior]: 4.30), I10 item (GPA [sophomore]: 3.93; [senior]: 4.34), I13 item (GPA [sophomore]: 3.95; [senior]: 4.30) and I15 item (GPA [sophomore]: 3.57; [senior]: 4.02).

3.3 Descriptive Statistics of SRSS According to Gender

Within the scope of the study, whether self-regulatory strategies of prospective science teachers in different class levels vary depending on the gender is among the examined sub-problems. With this purpose, descriptive statistics regarding the answers given to the items according to gender are given in Table 6.

Table 6. Descriptive statistics of SRSS item scores according to gender

Items			Gender	Class 1		Class 2		Class 3		Class 4	
				$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
F1	Item 1	While studying for a topic, I give a break when I don't understand something.	Male	4.15	1.62	4.82	1.05	4.39	1.23	5.04	1.33
			Female	4.12	1.09	4.45	1.26	4.77	1.23	4.14	1.35
	Item 2	While studying, I quit if I am bored.	Male	4.12	1.56	4.59	1.22	4.04	1.37	5.17	0.89
			Female	4.24	1.27	4.68	1.17	3.50	1.54	3.81	1.29
	Item 3	I quit studying if I don't understand the topic.	Male	3.38	1.58	3.95	1.33	3.68	1.59	4.91	1.31
			Female	3.96	1.21	3.68	1.36	3.27	1.42	3.33	1.35
F2	Item 4	On my desk, I only keep resources required for studying (books, notebooks etc.)	Male	4.77	1.42	3.86	1.58	4.75	1.17	4.48	1.44
			Female	4.40	1.22	4.55	1.22	4.86	1.32	4.86	1.15
	Item 5	I switch off the television in order to concentrate while studying.	Male	5.54	0.90	4.73	1.45	4.93	1.51	4.52	1.83
			Female	4.04	1.51	5.09	1.51	5.18	1.18	4.67	1.35
	Item 6	I try to remove the things, which distract me while studying.	Male	4.92	1.13	4.73	1.24	4.93	1.36	4.43	1.56
			Female	4.32	1.38	5.18	1.22	5.09	1.19	4.43	1.29
	Item 7	Before starting to study, I organize the environment in which I will study.	Male	5.23	1.03	4.41	1.37	5.00	1.31	5.04	1.02
			Female	4.52	1.16	4.95	1.13	5.05	1.17	4.76	1.37
	Item 8	I study in a quiet environment in order to concentrate.	Male	5.15	1.32	4.77	1.31	5.04	1.29	4.57	1.59
			Female	4.36	1.38	5.18	1.01	4.95	1.53	5.00	1.34
F3	Item 9	I study the topic using different resources.	Male	4.12	1.56	3.41	1.18	3.50	1.20	4.13	1.36
			Female	3.44	0.77	3.73	1.28	4.09	1.48	4.52	1.12
	Item 10	While studying for a topic, I combine the information I gather from different resources.	Male	4.85	1.19	3.86	1.28	3.57	1.55	4.61	1.20
			Female	4.08	1.41	4.36	1.26	4.23	1.57	4.86	0.85
	Item 11	While studying for a topic, I solve questions from test books other than course books.	Male	3.77	1.56	4.09	1.60	3.57	1.73	4.61	1.34
			Female	3.36	1.22	3.45	1.44	3.41	1.47	4.48	1.63
F4	Item 12	While studying, I remind myself that the topic will be necessary in my future life.	Male	3.73	1.46	2.95	1.43	3.07	1.39	3.61	1.50
			Female	3.40	1.15	3.59	1.37	3.77	1.34	4.38	1.20
	Item 13	I motive myself to study more thinking that I will get a high grade.	Male	4.92	1.38	4.41	1.05	4.14	1.48	4.17	1.64
			Female	4.08	1.22	4.41	1.37	5.27	0.83	4.52	1.12
	Item 14	I motive myself to study in order to be loved by my teacher.	Male	4.19	1.72	2.95	1.59	2.64	1.45	2.87	1.55
			Female	3.20	1.47	3.55	1.47	2.86	1.75	3.33	1.74
	Item 15	I persuade myself that I need to study hard in order to learn the topic.	Male	5.12	1.07	3.95	1.33	4.18	1.33	4.43	1.50
			Female	4.40	1.22	4.77	1.27	5.09	1.11	4.57	1.29
	Item 16	While studying, I remind myself how important getting a good grade is.	Male	4.85	1.26	4.09	1.23	4.18	1.49	4.30	1.64
			Female	4.20	1.35	4.91	1.11	4.86	1.32	4.33	1.49
F5	Item 17	While studying, I summarize the topic by drawing schemas.	Male	3.62	1.44	3.14	1.36	3.32	1.36	3.65	1.67
			Female	3.32	1.35	3.77	1.57	3.36	1.29	4.33	1.28
	Item 18	While studying, I summarize using my own sentences.	Male	5.00	1.36	4.23	1.15	4.39	1.23	5.17	1.19
			Female	4.24	1.33	4.45	1.01	4.05	1.56	4.57	1.16
	Item 19	I list the concepts, which I do not understand.	Male	4.69	1.09	3.45	1.41	3.75	1.46	4.22	1.44
			Female	3.56	1.29	4.18	1.50	4.50	1.41	3.90	1.26
F6	Item 20	I explain myself the way I used while solving a question.	Male	4.62	1.60	4.23	1.19	4.11	1.31	4.65	1.27
			Female	4.00	1.22	4.64	1.53	4.64	1.33	4.48	1.03
	Item 21	While studying for a topic, I explain the topic to myself.	Male	4.54	1.58	4.18	1.30	4.14	1.46	4.91	0.90
			Female	4.04	1.24	5.23	0.97	4.27	1.45	4.19	1.17
	Item 22	I ask myself questions in order to be sure that I understand the topic I study.	Male	4.19	1.23	4.05	1.09	3.68	1.47	4.43	1.38
			Female	3.56	1.00	4.77	1.02	4.59	1.18	4.24	1.00
F7	Item 23	I make a study plan before starting to study.	Male	4.00	1.47	3.18	1.40	3.68	1.47	3.87	1.46
			Female	3.32	1.07	3.09	0.97	3.95	1.05	3.81	1.57
	Item 24	I list what I should do before starting to study.	Male	4.42	1.39	3.77	1.38	3.57	1.50	3.83	1.72
			Female	3.56	1.61	4.05	1.56	3.91	1.31	4.29	1.55
	Item 25	Before starting a study, I determine what I should learn.	Male	4.23	1.14	3.32	1.39	3.93	1.39	4.22	1.41
			Female	3.48	0.96	4.09	1.27	4.32	1.36	4.48	1.12
	Item 26	Before starting to study, I determine the way I will follow during study.	Male	4.27	1.34	4.00	1.48	3.50	1.53	4.04	1.33
			Female	3.64	1.32	4.09	1.34	4.32	1.39	4.43	1.25
F8	Item 27	While studying I write down the definitions of important concepts.	Male	4.42	1.60	4.36	1.33	4.89	1.37	4.91	1.47
			Female	3.84	1.21	4.73	1.12	5.09	1.11	4.95	0.97
	Item 28	While studying for a topic, I underline the important points.	Male	5.00	1.39	5.09	1.06	4.86	1.04	5.43	0.73
			Female	4.88	0.97	5.00	1.02	5.27	0.98	4.90	1.18
	Item 29	While studying for a topic, I mark the important point with color markers.	Male	4.15	1.83	4.82	1.22	4.61	1.47	5.17	0.89
			Female	4.36	1.25	4.68	1.52	4.68	1.52	4.67	1.20

When Table 6 is examined, it is seen that there are differences between the answers given to the same items by male and female prospective teachers in the same class level. In order to examine the meaningfulness of the difference between

the answers given to SRSS items by male and female prospective teachers, Mann-Whitney U test was carried out and the related results are indicated in Table 7.

Table 7. Mann-Whitney U test results of SRSS according to gender in class levels

Items	Class 1			Class 2			Class 3			Class 4		
	U	Z	P	U	Z	P	U	Z	p	U	Z	P
Item 1	317.00	-0.16	0.88	202.50	-0.97	0.33	254.50	-1.08	0.28	144.00	-2.37	0.02
Item 2	314.50	-0.20	0.84	234.50	-0.18	0.86	242.00	-1.32	0.19	98.50	-3.46	0.00
Item 3	244.00	-1.56	0.12	200.50	-1.01	0.31	259.00	-0.98	0.33	92.00	-3.59	0.00
Item 4	260.00	-1.27	0.21	185.00	-1.40	0.16	283.00	-0.51	0.61	208.50	-0.80	0.42
Item 5	137.50	-3.78	0.00	198.50	-1.10	0.27	287.00	-0.46	0.65	231.50	-0.25	0.81
Item 6	240.00	-1.67	0.10	178.00	-1.59	0.11	288.50	-0.41	0.68	228.00	-0.33	0.74
Item 7	199.00	-2.49	0.01	187.00	-1.34	0.18	307.50	-0.01	0.99	221.50	-0.50	0.62
Item 8	203.50	-2.40	0.02	202.50	-0.99	0.33	305.50	-0.05	0.96	205.50	-0.89	0.37
Item 9	193.00	-2.58	0.01	213.50	-0.69	0.49	243.00	-1.30	0.19	198.50	-1.04	0.30
Item 10	218.00	-2.07	0.04	186.00	-1.35	0.18	236.00	-1.44	0.15	224.50	-0.42	0.67
Item 11	260.50	-1.24	0.21	174.50	-1.61	0.11	293.50	-0.29	0.77	240.50	-0.02	0.98
Item 12	282.00	-0.84	0.40	175.50	-1.60	0.11	227.50	-1.64	0.10	172.00	-1.67	0.09
Item 13	186.50	-2.70	0.01	236.00	-0.15	0.88	167.00	-2.86	0.00	224.00	-0.43	0.67
Item 14	204.50	-2.31	0.02	189.50	-1.26	0.21	293.00	-0.30	0.76	205.50	-0.86	0.39
Item 15	213.00	-2.22	0.03	149.00	-2.25	0.02	183.00	-2.52	0.01	237.50	-0.10	0.92
Item 16	230.00	-1.85	0.07	149.00	-2.27	0.02	223.50	-1.70	0.09	236.50	-0.12	0.90
Item 17	289.50	-0.69	0.49	184.00	-1.39	0.16	306.00	-0.04	0.97	182.00	-1.43	0.15
Item 18	220.50	-2.06	0.04	223.00	-0.46	0.64	269.50	-0.77	0.44	159.00	-2.04	0.04
Item 19	155.50	-3.28	0.00	178.00	-1.54	0.12	220.50	-1.74	0.08	199.50	-1.02	0.31
Item 20	229.00	-1.85	0.06	190.00	-1.26	0.21	237.50	-1.42	0.16	213.00	-0.70	0.49
Item 21	238.00	-1.69	0.09	129.00	-2.75	0.01	287.00	-0.42	0.67	159.50	-2.01	0.05
Item 22	228.00	-1.89	0.06	150.50	-2.25	0.03	201.00	-2.15	0.03	212.00	-0.72	0.48
Item 23	227.50	-1.91	0.06	228.00	-0.34	0.73	273.50	-0.69	0.49	238.00	-0.08	0.93
Item 24	223.50	-1.98	0.05	213.00	-0.69	0.49	262.50	-0.91	0.36	207.00	-0.83	0.41
Item 25	203.50	-2.39	0.02	165.50	-1.84	0.07	265.50	-0.85	0.40	220.50	-0.52	0.60
Item 26	231.50	-1.81	0.07	240.00	-0.05	0.96	215.50	-1.84	0.07	201.00	-0.98	0.33
Item 27	228.50	-1.86	0.06	207.50	-0.85	0.40	298.00	-0.21	0.83	215.50	-0.65	0.52
Item 28	273.50	-1.03	0.31	226.50	-0.39	0.70	236.00	-1.49	0.14	182.00	-1.51	0.13
Item 29	318.50	-0.13	0.90	239.00	-0.07	0.94	301.00	-0.14	0.89	183.50	-1.45	0.15

When Table 7 is examined, it is seen that the self-regulatory strategies of particularly the 1st class prospective teachers vary significantly according to gender. In addition, it is seen that in other class levels, the meaningfulness of this difference is encountered in several items. When examined in more detail, it is seen that the responses given by 1st class prospective teachers to the items "effort regulation" (I1-I3) dimension are similar, however, the responses given to the items in "attention focusing" (I5, I7, I8), "using additional resource" (I9, I10), "motivation regulation" (I13, I14, I15, I16), "summarizing strategy" (I18, I19), "self-instruction" (I20-I22), "planning" (I23-I26) and "highlighting strategy" (I17) are significantly different. When Table 7 is examined in order to determine of which gender the difference is in favor, it is found that all self-regulatory strategies of male prospective teachers are significantly higher than female prospective teachers. When the situation is examined for the 2nd class prospective teachers, it is seen that the self-regulatory strategies of female prospective teachers are significantly higher than male prospective teachers in "motivation regulation" (I15, I16), "self-instruction" (I21, I22) and "planning" (I25) dimensions. When responses of 3rd class prospective teachers in "motivation regulation" (I13, I15 and I16), "self-instruction" (I22) and "planning" (I26) dimensions, it is seen that self-regulatory strategies of female prospective teachers are significantly higher than those of male prospective teachers similar to the 2nd class prospective teachers. When responses of the 4th class prospective teachers to the items are examined, it is seen that self-regulatory strategies of male prospective teachers are higher than those of female prospective teachers in "effort regulation" (I1-I3), "motivation regulation" (I12) and "self-instruction" (I21) dimensions. However, self-regulatory strategies of female prospective teachers in "summarizing strategy" (I18) dimension are significantly higher than those of male prospective teachers.

3.4 Descriptive Statistics of CSES According to Gender

Within the scope of the study, female and male prospective teachers' reactions to CSES items were examined via descriptive statistics and findings were given in Table 8.

Table 8. Descriptive statistics of CSES item scores according to gender

Items			Gender	Class 1		Class 2		Class 3		Class 4	
				$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
SACT	Item 1	Applying a set of chemistry rules to different elements of the periodic table	Male	1.73	0.67	3.36	0.49	3.29	0.71	3.96	0.64
			Female	2.96	0.68	4.18	0.59	4.18	0.50	4.67	0.48
	Item 2	Tutoring another student in a first year chemistry course	Male	2.65	1.20	4.05	0.65	3.75	0.52	3.96	0.71
			Female	2.56	0.87	3.82	0.73	4.14	0.64	4.24	0.77
	Item 3	Explaining something that you learning in this chemistry course to another person	Male	3.08	1.06	3.86	0.83	4.18	0.55	4.13	0.55
			Female	3.52	0.82	4.18	0.50	4.18	0.66	4.10	0.83
	Item 4	Choosing an appropriate formula to solve a chemistry problem	Male	4.00	0.89	4.14	0.71	3.82	0.67	4.13	0.69
			Female	3.88	0.53	4.09	0.61	4.32	0.65	4.14	0.65
	Item 5	After reading an article about a chemistry experiment, you writing a summary of the main points	Male	2.73	0.87	3.86	0.64	4.11	0.63	3.87	0.46
			Female	2.68	0.90	4.09	0.75	4.23	0.61	3.86	0.48
	Item 6	After watching a television documentary dealing with some aspect of chemistry experiment, writing a summary of its main points	Male	2.50	0.86	3.36	0.58	4.07	0,66	3.65	0.57
			Female	2.72	0.79	3.86	0.77	4.05	0.84	3.95	0.59
	Item 7	After listening to a public lecture regarding some chemistry topic, explaining its main ideas to another person	Male	2.23	0.86	4.00	0.82	4.11	0.63	3.91	0.51
			Female	2.40	0.82	4.27	0.70	4.09	0.68	3.71	0.46
SLCT	Item 8	Achieving a passing grade in a chemical hazards course	Male	2.31	0.88	4.05	0.58	3.86	0.59	3.96	0.71
			Female	2.60	0.87	4.18	0.59	4.14	0.83	4.29	0.64
	Item 9	Learning chemistry theory	Male	3.77	0.51	4.14	0.77	4.04	0.51	4.13	0.55
			Female	3.56	0.51	4.09	0.68	4.23	0.53	3.62	0.50
	Item 10	Achieving a passing grade in a Part Two chemistry course	Male	3.58	0.64	3.86	0.71	4.07	0.47	4.39	0.66
			Female	3.56	0.51	4.00	0.76	4.27	0.70	4.29	0.56
SACS	Item 11	Proposing a meaningful question that could be answered experimentally	Male	3.19	0.80	3.64	0.85	3.71	0.76	3.70	0.47
			Female	2.88	0.78	3.64	0.73	4.05	0.72	3.62	0.50
	Item 12	Knowing how to convert the data obtained in a chemistry experiment to get a result	Male	3.81	0.57	4.32	0.72	4.11	0.63	4.04	0.71
			Female	3.60	0.58	4.23	0.69	4.05	0.65	4.33	0.73
	Item 13	Writing up the experimental procedures in a laboratory report	Male	3.15	0.78	3.95	0.49	4.21	0.74	4.13	0.69
			Female	3.24	0.72	3.95	0.65	4.09	0.53	4.48	0.75
	Item 14	Writing up the results section in a laboratory report	Male	2.00	0.94	4.14	0.64	3.96	0.43	3.87	0.55
			Female	2.32	0.85	4.23	0.69	4.27	0.55	3.62	0.50
SLCS	Item 15	Ensuring that data obtained from an experiment is accurate	Male	3.08	0.89	3.59	1.01	3.64	0.68	3.83	0.58
			Female	2.96	0.84	3.55	0.80	3.82	0.66	4.24	0.62
	Item 16	Determining the appropriate units for a value determined using a Formula	Male	3.42	0.76	3.91	0.61	3.68	0.67	3.83	0.39
			Female	3.64	0.49	4.14	0.64	3.91	0.75	3.90	0.54
	Item 17	Applying theory learning in a lecture for a laboratory experiment	Male	3.65	0.63	3.73	0.77	3.71	0.60	3.74	0.45
			Female	3.76	0.44	4.00	0.53	4.14	0.64	3.90	0.54

When Table 8 was examined, it was seen that there are differences in the answers of male and female prospective teachers. In order to examine the meaningfulness of the difference in male and female prospective teachers' answers, Mann-Whitney U test was done and the related results were given in Table 9.

Table 9. Mann-Whitney U test results of CSES according to gender in class levels

Items	Class 1			Class 2			Class 3			Class 4		
	U	Z	*P*	U	Z	*p*	U	Z	*p*	U	Z	*p*
Item 1	78	-4.897	0,000	86	-4.032	0,000	114	-4.224	0.000	105	-3.538	0.000
Item 2	312.5	-0.246	0.806	199	-1.109	0.268	211.5	-2.215	0.027	190.5	-1.29	0.197
Item 3	246	-1.663	0.096	196,5	-1.272	0.203	303.5	-0.102	0.919	236.5	-0.134	0.894
Item 4	280	-0.958	0.338	231,5	-0.277	0.782	193.5	-2.522	0.012	240	-0.039	0.969
Item 5	318.5	-0.13	0.897	192,5	-1.316	0.188	278	-0.672	0.501	238.5	-0.097	0.923
Item 6	273.5	-1.045	0.296	150.5	-2.353	0.019	304.5	-0.075	0.940	188	-1.534	0.125
Item 7	294.5	-0.612	0.541	197	-1.131	0.258	305	-0.066	0.947	199.5	-1.27	0.204
Item 8	269.5	-1.107	0.268	214	-0.785	0.432	244.5	-1.351	0.177	181	-1.564	0.118
Item 9	250	-1.751	0.080	232	-0.254	0.799	256	-1.292	0.196	138	-2.905	0.004
Item 10	305.5	-0.43	0.668	218	-0.61	0.542	249	-1.359	0.174	214.5	-0.714	0.475
Item 11	250.5	-1.521	0.128	240	-0.051	0.959	232.5	-1.583	0.113	223	-0.529	0.597
Item 12	276	-1.1	0.271	223	-0.488	0.626	293	-0.335	0.738	187.5	-1.374	0.169
Item 13	307	-0.365	0.715	241	-0.029	0.977	271	-0.811	0.417	173.5	-1.738	0.082
Item 14	256	-1.373	0.170	223	-0.498	0.619	222.5	-2.178	0.029	178.5	-1.905	0.057
Item 15	293.5	-0.636	0.525	238	-0.099	0.921	263	-0.969	0.333	161	-2.177	0.029
Item 16	286.5	-0.841	0.400	197.5	-1.202	0.229	256.5	-1.096	0.273	226.5	-0.483	0.629
Item 17	297	-0.651	0.515	185	-1.488	0.137	205	-2.274	0.023	207.5	-1.028	0.304

When Table 9 was examined, it was seen that there is a significantly difference in the male and female prospective teachers' answers for I1, I2, I4, I9, I14 and I17 items. Content of these items and the findings obtained after examining them with the descriptive statistics in Table 8 are as follows:

When the answers given at all class levels to I1 item of CSES was examined, it was seen that female prospective teachers have a higher self efficacy compared to male prospective teachers in all class levels (GPA [freshman]: Male=1.73, Female=2.96; [sophomore]: Male=3.36, Female=4.18; [junior]: Male=3.29, Female=4.18; [senior]: Male=3.96, Female=4.67). When results were examined, it was seen that prospective teachers in both groups (male and female) become more self-efficacy in their answers to this item as their class level increases.

When the answers given to the I2 item of CSES was examined, it was seen that male prospective teachers are especially self-efficacy in their sophomore years (GPA [sophomore]: Male=4.05), however, their self-efficacy to teach freshmen drops as their class level increases. The self-efficacy that is aimed in this item shows one's belief in their knowledge related to information and concepts of basic chemistry. By looking at the result for the I2 whether there is a difference at all class levels according to gender, it was seen that female juniors have a higher self efficacy compared to male juniors (GPA [junior]: Male=3.75, Female=4.14). However, no such significantly difference is present between female and male seniors. When the answers given to the I4 item of CSES was examined, it was seen that female juniors have a higher self efficacy in collecting data related to an experiment compared to male juniors (GPA [junior]: Male= 4.05, Female=4.32). When the answers given to the I9 item of CSES was examined, it was seen that male seniors have a higher self efficacy compared to female seniors (GPA [senior]: Male= 4.13, Female=3.62). When all the answers given to all items are examined, it can be observed that female prospective teachers have a high self-efficacy especially in the items of the second part [Self Efficacy in Learning Chemistry Skills] of CSES. When the reactions given to the I14 of CSES (GPA [junior]: Male= 3.96, Female= 4.27) and the answers given to the I17 item (GPA [junior]: Male= 3.71, Female= 4.14) were examined, it was seen that female juniors have a higher self-efficacy compared to male juniors.

3.5 Relationship between Self-regulatory Strategies and Chemistry Self-efficacy

The correlation matrix was arranged separately for class level as the prospective science teachers in different class levels of university. Obtained correlation matrix was presented in Table 10.

Table 10. Relationship between chemistry self-efficacy and self-regulatory strategies according to class level

Class	Self Efficacy	F1[a]	F2[a]	F3[a]	F4[a]	F5[a]	F6[a]	F7[a]	F8[a]
	Self Efficacy	0.20	0.16	0.22	0.22	0.22	.322*	.323*	.523*
	SACT	-0.01	0.01	-0.08	-0.17	-0.07	-0.18	-0.01	0.12
Class 1	SLCT	0.17	0.18	0.10	0.15	0.20	.320*	0.07	0.22
	SACS	0.13	0.24	0.15	0.27	0.02	.278*	.378*	.400*
	SLCS	0.11	-0.09	0.27	0.21	.298*	0.24	0.24	.355*
	Self Efficacy	-0.04	0.28	0.21	.337*	0.03	-0.07	0.27	0.04
	SACT	-0.03	0.13	0.23	.414*	0.10	-0.01	.310*	-0.12
Class 2	SLCT	-0.19	0.26	0.14	0.20	-0.02	-0.15	.322*	0.07
	SACS	0.21	0.23	0.21	0.16	-0.06	-0.10	0.02	0.13
	SLCS	-0.08	0.23	0.08	0.28	0.08	0.05	0.16	0.04
	Self Efficacy	-0.01	.325*	.617*	.599*	.290*	.394*	.453*	0.23
	SACT	-0.08	0.25	.588*	.466*	0.22	.371*	.399*	0.20
Class 3	SLCT	0.06	.301*	.690*	.613*	0.21	.370*	.513*	0.21
	SACS	0.02	.333*	.293*	.410*	0.25	.298*	.324*	0.21
	SLCS	-0.03	0.14	.373*	.389*	0.22	0.20	0.20	0.11
	Self Efficacy	-0.19	0.03	0.23	0.01	0.16	0.08	0.26	0.15
	SACT	-0.16	0.08	0.26	-0.01	0.06	0.12	0.07	0.08
Class 4	SLCT	0.01	-0.17	-0.07	-0.12	0.07	0.01	0.15	0.23
	SACS	-0.14	0.23	.466*	0.13	.373*	0.18	.375*	.338*
	SLCS	-0.27	-0.02	0.06	0.05	0.00	-0.05	0.19	-0.20

[a]F1: Effort Regulation, F2: Attention Focusing, F3: Using Additional Resource, F4: Motivation Regulation, F5: Summarizing Strategy, F6: Self-Instruction, F7: Planning, F8: Highlighting Strategy. *$p< \alpha$

When Table 10 is examined, it is seen that self-efficacy levels of the 3rd class prospective teachers is significantly related with "attention focusing, using additional resource, motivation regulation, summarizing strategy, self-instruction and planning" self-regulatory strategies. When other class levels are examined, it is seen that the chemistry self-efficacy levels of the 1st class prospective teachers are related with "self-instruction and highlighting strategy", those of 2nd class prospective teachers are related with "motivation regulation" self-regulatory strategies. However, it is seen that the chemistry self-efficacy levels of the 4th class prospective teachers aren't related with any self-regulatory strategy.

Within the scope of the research, multiple regression analysis was used in order to examine the predictive power and level of self-regulatory strategies of prospective science teachers for chemistry self-efficacy levels. As the prospective teachers included in the research group were attending different class levels, data were weighted in the analyses

according to the class level. As a result of the weighting, a correlation matrix was constituted based on the data weighted according to the class level in order to examine the relationship between predicted variable chemistry self-efficacy levels of prospective teachers and self-regulatory strategies which were predictive variables. Obtained correlation matrix was presented in Table 11.

Table 11. Relationship between self-regulatory strategies and chemistry self-efficacy weighted according to the class level

	Self-Efficacy	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**
Effort Regulation (F1)	0.002							
Attention Focusing (F2)	.161**	0,04						
Using Additional Resource (F3)	.306**	.115*	.291**					
Motivation Regulation (F4)	.180**	0.036	.518**	.448**				
Summarizing Strategy (F5)	.135**	-0.001	.215**	.479**	.390**			
Self-Instruction (F6)	.190**	.168**	.324**	.386**	.288**	.488**		
Planning (F7)	.264**	-0.015	.372**	.518**	**.615****	.603**	.376**	
Highlighting Strategy (F8)	.249**	.180**	.481**	.393**	.350**	.395**	.492**	.363**

When Table 11 is examined, it is seen that the chemistry self-efficacy is related with "attention focusing, using additional resource, motivation regulation, summarizing strategy, self-instruction, planning and highlighting strategy" from self-regulatory strategies. Considering that there should be a linear relationship between the predicted variable and the predictive variables, which is one of the basic assumptions of multiple regression analysis, it is seen that the variables which are suitable to be included in multiple regression analysis are "using additional resource (.31), planning (.26) and highlighting strategy (.25)" (Kalaycı, 2008).

Findings obtained as a result of reverse staged multiple linear regression analysis weighted according to the class level due to the verification of required assumptions are given in Table 12.

Table 12. Reverse staged multiple linear regression analysis weighted according to the class level

Regression Model	**B**	**t**	***p***	**r**	**Partial r**	**Tolerance**	**VIF**
Constant	3.24	21.60	0.000				
Using Additional Resource	0.25	3.27	0.001	0.31	0.23	0.846	1.183
Highlighting Strategy	0.15	2.03	0.044	0.25	0.15	0.846	1.183
$F_{(2,186)}$=11.870		p=.000					
R=0.34		Corrected R^2=0.11					

When Table 12 is examined, it is seen that as "planning" self-regulatory learning strategy isn't significant, it was removed from the model in the model in which predictive power of "using additional resource, planning and highlighting strategy" self-regulatory strategies of prospective science teachers for chemistry self-efficacy levels, the chemistry self-efficacy level is explained by fixed regression model which includes "using additional resource and highlighting strategy" self-regulatory strategies. According to this, 11% of chemistry self-efficacy levels of prospective science teachers can be explained by the regression equation as *Chemistry Self-Efficacy level = 0.25 × (Using Additional Resource) +0.15 (Highlighting Strategy) + 3.24.* It is seen that the obtained regression model is significantly and the model's ability to explain the self-efficacy levels of prospective teachers is low.

4. Discussion

In this study, the aim is to determine whether there is a significantly difference in the self-regulatory strategies used by prospective science teachers (1st, 2nd, 3rd and 4th class) while studying for chemistry lesson and their chemistry self efficacy who have taken General Chemistry according to gender and class level. Departing from this basic purpose, for the first research question of the study, it was observed in Table 2 and 3 that the highest participation in the behaviors in "motivation regulation" dimension of the self-regulatory strategies of prospective teachers which included only "I motive myself to study more thinking I will get good classes" and "I motive myself to study in order to be loved by my teacher" items was realized by the 1st class prospective teachers. However, it was observed that the highest participation in the behaviors in all other dimensions was realized as the class level increased, particularly by 4th class prospective teachers. The fact that responses given to items in each dimension of self-regulatory strategies used in studying indicated high participation as the class level increased is parallel with the findings obtained from some related studies. It was stated in our findings obtained considering gender factor that in the study carried out by Zimmerman and Martines-Pons (1990) in which the relation between academic competences and self-regulatory strategies if students in 5th, 8th and 11th class levels was examined in terms of gender and class level, female students indicated higher participation in almost all dimensions of self-regulatory strategies. In the related study, it was also defined that the lowest participation in the related items in each dimension of SRSS was realized by 5th class students, they indicated significantly differences compared to 8th and 11th classes, however; there was no significantly difference between 8th and 11th classes. Again, in a study in which motivational beliefs, test anxiety, self-efficacy and self-regulatory strategies of

students in 9th, 10th, 11th and 12th classes were examined in terms of ethnical groups and class level, it was observed that there was a higher participation in using self-regulatory strategies in favor of 12th class level in the interval from 9th class level to 12th class level (Ongowo & Hungi, 2014).

When the meaningfulness of prospective teachers' reactions to CSES were examined for the second research question of the study in Table 4 and Table 5, it was seen that the difference in the answers of prospective teachers at different class levels was significantly for every item in CSES except for one item in "applying theory of chemistry" and one item in "learning chemistry skills" ($p<.\alpha$). When Table 5 was examined for the results that are the outcome of the analysis which was done to determine at what class level the difference occurs, it was observed that in all items except those in some sub-dimensions of CSES (I4, I5, I6, I7, and I17 items) 1st class prospective teachers have a significantly low self efficacy compared to those who are at more advanced classes. According to Table 4 and 5, there is an important point that should be noted on I5, I6, I7, I9 and I14 items of CSES. The results show that chemical self-efficacy of 2nd and 3th class prospective teachers are better than 4th class prospective teachers. For this general result, curriculum of the related department of the participant students was examined. According to the curriculum, students are supposed to take General Chemistry (I) and (II) and General Chemistry Laboratory (I) and (II) for two semesters during their 1st class. At this same department, there are more variations in chemistry-related courses in the 2nd class, General Chemistry (III): Analytical Chemistry and General Chemistry (IV): Organic Chemistry. In the 3rd class at this department take a lab class, which aims to transform their basic knowledge in all disciplines (physics, chemistry and biology) to skills Science Lab Applications (I) and (II), and a compulsory elective course which focuses on the importance of daily chemistry (Special Topics in Chemistry). 4th class period is the last term of education and learning received by our prospective teachers just before a term in which they will practice their profession. However, due to the nature of the curriculum in the 4th class, students take classes related to their field – Biology – and classes related to education sciences that focus on "Professional Teaching Knowledge". As such, they do not have classes that focus on "Chemistry". In our country, before practicing the profession of teaching, our prospective teachers go through certain stages; PPST (Public Personnel Selection Test) and PTKT (Professional Teaching Knowledge Test). Our prospective teachers are responsible for all topics related to the department they graduate from (Physics, Chemistry and Biology) particularly in one of those two exams called PTKT. Therefore, when our prospective teachers are in the senior class, they prepare for both course period exams and the exams defined above using additional resources related to all courses they take in their education-teaching period. Thus, we can say that the reason for the significantly lower self-efficacy of prospective teachers in the 4th class for five items (I5, I6, I7, I9 and I14) in CSES compared to prospective teachers in the 2nd and 3rd classes is that they do not have "chemistry" lessons in the 4th class. Bautista (2011) explains the generally low self-efficacy of prospective primary school teachers with the fact that they have little to zero teaching experience and that they have an education that is comprised of weak conceptual comprehension. One of the aims of the science courses at the department of primary school education is to increase teachers' self-efficacy because the basis for a successful teaching is high self-efficacy in teachers (Bhattacharyya, Volk & Lumpe, 2009). Palmer (2006) emphasizes the necessity of additional resources for self-efficacy, namely, (a) mastery in cognitive content (b) mastery in cognitive pedagogy, and role-playing in in-class activities. As such, the fact that chemistry self-efficacy of prospective science teachers is low especially at freshman year can be related to the resources that are influential in the emergence of self efficacy, as Palmer (2006) also indicates in his study. The fact that freshmen are new at university when they take the basic lab classes in which they put into practice their theoretical learning and basic know how into practice can be the reason for their lower self efficacy compared to the students at later years.

According to the third research questions' findings obtained regarding whether the self-regulatory strategies of prospective teachers in different class levels within the scope of the study varied depending on the gender, differences were observed in answers given to the items by female and male prospective teachers in the same class level. According to the findings obtained from Table 6 and Table 7 following the analyses carried out depending on the gender, all self-regulatory strategies of 1st class male prospective teachers in the Department of Science Education for studying for chemistry lesson were found to be higher than those of female prospective teachers. In addition, in 2nd and 3rd class levels, it was observed that the self-regulatory strategies of female prospective teachers were higher than those of male prospective teachers in a few items. The all findings obtained for 2nd and 3rd classes are parallel with the previous studies indicating gender differences in favor of girls. For example, Zimmerman and Martinez-Pons (1990) observed in their studies that female students used self-regulatory strategies (target determination, planning strategies, keeping records and self-observation) more than male students did. Similarly, Ablard and Lipschultz (1998) stated that female students used self-regulatory strategies such as "personal regulation or optimizing the environment" more often. Again, in a study in which female and male students were compared in terms of using self-regulatory strategies (Virtanen & Nevgi, 2010), it was defined that female students participated slightly higher in "Forethought of Learning and in the Strategies in Learning" dimensions than male students. Nevgi (2002) and Niemi, Nevgi and Virtanen (2003) determined in their studies that female students used the key words while studying more than male students do and they were more

organized than male students were, thus they combine the information they learned in the early stages of their studies with newly acquired information more actively. Again, Kadıoğlu, Uzuntiryaki and Çapa-Aydın (2011) observed in their studies that female students used self-regulatory strategies while studying for the chemistry lesson more than male students did. Likewise, Şenler and Sungur-Vural (2014) defined in their studies that female prospective teachers used the strategies such as "planning, monitoring and evaluating" in their own learning process more than male prospective teachers did and they made more effort. Batdal Karaduman, Güder, Özsoy-Güneş and Kırbaşlar (2015) observed in their studies that in using self-regulatory strategies, female prospective teachers indicated higher participation in the dimensions of "planning and lack of self-directedness" more than male prospective teachers did. However, when the responses given to the items by 4th class prospective teachers in our study are examined, it is seen that self-regulatory strategies of male prospective teachers were significantly higher than those of female prospective teachers in terms of items in a number of dimensions but only in "Summarizing" strategy, female prospective teachers participated higher than male prospective teachers did.

Within the scope of the study, reactions of male and female prospective teachers to the items of CSES for the fourth research question were examined via descriptive statistics, and when the results given in Table 8 were examined, it was seen that there are differences in the answers of male and female prospective teachers. In order to examine the meaningfulness of the difference in answers, Mann-Whitney U test was applied, and the related results were given in Table 9. When Table 8 and Table 9 were examined together so as to see the differences in class levels according to gender, it was observed that students from both gender groups have the highest self-efficacy at 3rd and 4th classes according to the answers given to all items of the CSES. When the results in Table 8 and Table 9 were examined, it was observed that 2nd, 3rd and 4th classes have a higher self-efficacy throughout the whole scale compared to the 1st class. When Table 8 was examined, it was seen that there is a significantly difference in the answers given by male and female prospective teachers at all class levels in SACT sub-dimension for I1 item, in the 3rd class in SACT sub-dimension for I2 and I4 items, in SACS sub-dimension for I14 item and in SLCS sub-dimension for I17 item and in the 4th class in SLCT sub-dimension for I9 item. Two items for which female prospective teachers present a higher self-efficacy than male prospective teachers are the ones that are about summarizing the results of what one learns after reading an article or attending a conference on chemistry. From the answers given to these two items, it can be drawn that female prospective teachers have a higher self-efficacy in their capacity to draw conclusions from a scientific article about a topic of which they have learned in theory in class. It was also observed that female prospective teachers have high self-efficacy in their skills to relate the important details of a chemistry-related topic they have listened to at a conference. Contrary to the findings of our study, female prospective teachers have a lower chemistry self-efficacy in many of the studies examined within the scope of the study (Lloyd, Walsh & Yailagh, 2005; Michaelides, 2008; Pajares, 1996, 2002; Pintrich & De Groot, 1990). In a study, Garcia (2010) expressed that while female students have a significantly lower self-efficacy at the beginning of the application process, there is a significantly increase in their self-efficacy at the end of the semester. Likewise, in their study, Dalgety and Coll (2006) found that male students have a higher self-efficacy compared to female students. In their interviews at the end of the study, Dalgety and Coll also expressed that male students gave more confident answers compared to female students.

Finally, for the fifth research question of this study, the relationship level between the self-regulatory strategies of prospective science teachers and their self-efficacies was tried to be determined. Departing from the basic purpose, according to the correlation matrix constituted according to different class levels of prospective teachers participating in the study, it was observed that the significantly relationship between self-regulatory strategies and chemistry self-efficacy was the most in the 3rd class. According to data obtained from Table 10, 3rd class prospective teachers indicated significantly relationships in all sub-dimensions of CSES particularly between "using additional resource, motivation regulation, attention focusing and planning" self-regulatory strategies. Another result obtained in the study was that the relationship between certain sub-dimensions of both scales was indicated to be significantly in 1st and 2nd class prospective teachers respectively. According to the curriculum defined above in the Department of Science Education the 3rd class prospective teachers take all chemistry-related lessons until the class they are attending. Therefore, it was an expected result that the relationship between the chemistry self-efficacy sub-dimensions and the self-regulatory strategies used by those in the 3rd class while studying for chemistry lesson was meaningful. Self-efficacy levels of the 4th grade prospective science teachers are not related to any of the self-regulatory strategies. When Table 10 was examined for another result obtained in the study, it was seen that the chemistry for the 4th class, might say that 4th class period is the last term of education and learning received by our prospective teachers just before a term in which they will practice their profession. Due to the nature of the curriculum in the 4th class, prospective teachers take classes related to their field – Biology – and classes related to education sciences that focus on "Professional Teaching Knowledge." As such, they do not have classes that focus on "Chemistry". When our prospective teachers are in the 4th class, they prepare for both course period exams and the exams defined above using supplementary resources related to all courses they take in their education-teaching period. Therefore, we can assume as

the reason for the result we obtained from the study for the 4th class prospective teachers that they become distanced from all "chemistry courses" due to their class level and they have different examinations to prepare beyond their graduate program. All these obtained results were in parallel with the results of many studies in literature in which the relations between the self-regulatory strategies of students/prospective teachers and both academic chemistry performances/chemistry success (Zimmerman & Resemberg, 1997; Chen, 2002) and chemistry self-efficacy/teacher self-efficacy in were examined in terms of gender/class level/ethnical group (Alderman, 1999; Loong, 2012; Ongowo & Hungi, 2014; Tunde, 2014; Zimmerman & Martines-Pons, 1990). The results of the study by Tunde (2014) showed that self-regulated strategies have a significantly influence on predicting the students' academic performance in chemistry. Loong (2012) found that effort regulation was an effective instructional strategy in science class. Again, in a study in which motivational beliefs, test anxiety, self-efficacy and self-regulatory strategies of students in 9th, 10th, 11th and 12th grades were examined in terms of ethnical groups and grade level, it was observed that there was a higher participation in using self-regulatory strategies in favor of 12th class level in the interval from 9th class level to 12th grade level (Ongowo & Hungi, 2014). The study of Schunk and Zimmerman (1998) showed that compared to naïve self-regulators, skilful self-regulators set higher quality goals, have higher self-efficacy, can instruct themselves and monitor their learning process instead of using self-handicapping strategies, seek more opportunities for self-evaluation and reflect systematically on their learning experiences which positively influences new forethought processes. Again, given the wealth of studies, which have demonstrated the positive association between self-regulation, motivation, self-efficacy and academic performance (Yip, 2007; Zusho & Edwards, 2011).

When Table 11 is examined, it is seen that the chemistry self-efficacy is related with "attention focusing, using additional resource, motivation regulation, summarizing strategy, self-instruction, planning and highlighting strategy" from self-regulatory strategies. Considering that there should be a linear relationship between the predicted variable and the predictive variables, which is one of the basic assumptions of multiple regression analysis, it is seen that the variables which are suitable to be included in multiple regression analysis are "using additional resource, planning and highlighting strategy". As a result, "planning" self-regulatory strategy was removed from the model in the model in which predictive power of "using additional resource", planning and highlighting strategy" self-regulatory strategies of prospective science teachers for chemistry self-efficacy levels as it wasn't significantly, the chemistry self-efficacy level is explained by fixed regression model which includes "using additional resource and highlighting strategy" self-regulatory strategies (Table 12). According to this, 11% of chemistry self-efficacy levels of related prospective teachers can be explained by these two self-regulatory strategies (using additional resource and highlighting strategy). Although the obtained regression model is significantly, it is seen that the model's ability to explain the self-efficacy levels of the prospective teachers is low. Motivational beliefs such as self-efficacy have been found to determine the choice, effort and degree of persistence for one's goal (Bandura, 1986). Zimmerman (2000), self-efficacy beliefs help students motivate to learning through the use of self-regulatory processes such as goal setting, self-monitoring, self-evaluation, and strategy use. According to many researches, it is emphasized that there is a relation between higher academic motivation of students and their having higher self-regulatory learning skills (Schmitz &Wiese, 2006; Stoeger & Ziegler, 2007; Velayutham, Aldridge & Fraser, 2011).

This study was carried out with prospective science teachers. The self-regulation strategies and chemistry (or science, biology, physic self-efficacy etc.) of the science teachers on duty should be investigated and in-service training programs for the science teachers should be arranged for improving their self-regulation strategies or self-efficacy. Science teachers and prospective teachers should be trained on how to teach the self-regulation strategies to their students. Science teachers should engage students in complex, open ended activities, offer them choices and opportunities to control challenge and involve them in evaluating their own and other's work. The improvement of self-regulation strategies will also contribute to science knowledge of the students. Neber and Schommer-Aikins (2002) emphasized that science learning environment correlates significantly and positively with self-regulatory activities, the intrinsic value of science, and task goal orientation of the elementary school pupils. For this reason, the effects of self-regulation strategies increase of primary and secondary school students on science education should be investigated by the researcher. Among other recommendations that may be made departing from the results obtained within the scope of study; self-regulatory strategies used by students and their chemistry self-efficacies in different countries at the same class level while studying for chemistry lesson may be compared. While determining the scope of this recommendation, it is important to consider the determined targets and acquisitions for the education-teaching curricula of the related lesson and students in different countries. For example, Tang and Neber (2008) carried out a survey regarding the motivation and self-regulation in Chemistry learning among Americans, Chinese and Germans. The findings indicated that the American group scored higher than their Chinese and German counterparts did in motivational and self-regulatory characteristics.

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