Investigating Secondary School Students' Motivation for Chemistry Class in Terms of Various Variables*

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Abstract

The aim of this study is to investigate the motivation of secondary school students for chemistry class in terms of gender, class standing, school type, grade point average, average score in chemistry class, parents' marital status, parentals' bereavement, mother's educational background, and father's educational background. The survey model of the quantitative research methods was used for the purpose of the study. The data were collected with *Chemistry Lesson Motivation Scale for Secondary School Students*[sic] by Eskicioğlu and Alpat (2017). The sample consists of 475 female and 399 male students, adding up to 874 students. The obtained data were analyzed with SPSS 20.0, a statistical software program. The study revealed no statistically significant difference between the sub-domains self-efficacy and extrinsic motivation but between anxiety and intrinsic motivation.Statistically significant differences were found between the students' motivation for chemistry class and school type, class standing, grade point average (GPA), average score in chemistry class, and father's graduation status.There was no statistically significant difference between parental's bereavement and mother's graduation status. No relationship was determined between anxiety and self-efficacy sub-domains of the chemistry motivation scale. However, the study observed a moderate relationship between self-efficacy and intrinsic and extrinsic motivation, a weak negative relationship between anxiety and intrinsic motivation, and a moderate positive relationship between extrinsic motivation and intrinsic motivation.

Keywords: Chemistry Class, Motivation For Chemistry Class, Secondary School Students

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INTRODUCTION

Education and teaching in general, and planning science programs in particular, are performed as of primary education following evaluation and decision steps. The concepts of natural sciences that students are expected to acquire in primary education lay the foundation of students' knowledge sets of natural sciences ahead in their academic lives. Therefore, great importance is attached to natural sciences as of primary education. It is necessary to analyze observations, discussions, findings, and data in view of the inculcated skills and knowledge in the early stages of education, to arouse curiosity in students about natural sciences, and to help students acquire all these components that will potentially affect their education ahead (Ayas et al., 2002). Chemistry is important, for it can be named as a discipline of natural sciences, which most profoundly affects everyday life. An effective chemistry education can present life-facilitating methods through a better understanding of many aspects, be they positive or negative, in the world (Novak and Gowin, 1984). Chemistry as a discipline includes many abstract concepts, theories, and principles. To exemplify, since many subjects such as atomic and molecular structures are taught without relating them to real-life settings and students cannot visualize these abstract concepts, the resultant semantic and conceptual confusion can be listed among grave problems of chemistry teaching (Herron and Nurrenbern, 1999). The study by Kalkan, Şahin, and Savcı (1994) on chemistry teaching practices reports a great variety of problems available in the studies on secondary education. The curricula of natural sciences were modified in 2004 to eliminate all the long-persisting issues. Moreover, the modification aimed to educate individuals with globally acceptable scientific standards, high self-esteem, high-quality discussion skills, and innovative thinking capacity, and skilled to solve problems (Açıkgöz, 2003; Ayas, 2013). The rectifications in 2007 and 2013 laid the groundwork for realistic and applicable innovative classes. The application of experimental methods along with theoretical teaching activities in almost every school led students to develop positive attitudes toward chemistry. The improved physical settings and conditions besides an ever-bettering educational system resulted in positive advancements in the nation's scientific practices by optimizing chemistry education (MEB, 2013). Çalık (2016) asserts that this improvement is insufficient, and chemistry should be taught with laboratory-based experiments rather than theory-based lecturing. Çalık also highlights that laboratory tools and devices supplementary to teachers' and students' efforts should be satisfactory in number and homogeneously distributed across the country. By foregrounding the educational planning and the ongoing examination system, he claims that theory-based and rote learning approaches are still in use. Instead, he suggests inquisitive and practical laboratory education as a significant helpful approach to the teaching of natural sciences.

Young learners wishing to become the scientists of the future should have an adequate level of motivation for science learning (Organisation for Economic Cooperation and Development, 2007). Above all, they need to develop scientific literacy to identify questions by using a piece of scientific knowledge, draw evidence-based conclusions, and make decisions about how human activities affect the natural world (Feinstein, 2011; Kelly, 2011; Eryaman, 2017). It is a global conviction that all students should be scientifically literate (Roberts, 2007).

Researchers of natural sciences attempt to reveal why students learn science, how they feel about it, how much effort they make, and their "craving" for knowledge, among which is students' motivation levels. More specifically, to reveal students' motivation, it is important to investigate to what it contributes. The data to be obtained from this study can help natural science teachers and students to maintain their motivation.

The most well known theory developed about motivation belongs to Bandura. Social Cognitive Theory, developed by Bandura (1986, 2001, 2005), was improved by Pajares and Schunk (2001) and Pintrich (2003). The Social Cognitive Theory accounts for human learning and motivation in view of interactions incorporating personal characteristics, such as intrinsic motivation, self-efficacy, and self-determination, environmental contexts (e.g., high school), and behavior (e.g., enrolling in advanced science courses). Although there are many learning and motivation theories explaining certain sides of behavior (Schunk, Pintrich, and Meece, 2008), the extensiveness of Social Cognitive Theory makes it applicable to the Bryan, Glynn and Kittleson's research study (Bryan, Glynn and Kittleson, 2011). The Social Cognitive Theory was crafted to describe how people develop competencies, attitudes, values, behavioral styles, and how they motivate their operational level (Bandura, 2006)

Motivation in the Social Cognitive Theory refers to an internal aspect that induces, governs, and sustains goal-oriented behavior. Motivated students have higher academic achievement by exhibiting behaviors such as studying, asking, seeking advice, and partaking in classes, laboratories, and study groups (Schunk et al., 2008). Congruent with Social Cognitive Theory, the motivation for learning science can be referred to as an internal aspect that leads to, orients, and sustains science-learning behavior. Sanfeliz and Stalzer (2003) believe that one of their vital teaching responsibilities is to promote students' motivation to learn. Students motivated to learn science and exhibit science-learning behavior have such goals as good science grades and science-based professions (Sanfeliz and Stalzer, 2003). The researchers mentioned that motivated students enjoy learning science, have confidence in their capacity to learn, and assume responsibility for their own learning. As indicated in these descriptions, science learning motivation is multicomponential, and this is how it is conceptualized in the Social Cognitive Theory. These components are kinds and properties of motivation, reviewed by Glynn and Koballa (2006), Koballa and Glynn (2007), Eccles and Wigfield (2002), Pintrich (2003), and Schunk et al. (2008). From Sanfeliz and Stalzer's (2003) description, it can be understood that three motivation components—intrinsic motivation, self-efficacy, and self-determination—have important parts in science learning. Intrinsic motivation denotes the inherent satisfaction in learning science as it is (e.g., Eccles, Simpkins, and Davis-Kean, 2006), self-efficacy refers to students' belief that they can achieve well in science (e.g., Baldwin, Ebert-May, and Burns, 1999), and self-determination is the control that students think they have over their own science learning (Black and Deci, 2000). These aspects can affect the way students' science learning behaviors are induced, governed, and sustained.

The research studies on primary school students have shown that students are greatly interested in and care about natural science classes (Yaman and Öner,2006; Durmaz and Özyıldırım, 2005; Eke, 2010). Hendley, Stables, and Stables (1996) have created an ordered list of the most liked classes based on the replies of 190 students and the natural science class has been reported to occur in the fifth place out of 12 classes. According to what is understood from their study, the natural sciences course is in the top 5 among the twelve popular courses. A similar study has been carried out by Gibson and Chase (2002) to find that students tend to express positive views of natural sciences thanks to their curiosity, desire to explore and research, and ability to practice on their own. Haussler and Hoffmann (2000) have revealed the interests of the students of 11-16 years of age in physics class. Simple explanations of everyday phenomena by physics laws have aroused the students' interests. Çepni, Küçük, and Ayvacı (2004) have indicated that the participating fourth graders foster a keen interest in such astronomic concepts as stars, space, and planets.A similar study has been conducted by Laçin-Şimsek (2007). The study has found that the participating students are interested in technological issues and in chemistry, biology, and astronomy as scientific disciplines. Kurbanoğlu (2014), studied with 372 students, determined that gender and subject type variables affect attitude and anxiety towards chemistry course. Generally, the related literature was realized to incorporate studies on students' desires, readiness levels, and interests concerning natural science teaching. Nevertheless, there is exiguous research on students' motivation for the chemistry class. This study investigated secondary school students' motivation for the chemistry class to contribute to the literature in this sense.

Purpose of the study

The number of studies on students' motivation for chemistry class is scarce in the literature. Because chemistry class is a course in which basic education pertaining to a discipline influential in every walk of life is offered, it should be meticulously considered. In chemistry class, the importance of chemistry, particularly for humans and other creatures, can be explained to students, who can be motivated to become scientists of the future. In this sense, the following two questions form the backbone of the present study: What are the students' levels of motivation for the chemistry class? Do their motivation levels vary by various variables? The motivation of the secondary school students was investigated in consideration of four sub-categories, namely self-efficacy, extrinsic motivation, and intrinsic motivation.

The research problems are as follows:

1. What are the secondary school students' levels of motivation for the chemistry class?

2. What are the secondary school students' levels of motivation for the chemistry class in terms of age, gender, class standing, school type, grade point average, average score in chemistry class?

The study attempts to determine secondary school students' motivation for the chemistry class based on various variables and to reveal differences, if any.

METHOD

Research Model

The correlational survey research, a quantitative study model, was used for the purpose of the study. Correlational research is conducted to describe and analyze in depth the relationships between two or more variables (Karakaya, 2014, 68).

Sampling

The study sample to the west of Turkey are 874 students studying in secondary schools in the province. population here corresponds to middle school students in Turkey. The data in the study were collected from six public schools and two private schools providing education. Public schools S1, S2, S3, S4, S5, S6 for coding data; private schools are expressed as P1, P2.

Table 1. Participants' Genders

Gender	f	%
Female	475	54.35
Male	399	45.65

Table 1 presents that the female and male students constitute 54.35% and 45.65% of the sample, respectively.

Table 2. Analyses of Descriptive Statistics of Participants' Class Standings

Class	F	%
9	484	55.3
10	209	23.9
11	88	10.0
12	93	10.6

According to Table 2, 55.3%, 23.9%, 10.0%, and 10.6% of the students are in 9th, 10th, 11th, and 12th grades, respectively.

Table 3. Grade Point Averages of Participants

Grade Point Averages	f	%
0-44	14	1.6
44-54	28	3.2
55-69	68	7.8
70-84	263	30.1
85 or higher	501	57.3

As observable in Table 2, the grade point averages of 1.6%, 3.2%, 7.8%, 30.1%, 57.3% of the participants are 0-44, 44-54, 55-69, 70-84, and 85 or higher, respectively.

Table 4. Average Points of Participants in Chemistry Class

Average Points in Chemistry	f	%
0-44	34	3.9
44-54	68	7.8
55-69	120	13.7
70-84	205	23.5
85 or higher	447	51.1

Table 4 shows that the average points of 3.9%, 7.8%, 13.7%, 23.5%, 51.1% of the participants in the chemistry class are 0-44, 44-54, 55-69, 70-84, and 85 or higher, respectively.

Table 5. School Types of Participants

School Type	f	%
Private school	67	7.7
State school	807	92.3

Table 5 indicates that 7.7% of the participating students attend private schools, while 92.3% go to state schools.

Table 6. Participants' Schools

School	f	%
P1	42	4.8
S1	163	18.6
S2	243	27.8
S3	262	30.0
S4	50	5.7
S5	50	5.7
S6	41	4.7
P2	23	2.6

Tablo 6 presents that 4.8%, 18.6%, 27.8%, 30.0%, 5.7%, 5.7%, 4.7%, and 2.6% of the participants attend P1, S1, S2, S3, S5, S6, and P2, respectively.

Data Collection Tool

The data were collected with *Chemistry Lesson Motivation Scale for SecondarySchool Students*[sic] by Eskicioğlu and Alpat (2017). It is impossible to observe directly the attitudes and thoughts of participants in quantitative research. Due to the impossibility of directly assessing attitudes and views, these are assessed based on the degrees of reactions to predetermined propositions and judgments (Cebeci, 2010, 101). The tool of this study is a 5-point Likert scale. The levels are 1.00-1.79 for "never", 1.80-2.59 for "rarely", 2.60-3.39 for "sometimes", 3.40-4.19 for "generally", and 4.20-5.00 for "always".

Data Analysis

To test the reliability of the scores from the scale, Cronbach's Alpha coefficient was calculated to assess internal consistency. It was calculated to be 0.904. An internal consistency level of more than 0.80 refers to high reliability ($p<0.05$). The skewness and kurtosis values were calculated to find whether the obtained data are normally distributed. For a normal distribution, the values of skewness and kurtosis should range between -2 and +2 (Şencan, 2005).

Table 7. Skewness and Kurtosis Values

Domains	Skewness	Kurtosis
Self-efficacy	-.426	-.122
Anxiety	-.179	-.643
Extrinsic motivation	-.041	-.588
Intrinsic motivation	-.031	-.609

Table 7 shows that the data are normally distributed, so parametric tests were employed for the analyses. The obtained data were analyzed by exploratory factor analysis, descriptive statistical analyses, independent samples and ANOVA and correlation analysis. The strength of relationship in correlation analyses can occur between -1 and +1. R values of 0.00-0.29, 0.30-0.69, and 0.70 and higher refer to weak, moderate, and strong correlations between variables, respectively (Ural and Kılıç, 2006).

RESULTS

Table 8. Descriptive Statistical Analyses of Domains

Domains	X	ss
Self-efficacy	3.46	.02854
Anxiety	3.22	.03183
Extrinsic motivation	2.97	.03238
Intrinsic motivation	2.96	.03136

Table 11 evidences that the motivation levels of the secondary school students concerning the chemistry class are "generally" (X= 3.46) in the "self-efficacy" sub-domain, "sometimes" in the "anxiety" sub-domain (X = 3.22), "sometimes" (X = 2.97) in the "extrinsic motivation" sub-domain, and "sometimes" (X = 2.96) in the "intrinsic motivation" sub-domain.

Table 9. Descriptive Statistical Analyses of "Self-Efficacy" Domain

Domain	Items	X	ss
Self-efficacy	I07. It is important for me to get a high score in chemistry class.	4.29	.03330
	I03. I wish to be more successful in chemistry exams than the other students.	3.99	.03829
	I30. Understanding chemistry gives me a sense of achievement.	3.86	.04207
	I08. I make the necessary effort to learn chemistry.	3.77	.03685
	I01. I like learning chemistry.	3.48	.03893
	I12. I think that my achievement in chemistry class will be as high as or higher than the other students.	3.43	.04145
	I05. If I have difficulty in learning chemistry, I try to identify the cause.	3.36	.04177
	I26. I get well-prepared for chemistry exams and laboratory practices.	3.28	.04253
	I24. I believe that I can thoroughly gain the knowledge and skills in the chemistry class.	3.22	.04139
	I09. I use strategies that will help me learn chemist well.	3.19	.04064
	I28. I am confident that I will be successful in chemistry exams.	3.14	.04278
	I21. I am confident that I will be successful in chemistry laboratory and projects.	3.09	.04291
	I29. I believe that I will get high scores in chemistry class.	2.90	.04661

As observable in Table 9, the items that the participants believe best express themselves in the "self-efficacy" sub-domain are "It is important for me to get a high score in chemistry class (X=

4.29)", "I wish to be more successful in chemistry exams than the other students (X= 3.99)", and "Understanding chemistry gives me a sense of achievement (X= 3.86)". On the other hand, the least expressive items are "I believe that I will get high scores in chemistry class (X= 2.90)", "I am confident that I will be successful in chemistry laboratory and projects (X= 3,09)", and "I am confident that I will be successful in chemistry exams (X= 3,14)"

Table 10. Descriptive Statistical Analyses of "Anxiety" Domain

Domain	Items	X	ss
Anxiety	I15. I think of how my score in chemistry class will affect my grade point average.	3.88	.04076
	I13. I am anxious about being unsuccessful in chemistry exams.	3.43	.04591
	I06. I get anxious when it is time for chemistry exam.	3.25	.04693
	I04. It makes me anxious to think of how chemistry exams will be.	3.19	.04669
	I18. I dislike taking chemistry exams.	2.93	.04936
	I14. It makes me anxious to think that the other students will be more successful in chemistry class than me.	2.66	.04732

As evident in Table 10, the items that the participants believe best express themselves in the "anxiety" sub-domain are "I think of how my score in chemistry class will affect my grade point average (X= 3.88)", "I am anxious about being unsuccessful in chemistry exams (X= 3.43)", and "I get anxious when it is time for chemistry exam (X= 3.25)". The least expressive items as stated by the participants are "It makes me anxious to think that the other students will be more successful in chemistry class than me (X= 2.66)", "I dislike taking chemistry exams (X= 2.93)", and "It makes me anxious to think of how chemistry exams will be (X= 3.19)".

Table 11. Descriptive Statistical Analyses of "Extrinsic Motivation" Domain

Domain	Items	X	ss
Extrinsic motivation	I11. I think of how chemistry knowledge I have acquired will help me.	3.32	.04227
	I19. I think of how I will make use of chemistry knowledge I have acquired.	3.13	.04263
	I17. I think of how chemistry learning will help my career.	3.02	.04411
	I25. Chemistry knowledge I have acquired has practical value for me.	2.98	.04311
	I10. I think of how learning chemistry will help me find a good job.	2.90	.04478
	I02. Chemistry knowledge I have acquired relates to my personal goals.	2.74	.04327
	I23. Chemistry knowledge I have acquired relates to my life.	2.71	.04495

Table 11 reveals that the items that the participants believe best express themselves in the "extrinsic motivation" sub-domain are "I think of how chemistry knowledge I have acquired will help me. (X= 3.32)", "I think of how I will make use of chemistry knowledge I have acquired (X= 3.13)", and "I think of how chemistry learning will help my career (X= 3.02)". The least expressive items as stated by the participants are "Chemistry knowledge I have acquired relates to my life (X= 2.71)", "Chemistry knowledge I have acquired relates to my personal goals (X= 2.74)", and "I think of how learning chemistry will help me find a good job (X= 2.90)".

Table 12. Descriptive Statistical Analyses of "Intrinsic Motivation" Domain

Domain	Items	X	ss
Intrinsic motivation	I22. I find learning chemistry interesting.	3.33	.04301
	I16. Learning chemistry is more important for me than my score in the class.	2.99	.04550
	I20. If I don't understand chemistry, it is my fault.	2.98	.04444
	I27. I like a challenging chemistry class.	2.53	.04730

Table 12 shows that the items that the participants believe best express themselves in the "intrinsic motivation" sub-domain are "I find learning chemistry interesting (X= 3.33)" and "Learning chemistry is more important for me than my score in the class (X= 2.99)". The least expressive items for the participants are "I like a challenging chemistry class (X= 2.53)" and "If I don't understand chemistry, it is my fault (X= 2.98)".

Table 13. Independent Samples t-test Results by Sub-domains in Chemistry Motivation Scale

Domain	Gender	n	$\bar{X}$	ss	t	df	p
Self-efficacy	Female	475	3.4496	.80139	-.663	872	.507
	Male	399	3.4876	.89224			
Anxiety	Female	475	3.3807	.90100	5.320	872	.000
	Male	399	3.0459	.95603			
Extrinsic Motivation	Female	475	2.9468	.91715	-.995	872	.320
	Male	399	3.0115	1.00326			
Intrinsic Motivation	Female	475	2.8742	.88461	-3.037	872	.002
	Male	399	3.0645	.96649			

Table 13 reveals no statistically significant difference between gender and the sub-domains self-efficacy ($t_{(872)}$= -.663; p>.05) and extrinsic motivation ($t_{(872)}$=.32; p>.05). Yet a statistically significant difference was observed between gender and the sub-domains critical anxiety ($t_{(872)}$= 5,32; p<.05) and intrinsic motivation ($t_{(872)}$= -3.037; p<.05). It can be concluded from the mean scores of the variables at stake that the female students are more concerned about chemistry exams and scores than the male participants. It can be realized that the male students have higher levels of intrinsic motivation than the female students.

Table 14. ANOVA Results by Students' Motivation for Chemistry and Schools

Variable	Source of Variance	Sum of Squares	sd	Mean Square	F	p	Significant Difference
Self-efficacy	Between Groups	30.277	7	4.325	6.335	.000	D-C; D-F; D-G; D-H
	Within Groups	591.301	866	.683			
	Total	621.578	873				
Anxiety	Between Groups	50.688	7	7.241	8.683	.000	B-D; C-B; C-D; C-E; C-F
	Within Groups	722.176	866	.834			
	Total	772.864	873				
Extrinsic motivation	Between Groups	23.215	7	3.316	3.696	.001	D-C; D-E; D-G
	Within Groups	777.008	866	.897			
	Total	800.223	873				
Intrinsic motivation	Between Groups	46.884	7	6.698	8.243	.000	B-C; D-C; F-C; H-C
	Within Groups	703.668	866	.813			
	Total	750.552	873				

A: P1, B: S1 C: S2 D: S3, E:S4, F: S5, G: S6, H: P2

It is evident from Table 14 that there is a statistically significant difference between the participants' schools and their scores in self-efficacy (F=6.335; p<.05), anxiety (F=8.683; p<.05), extrinsic motivation (F=3.696; p>.05), and intrinsic motivation (F= 8.243; p>.05). According to the Tukey's test performed to identify the source of difference, the students of the S3 have a higher level of self-efficacy in terms of motivation for chemistry than those of the S2, S5, S6 , and P2. It was observed that the students of S1 were more anxious in terms of motivation for chemistry than those of S3, whereas the students in S2 more anxious than S1, S3, S4, and S5. The analyses also showed that the students of S3 had higher levels of extrinsic motivation than those of S2, S4, and S6. The students of S1, S3, S5, and P2 were found to have higher levels of intrinsic motivation than those of S2.

Table 15. ANOVA Results by Students' Motivation for Chemistry and Class Standings

Variable	Source of Variance	Sum of Squares	sd	Mean Square	F	p	Significant Difference
Self-efficacy	Between Groups	14.128	3	4.709	6.745	.000	C-A; C-B; D-B
	Within Groups	607.451	870	.698			
	Total	621.578	873				
Anxiety	Between Groups	21.157	3	7.052	8.162	.000	A-D; B-D
	Within Groups	751.707	870	.864			
	Total	772.864	873				
Extrinsic motivation	Between Groups	12.111	3	4.037	4.456	.004	C-A; C-B
	Within Groups	788.112	870	.906			
	Total	800.223	873				

	Between Groups	19.395	3	6.465	7.693	.000	C-A; C-B; D-A; D-B
Intrinsic motivation	Within Groups	731.158	870	.840			
	Total	750.552	873				

A: 9th grade, B: 10th grade, C: 11th grade, D: 12th grade

It is evident from Table 15 that there is a statistically significant difference between the participants' class standings and their scores in self-efficacy (F=6.745; p<.05), anxiety (F=8.162; p<.05), extrinsic motivation (F=4,456; p>.05) and intrinsic motivation (F= 7.693; p>.05). According to the Tukey's test performed to identify the source of difference, the 11th-graders have a higher level of self-efficacy in terms of motivation for chemistry than the 9th- and 10th-graders do, while the self-efficacy level of the 12th-grade students is higher than that of the 10th-graders. The 9th- and 10th-grade students were found to be more anxious than the 12th-graders.Besides, the 11th-graders were observed to be extrinsically more motivated than the 9th- and 10th- graders, and the 11th- and 12th-graders to be intrinsically more motivated than the 9th- and 10th-grade students.

Table 16. ANOVA Results by Students' Motivation for Chemistry and Grade Point Averages

Variable	Source of Variance	Sum of Squares	sd	Mean Square	F	p	Significant Difference
Self-efficacy	Between Groups	77.129	4	19.282	30.777	.000	D-C; E-A; E-B; E-C; E-D
	Within Groups	544.449	869	.627			
	Total	621.578	873				
Anxiety	Between Groups	13.289	4	3.322	3.801	.005	E-D
	Within Groups	759.575	869	.874			
	Total	772.864	873				
Extrinsic motivation	Between Groups	38.872	4	9.718	11.092	.000	E-C; E-D
	Within Groups	761.351	869	.876			
	Total	800.223	873				
Intrinsic motivation	Between Groups	34.256	4	8.564	10.390	.000	E-C; E-D
	Within Groups	716.296	869	.824			
	Total	750.552	873				

A: 0-44, B: 44-54, C: 55-69, D: 70 -84, E: 85 or higher

It is understandable from Table 16 that there is a statistically significant difference between the participants' grade point averages and their scores in self-efficacy (F=30.777; p<.05), anxiety (F=3.801; p<.05), extrinsic motivation (F=11.092; p>.05), and intrinsic motivation (F= 10.390; p>.05). According to the results of the Tukey's test conducted to find the source of difference, the students with a GPA of 85 or higher have a higher level of self-efficacy in chemistry than the ones with 0-44, 44-54, 55-69, and 70-84, whereas the ones with 70-84 are more self-efficacious than those with 55-69 and the ones with 70-84 GPA are more anxious in terms of motivation for chemistry than the students with 85 or higher GPA. The results also evidence that the students having a GPA of 85 or higher are intrinsically and extrinsically more motivated than the students with 55-69 and 70-84.

Table 17. ANOVA Results by Students' Motivation for Chemistry and Average Scores in Chemistry Class

Variable	Source of Variance	Sum of Squares	sd	Mean Square	F	p	Significant Difference
Self-efficacy	Between Groups	142.563	4	35.641	64.657	.000	C-A; D-A; D-B; D-C, E-A, E-B, E-C, E-D
	Within Groups	479.015	869	.551			
	Total	621.578	873				
Anxiety	Between Groups	42.039	4	10.510	12.497	.000	B-E, C-E,
	Within Groups	730.825	869	.841			
	Total	772.864	873				
Extrinsic motivation	Between Groups	71.151	4	17.788	21.202	.000	D-A, E-A, E-B, E-C, E-D
	Within Groups	729.073	869	.839			
	Total	800.223	873				
Intrinsic motivation	Between Groups	79.819	4	19.955	25.853	.000	B-A, D-A, E-A, E-B, E-C, E-D
	Within Groups	670.733	869	.772			
	Total	750.552	873				

A: 0-44, B: 44-54, C: 55-69, D: 70 -84, E: 85 or higher

It is clear from Table 20 that there is a statistically significant difference between the participants' average scores in chemistry class and self-efficacy (F=64.657; p<.05), anxiety (F=12.497; p<.05), extrinsic motivation (F=21.202; p<.05), and intrinsic motivation (F= 25.853; p<.05). The Tukey's test conducted to find the source of difference manifested that the students with an average score of 55-69 or 70-84 in chemistry class had a higher level of self-efficacy in chemistry than the ones with 0-44; the students with 70-84 than the students with 44-54 and 55-69; the students with 85 or higher than those with 0-44, 44-54, 55-69, and 70-84. The students with an average score of 44-54 and 55-69 in the chemistry class were found to be more anxious in terms of motivation for chemistry than those with 85 or higher and the students with 70-84 have higher levels of extrinsic motivation than those with 0-44 and those with 85 or higher than the ones with 0-44, 44-54, 55-69, and 70-84. It was also found that the students with 70-84 and 44-54 average points were intrinsically more motivated than the ones with 0-44 and those with 85 or higher than the students with 0-44, 44-54, 55-69, and 70-84.

DISCUSSION AND CONCLUSION

The secondary school students were generally observed to be motivated for the chemistry class in terms of self-efficacy. The students' mainly exhibiting self-efficacy as regards chemistry can be considered positive for chemistry education and it becomes easier to teach in a subject where students feel self-efficacious. The secondary school students herein were found to be "sometimes" anxious and intrinsically and extrinsically motivated, which means that they are moderately motivated for the chemistry class. Pehlivan and Köseoğlu (2011) found no difference between science high school students' attitudes for chemistry lesson and gender. The same situation is also seen in different studies (Barrington & Hendricks, 1988; Çoban, 1989; Güler, 1997; George, 2000; Saracaloğlu, BaÇer, Yavuz and Narlı, 2004; Alçı and Erden, 2006; Yılmaz, 2006; Çokadar and Külçe, 2008) has been demonstrated. In the study of Kıngır et al. (2006), it was determined that students have a positive attitude towards chemistry lesson, and when other variables of the study were evaluated, there was no significant difference between female students and male students. Yaman and Karamustafaoğlu (2006) found that the gender factor was not effective in pre-service teachers' attitudes towards chemistry course. There was only a slight difference between male and female students in favor of female students in average scores. In their study, Kıngır and Yazıcı (2007) found a significant difference in attitudes towards chemistry lesson among students studying at different types of high schools. Sezgin Saf (2011) showed in his study that gender has no effect on motivation related to chemistry course. The study conducted by Sezer et al. (2006) revealed that the self-efficacy perceptions of the students in the schools that enroll students with exam and ability are higher than the self-efficacy perceptions of the students in the general high schools towards the chemistry course.

In the "self-efficacy" sub-domain, the secondary school students found it important to get high scores in chemistry class, to be more successful than the other students, and to understand chemistry. In the same domain, they also consider that they won't be able to get high scores and be successful in chemistry projects and exams.

In the "anxiety" sub-domain, they are anxious about being unsuccessful in chemistry exams and the chemistry exams and concerned that their average scores in chemistry class may affect their GPAs. The anxiety that the other students are more successful in chemistry class is less observable in the secondary school students.

In the "extrinsic motivation" sub-domain, the students were determined to think that chemistry knowledge, using chemistry, and learning chemistry will be helpful in their careers. They were detected in the "extrinsic motivation" sub-domain to feel less strongly about chemistry's being related to their lives and personal goals and its capacity to assist them with finding a good job.

In the “intrinsic motivation” sub-domain, the students expressed that they found learning chemistry interesting and more important than scores. It was realized that the students did not blame themselves for having difficulty in chemistry class and not being able to understand chemistry.

The "gender" variable was found not to affect self-efficacy and extrinsic motivation in terms of the students’ motivation for chemistry class. Statistically significant differences were discovered between the participants’ genders and their anxiety and intrinsic motivation. The female students were more concerned over chemistry exams and scores than the male participants. On the other hand, the male students had higher levels of motivation than the females. In other words, the female students felt more concerned about achievement and scores in the chemistry class, whereas the male students thought more about making use of the class, its relation to life, and enjoying it as they learn it.

Statistically significant differences were detected between the participants’ schools and their self-efficacy, anxiety, intrinsic motivation, and extrinsic motivation. The students of the S3 were found to be more self-efficacious that the students of S2, S5, S6, and P2.

It was observed that the students of S1 were more anxious in terms of motivation for chemistry than those of S3, whereas the students in S2 more anxious than S1, S3, S4, and S5. The analyses also showed that the students of S3 had higher levels of extrinsic motivation than those of S2, S4, and S6. The students of S1, S3, S5, and P2 were found to have higher levels of intrinsic motivation than those of S2.

Statistically significant differences were detected between the participants’ class standings and their self-efficacy, anxiety, intrinsic motivation, and extrinsic motivation. The students’ class standings are correlated with their motivation in terms of four different domains. Higher class standing corresponds to positive changes in their motivation for chemistry class.

Statistically significant differences were found between the participants’ grade point averages and their self-efficacy, anxiety, intrinsic motivation, and extrinsic motivation. The secondary school students with higher GPAs had higher self-efficacy in chemistry class than those with low GPAs. The students with lower GPAs were observed to be more anxious about chemistry class than the ones with higher GPAs. The participants having higher GPAs were realized to be intrinsically and extrinsically motivated than the ones with lower GPAs.

Statistically significant differences were observed between the participants’ average points in chemistry class and their self-efficacy, anxiety, intrinsic motivation, and extrinsic motivation. The students with higher average scores in chemistry class were discovered to exhibit higher self-efficacy. The students with lower average scores were observed to be more anxious about chemistry class than the ones with higher average scores. The intrinsic and extrinsic motivation levels of the students with high average scores in chemistry class were high, while the ones with low average scores were found to be intrinsically and extrinsically less motivated.

No statistically significant differences were found between the participants’ parentals’ bereavement and their self-efficacy, anxiety, intrinsic motivation, and extrinsic motivation

Suggestions

It is understood that the students have motivations for the chemistry course. For this reason, in-class and out-of-class applications can be made to increase their motivation.

Considering that the participating students were found to exhibit high self-efficacy levels for chemistry class, more students can be encouraged to grow more interested in chemistry class and thus in other natural sciences.

Compared to male students, female students can be helped understand that chemistry is not only a class to be successful in but also very related to life and efforts can be made to do so.

In the earlier years of secondary education, more efforts can be invested in promoting secondary school students' motivation for chemistry class.

Students can be helped increase their scores to make them more interested in the class because the participants' motivation for the class was correlated with their GPAs and average scores in chemistry.

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