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Examining the High School Students' Chemistry Motivation, Chemistry Laboratory Anxiety and Chemistry Laboratory Self-Efficacy Beliefs towards Different Variables[1]

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ABSTRACT
In this study, it is aimed to investigate the high school students' chemistry motivation, chemistry laboratory anxiety, chemistry laboratory self-efficacy beliefs and their changes according to different variables. The study was designed in the relational survey model. The sample of the research consists of 642 high school students'. In the research, chemistry motivation scale, chemistry laboratory anxiety scale and chemistry laboratory self-efficacy beliefs scale were used as data collection tools. The difference between the chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy beliefs sub-dimensions according to class, gender and school type variables was examined by "Multivariate Variance Analysis MANOVA". The data meet the assumptions. As a result of the research, the high school students' chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy beliefs averages are at medium levels. When the changes in the sub-dimensions are examined, it is seen that there was significant difference according to class, school type and class-school type interaction. This results are similar to other study results.

Keywords: chemistry motivation, chemistry laboratory anxiety, chemistry laboratory self-efficacy beliefs, multivariate analysis of variance

INTRODUCTION

The rapid developments in science and technology, the changing needs of the individual and society, and the innovations and developments in the theories and approaches of learning and teaching have influenced the roles expected from individuals. As a result of these changes, individuals are expected to have the qualities such as producing information, using them functionally in life, solving problems, critical thinking, having communication skills, showing empathy, and contributing to society and culture. The main purpose of the education system is to train individuals as people with these characteristics. While trying to gain knowledge, skills and behaviors through the curriculum, the importance of the affective characteristics that make connections between these knowledge, skills and behaviors should not be forgotten as well (MEB, 2018). Curriculums should aim at gaining skills and competences, which will take individual differences into consideration, rather than merely transferring knowledge. In line with these objectives, science, especially chemistry curriculum, is gaining importance in educating individuals who can renew themselves and transfer their theoretical knowledge and learning to daily life by following the scientific and technological developments continuously in our age where social change and development gains momentum and information and communication technologies affect every moment of human life.

Among the objectives of the chemistry curriculum, there are titles as follows: to have knowledge about the basic concepts, principles, models, theories and laws of chemistry science, to use the knowledge and skills acquired in chemistry course in explaining the events related to daily life, health, industry and environment, to distinguish the positive and negative aspects of chemical technologies regarding life , to realize the contributions of chemistry to social life, economy and technology, to obtain data by making experiments, to make inferences by using these data, to interpret and to reach generalizations (MEB, 2018). The importance of affective and social factors should not be ignored more than the facilitators in stimulating cognitive factors such as methods, techniques and materials while carrying out teaching within the frame of these goals. Students' needs, interests, goals and expectations play an important role in interpreting information. The effect of affective variables such as motivation, attitude, anxiety and self-efficacy beliefs on learning constitutes the subject of many studies. There are many studies showing that

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positive emotions such as pleasure from learning increase motivation and success (Laukenmann, Bleicher, Fuss, Gläser-Zikuda, Mayring & von Rhöneck, 2003), and self-efficacy beliefs on motivation, academic achievement, stress and anxiety (Pajares, Britner & Valiante, 2000; Britner & Pajares, 2006).

Motivation is defined as intrinsic power. This intrinsic power can reveal a behavior, direct it and also make it permanent (Woolfolk, 2004). Motivation is an indication of whether or not they want to participate in learning activities (Matuga, 2009). Teachers should know their students' motivation levels for a course beforehand. If the student's motivation is low, they can take precautions and increase the motivation accordingly. The increasing motivation of the student will improve his or her success in that course. While it has been observed that positive emotions like motivation provide stimulation and increase success, and anxiety has an important place in negative emotions (Laukenmann, Bleicher, Fu, Glaser-Zikuda, Mayring, & Von Rhöneck, 2003). Math, test, exam, science and laboratory anxiety are usually investigated types of anxiety among the researchers. There are many studies showing that anxiety level has an effect on learning (Turner, & Linsay, 2003; Mallow, Kastrup, Bryant, Hislop, Shefner, & Udo, 2010; Kaya, & Cetin, 2012; Güven, Çam, & Sülün, 2015; Aydoğdu, 2017). Anxiety is a variable that negatively affects learning.Science anxiety is a debilitating interaction of emotion of fear, and tension during the interaction with science concepts (Mallow, 1994). Science anxiety indicated as a career filter; students avoids from entering certain fields as they have fear of participation in the prerequisite science courses (Udo, Ramsey, & Mallow, 2004). Science anxiety is defined as fear towards learning science (Azizoğlu, & Uzuntiryaki, 2006). Laboratory activities present opportunities to students to understand scientific concepts by enhancing their mental development (Hofstein, & Lunetta, 2004). Laboratory anxiety appears as another concern. Knowing the extent and cause of anxiety will be effective in identifying ways to eliminating anxiety and re-orienting students. Therefore, it is important to identify students' concerns.

Self-efficacy beliefs emerges as another important affective variable. Self-efficacy beliefs is defined as a person's belief in his or her own abilities to successfully complete a job (Bandura, 1994; Ölmez-Çağlar, Mirici, Erten, 2020). It is the judgment of the individual about herself or himself in order to cope with the difficult situations that she or he may face in the future (Senemoğlu, 1997). Self-efficacy is important because people often believe in doing things they can successfully complete and do not try what they think will fail (Bandura, 1994). Students who have high self-efficacy beliefs head for new tasks, they do not quail against the difficulties they face in doing these tasks and achieve success (Britner, 2008; Zeldin, & Pajares, 2000). Self-efficacy beliefs has a strong effect on the achievement level of individuals, which they themselves can also recognize. A strong sense of self-efficacy beliefs increases the level of individuals in many areas, such as success (Pajares, & Schunk, 2001).

It is necessary to investigate in depth the motivation that has a directing impact on making the individual act in the learning environment, the anxiety that affects the learning negatively and the self-efficacy beliefs that determines how individuals motivate their feelings, thoughts, behaviors and themselves. The relationship between variables such as motivation, anxiety, attitude and self-efficacy beliefs that will affect students' success in the fields where science and especially the fields such as chemistry where laboratory applications are used should be discovered and the effect of other variables on them should be examined. The aim of this study is to determine chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy beliefs of high school students and to determine the effect of gender, class and school type variables on them.

METHOD

The study was designed in the relational survey model. Relational survey is a model that enables to examine the relationship of two or more variables with one another (Fraenkel, Wallen & Hyun, 2012). The aim of this study was to determine the chemistry laboratory anxiety, chemistry motivation and chemistry laboratory self-efficacy beliefs of high school students', examine the relationship between these variables and according to gender, class and school type variables were compared and evaluated.

Sampling

The sample group of the study consists of 652 high school students in Turkey. 55.5% of the students were female, 44.5% were male. To select the participants was used convenience sampling technique. The education ministry in Turkey give permission to collect data for these schools. The students who participated in the research were attending either in Anatolian high schools, or vocational high schools. Their classes were classified as "9th grade, 10th grade, 11th grade and 12th grade".

Table 1: Characteristics of sampling

		f	%
Gender	Female	362	55.5
	Male	290	44.5
Class	9th grade	174	26.7
	10th grade	176	27
	11th grade	155	23.8
	12th grade	147	22.5

School Type	Anatolian High School	300	46
	Vocational High School	352	54

Data Collection Tools

Chemistry Motivation Scale: Chemistry motivation scale were developed by Glynn, Brickman, Armstrong and Taasoobshirazi (2011) and adapted to the Turkish by Tosun (2013). The motivation scale consisted of 19 statements in a 5-point Likert Type. Scale consists of career motivation, self-efficacy, grade motivation, self-determination, intrinsic motivation as named five sub-dimensions. The Cronbach Alpha reliability coefficient of the whole scale 0.84.

Chemistry Laboratory Anxiety Scale: The anxiety of high school students' towards chemistry laboratory were determined by the "Chemistry Laboratory Anxiety Scale" developed by Bowen (1999) and the Turkish adaptation studies made by Azizoğlu and Uzuntiryaki (2006). The anxiety scale consisted of 20 statements in a 5-point Likert Type. The scale had four sub dimensions. The Cronbach Alpha reliability coefficient of the use of laboratory instruments and chemicals sub dimension was 0.88, work with other students sub dimension was 0.87, data collection sub dimension was 0.86 and using laboratory time sub dimension was 0.87.

Chemistry Laboratory Self-Efficacy Beliefs Scale: The self-efficacy beliefs of high school students' towards chemistry laboratory were determined by the "Chemistry Laboratory Self-Efficacy Beliefs Scale" developed by Alkan (2016). The scale consisted of 14 statements in a 5-point Likert Type. The scale had two sub-dimensions named psychomotor self-efficacy and cognitive self-efficacy. The Cronbach Alpha reliability coefficient of the whole scale 0.885. The Cronbach Alpha reliability coefficient of the psychomotor self-efficacy beliefs sub-dimension was 0.82 and cognitive self-efficacy beliefs sub-dimension was 0.82.

Data Analysis

In the analysis of the data obtained from the study was performed with SPSS 17 programme. Descriptive statistics were calculated for the variables of chemistry laboratory self-efficacy beliefs, chemistry motivation, chemistry laboratory anxiety and all sub-dimensions. The difference between the chemistry laboratory self-efficacy beliefs, chemistry motivation, chemistry laboratory anxiety sub-dimensions according to gender, class and school type variables was examined by "Multivariate Variance Analysis MANOVA".

RESULTS

Assumptions of MANOVA

All assumptions required for MANOVA were justified before analyzing data. The analysis results are given in Table 2.

Table 2: Descriptive statistics for the observed variables.

Observed variables	Mean	5% Trimmed mean	SD	Min	Max	Skew.	Kurt.	α
Chemistry Laboratory Self-Efficacy Beliefs	3.29	3.31	.62	14	70	-,344	,079	0.88
Psychomotor self-efficacy beliefs	3.24	3.25	.75	7	35	-,187	-,332	0.79
Cognitive self-efficacy beliefs	3.34	3.35	.62	7	35	-,335	-,307	0.85
Chemistry Motivation	3.36	3.39	.62	19	95	-,629	,765	0.89
Career motivation	3.28	3.32	.78	5	25	-,614	,452	0.78
Self-efficacy	3.42	3.44	.75	4	20	-,570	,422	0.71
Grade motivation	3.53	3.55	.75	5	25	-,321	,028	0.78
Self-determination	3.26	3.28	.77	3	15	-,331	,070	0.60
Intrinsic motivation	3.14	3.17	.88	2	10	-,356	-,094	0.61
Chemistry Laboratory Anxiety	2.94	2.91	.72	20	100	,541	,197	0.92
The use of laboratory instruments and chemicals	2.89	2.86	.75	6	30	,542	,327	0.74
Work with other students	3.01	2.98	.88	4	20	,529	-,331	0.78
Data collection	2.98	2.96	.79	6	30	,338	-,219	0.79
Using laboratory time	2.95	2.92	.81	4	20	,423	,048	0.70

Note: Skew. = Skewness; Kurt. = Kurtosis; α = Cronbach's alpha.

When Table 2 is examined according to kurtosis skewness values it is seen that the data are distributed normally (Tabachnick, & Fidell, 2013). The mean and trimmed mean were compared to check for multivariate normality and extreme value in the data set. If mean and trimmed mean values were very different from each other, the Q-Q plot was first checked to specify the outliers. In these data set were observed a few outliers. Therefore Mahalanobis distance value was examined. Outliers whose Mahalanobis distance is above the critical value are excluded from the data set. In order to meet the multivariate normality assumption, these data were excluded from the analysis and the remaining 642 data met the multivariate normality assumption. Homogeneity of variance-

covariance matrices was evaluated by Box's M test and Levene tests. The significance of the Box's M test is as follows [Box's M=1616.770, $F_{(11.616)}$:1.552, p<0.05]. The homogeneity of covariance matrices was not met, therefore In interpreting MANOVA analysis, Pillai's trace value was evaluated. Levene test results are [p> .05]. Equality of variance in terms of dependent variables was accepted. The data meet the assumptions and were analyzed in accordance with the purpose of the study.
Findings descriptive statistics
Descriptive statistics related to the average of the scales applied within the context of the study between chemistry laboratory self-efficacy beliefs, chemistry motivation and chemistry laboratory anxiety all sub-dimensions of high school students are summarized in Table 3.

Table 3: Descriptive statistics.

Observed variables	N	Mean	SD
Chemistry Laboratory Self-Efficacy Beliefs	642	3.29	.73
Psychomotor self-efficacy beliefs	642	3.23	.76
Cognitive self-efficacy beliefs	642	3.34	.62
Chemistry Motivation	642	3.37	.62
Career motivation	642	3.30	.76
Self-efficacy	642	3.42	.75
Grade motivation	642	3.52	.75
Self-determination	642	3.27	.77
Intrinsic motivation	642	3.16	.87
Chemistry Laboratory Anxiety	642	2.93	.73
The use of laboratory instruments and chemicals	642	2.88	.73
Work with other students	642	2.99	.88
Data collection	642	2.97	.79
Using laboratory time	642	2.94	.79

When Table 3 is analyzed, it is seen that chemistry motivation average (X:3.37), chemistry laboratory anxiety average (X:2.93), and laboratory self-efficacy beliefs average (X:3.29), are at medium levels. When the sub-dimensions of the scales are examined, it is observed that the high school students have the highest average at chemistry motivation in the dimension of grade motivation (X:3.52), and they have the lowest average at chemistry laboratory anxiety in the sub-dimension of use of laboratory instruments and chemicals (X: 2.88).
Findings regarding the MANOVA
The comparison of psychomotor self-efficacy beliefs, cognitive self-efficacy beliefs sub-dimensions of chemistry laboratory self-efficacy beliefs, career motivation, self-efficacy, grade motivation, self-determination, intrinsic motivation sub-dimensions of chemistry motivation, the use of laboratory instruments and chemicals, work with other students, data collection, using laboratory time sub-dimensions of chemistry laboratory anxiety of high school students' according to gender, class and school type were conducted with MANOVA. MANOVA findings are given in Table 4.

Table 4. MANOVA findings

Source of the Variance		Value	F	Hypothesis df	Error df	p	η^2
Gender	Pillai's trace	.028	1.617	11	616	.090	.028
Class	Pillai's trace	.184	3.670	33	1854	.001	.061
School type	Pillai's trace	.167	11.254	11	616	.001	.167
Gender*Class	Pillai's trace	.067	1.279	33	1854	.134	.022
Gender* School type	Pillai's trace	.023	1.347	11	616	.194	.023
Class* School type	Pillai's trace	.162	3.197	33	1854	.001	.054
Gender*Class* School type	Pillai's trace	.047	.898	33	1854	.634	.016

When the table is examined, it is seen that there was significant difference on sub-dimension of scales according to class, school type and class-school type interaction ($F_{(Class)}$ =3.670; η^2=.061 p<0.05; $F_{(School\ type)}$ =11.254; η^2=.167 p<0.05; $F_{(Class*School\ type)}$ =.162; η^2=.054 p<0.05). The effect size are interpreted as small if eta square means (η^2) are below .01, medium if they are between .06 - .14, and large if they are above .14 (Cohen, 1988). The effect size eta square (η^2) value are .061 for the class, .167 for school type and .054 for the class-school type interaction. These eta square (η^2) ratios are effective values at medium and large level. The clarification percentages of the high school students' chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy beliefs by the class 6.1%, by the school type %16.7 and by the class-school type interaction 5.4%. There was no significant difference when gender, gender-class, gender-school type and gender-class-school type independent

variables were considered simultaneously (p>0.05). The ANOVA test was applied to determine which sub-dimensions of significant difference determined according to MANOVA. According to Tukey multiple comparison test class has a significant impact on the grade motivation, self-determination sub-dimensions of the chemistry motivation, the use of laboratory instruments and chemicals, work with other students, data collection, using laboratory time all sub-dimensions of chemistry laboratory anxiety and psychomotor self-efficacy beliefs, cognitive self-efficacy beliefs sub-dimensions of chemistry laboratory self-efficacy beliefs scale. The significant difference in chemistry motivation scale in grade motivation sub-dimension is between 11^{th} grade (X:3.3) and 10^{th} grade (X:3.7), in self-determination sub-dimension is between 11^{th} grade (X:3.12) and 12^{th} grade (X:3.5). The significant difference in chemistry laboratory anxiety scale in the use of laboratory instruments and chemicals sub-dimension is between 11^{th} grade (X:2.7) and 10^{th} grade (X:3.0), in work with other students sub-dimension is between 12^{th} grade (X:2.8) and 10^{th} grade (X:3.2), in data collection sub-dimension is between 12^{th} grade (X:2.9) and 10^{th} grade (X:3.1), using laboratory time sub-dimension is between 12^{th} grade (X:2.8) and 10^{th} grade (X:3.1). Chemistry laboratory self-efficacy beliefs scale in psychomotor self-efficacy beliefs sub-dimension is between 11^{th} grade (X:3.0) and 9^{th} grade (X:3.5), in cognitive self-efficacy beliefs is between sub-dimension 11^{th} grade (X:3.1) and 9^{th} grade (X:3.5).
The average of the Anatolian high school and vocational high school type of variables were also compared. There were significant difference according to school type on chemistry motivation scale in career motivation, grade motivation, self-determination, and intrinsic motivation sub-dimensions, in chemistry laboratory anxiety scale in use of laboratory instruments and chemicals, work with other students, data collection, using laboratory time sub-dimensions. The average of vocational high school students is higher than the Anatolian high school students. The averages are in career motivation ($X_{Vocational}$=3.4; $X_{Anatolian}$=3.2), in self-determination ($X_{Vocational}$=3.4; $X_{Anatolian}$=3.1) and in intrinsic motivation ($X_{Vocational}$=3.3; $X_{Anatolian}$=2.9). But in grade motivation Anatolian high school students average is higher than vocational high school students ($X_{Anatolian}$=3.6; $X_{Vocational}$=3.4). In all sub-dimensions chemistry laboratory anxiety scale, vocational high school students have less anxiety than Anatolian high school students. In use of laboratory instruments and chemicals ($X_{Anatolian}$=3.1; $X_{Vocational}$=2.7), work with other students ($X_{Anatolian}$=3.3; $X_{Vocational}$=2.8), data collection ($X_{Anatolian}$=3.2; $X_{Vocational}$=2.7), using laboratory time ($X_{Anatolian}$=3.2; $X_{Vocational}$=2.7).
When the effect of school type-class interaction variables was examined, the significant difference was in self-efficacy sub-dimension on chemistry motivation scale 12^{th} grade in favor of Anatolian high school ($X_{Anatolian}$=3.6; $X_{Vocational}$=3.3), in grade motivation sub-dimension 10^{th} grade in favor of Anatolian high school ($X_{Anatolian}$=3.9; $X_{Vocational}$=3.4),, in self-determination 10^{th} grade in favor of vocational high school ($X_{Anatolian}$=2.9; $X_{Vocational}$=3.4), in intrinsic motivation 10th grade in favor of vocational high school ($X_{Anatolian}$=2.8; $X_{Vocational}$=3.2). In chemistry laboratory anxiety scale, vocational high school students' anxieties in all sub-dimensions are less than Anatolian high school students' anxieties. In use of laboratory instruments and chemicals sub-dimension the significant difference is in 10^{th} grade ($X_{Anatolian}$=3.4; $X_{Vocational}$=2.6), in work with other students sub-dimension 10^{th} grade ($X_{Anatolian}$=3.8; $X_{Vocational}$=2.6), in data collection sub-dimension 10^{th} grade ($X_{Anatolian}$=3.7; $X_{Vocational}$=2.6), and in using laboratory time sub-dimension 10^{th} grade ($X_{Anatolian}$=3.6; $X_{Vocational}$=2.6).

DISCUSSION AND CONCLUSION

The aim of this study is to determine the chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy perception of high school students and to examine their change according to gender, class and school type variables. As a result of the research, it has been determined that chemistry motivation of high school students is at medium level. The students' anxiety levels and chemistry laboratory self-efficacy are also moderate. While students have the highest average of chemistry motivation in the dimension of grade motivation, they have the lowest average in the dimension of intrinsic motivation. In other study findings, the high average in the dimension of grade motivation stands out (Chumbley, Haynes, & Stofer, 2015; Saltaab, & Koulougliotis, 2015; Austin, Hammond, Barrows, Gouldd, & Gould, 2018; Wardhany, Subita, & Maharani, 2018). When the dimensions of the chemistry laboratory anxiety scale have been examined, the lowest average is in the use of laboratory instruments and chemicals dimension, and the highest average is in the dimension of work with other students. While students feel less worried about working in groups, they are more worried about working with chemicals and laboratory equipment. According to other studies, the highest anxiety score was under chemistry evaluation and the lowest was under learning chemistry (Şenocak, & Baloğlu, 2014). In the chemistry laboratory self-efficacy scale, the high average is under the dimension of cognitive self-efficacy beliefs, and the low average is under the dimension of psychomotor self-efficacy beliefs. According to other studies, students' average of psychomotor self-efficacy beliefs is higher than the cognitive self-efficacy beliefs (Ramnarain, & Ramaila, 2018). The results obtained from the means are quite consistent. In other words, cognitive self-efficacy beliefs from chemistry course are also high when students have high grade expectation from the chemistry course. Students who have anxiety about working with chemicals and tools in chemistry laboratory have low psychomotor self-efficacy beliefs. It also signifies that individuals with high self-efficacy can overcome and accomplish challenging tasks, while those with low self-efficacy beliefs avoid difficult tasks and do not have confidence in their ability to perform the task (Simorangkir, & Rohaeti, 2019). With the teaching method to be applied, self-efficacy towards chemistry can be improved (Ferrell, & Barbera, 2015). Increasing students' self-efficacy in a field can only be possible by having positive and successful experiences. Students can develop self-efficacy by giving them more hours to review concepts and solve problems of a given topic (Karataş, 2016).

The effects of gender, class and school type variables on the sub-dimensions of chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy belief scales have been examined by MANOVA. According to the results of the analysis, it has been determined that gender, gender-class, gender-school type and gender-class-school type variables have no effect. Findings related to the results of other studies are as follows. In their studies Çetin-Dindar, & Geban, (2015), finds that gender have no significant effect on chemistry motivation, Montes, Ferreira, & Rodrı´guez, (2018) finds that gender and school type do not affect chemistry attitude, You, Kim, Black, & Min (2018) finds that gender does not have a significant effect in science attitude, and, Boz, Yerdelen-Damar, Aydemir, and Aydemir (2016) finds that gender has no significant effect with chemistry self-efficacy. Besides, studies revealing the significant effect of gender are also noteworthy. Vincent-Ruz, Binning, Schunn, & Grabowski, (2018) report that gender is significant in chemistry self-efficacy, Saltaab, & Koulougliotis (2015) reports gender is effective in chemistry attitude, and age-gender is not effective. Class, school type and class-school type independent variables have a significant effect on that. While the effect of class and school type variables is moderate, the effect of class-school type interaction is of great value. These findings are also supported by other research results. In their studies Basso, Chiorri, Bracco, Carnasciali, Alloisio, & Grotti, (2018) determines that the type of school have an impact on studying chemistry. They also state that activity-based and affective applications including interesting contexts will increase students' motivation and make them reveal positive feelings about chemistry. Barbera, Adams, Wieman, & Perkins (2008) reports that the interest in chemistry varies according to the department studied. When the meaningful effect of the class independent variable has been examined in detail, it has been found that as the level of education increases, students' chemistry motivation decreases, their anxiety levels increases, and their self-efficacy beliefs decrease. The education system implemented in Turkey is seen as a cause of this situation. Similar results are in parallel with other studies (Çetin-Dindar, & Geban, 2015). (In Turkey) At the end of high school, students fall into the university entrance exam, and exam preparation process is very tiring and stressful for them. Although they prepare for the exam and improve themselves cognitively during this process, this situation is not enough to increase their motivation, to reduce their anxiety and to increase their self-efficacy beliefs.

When examining the chemistry laboratory anxiety averages of vocational high school students and Anatolian high school students from the school type variable in detail, it has been determined that the vocational high school students have a higher average in terms of material use, working with other students, collecting data and using time effectively. Practical learning is given in vocational high school. The high average of the students studying here indicates that the education given is effective. According to the results of other researches, chemistry motivation of vocational high school students is higher (Basso, Chiorri, Bracco, Carnasciali, Alloisio, & Grotti, 2018).

When the literature is examined, affective field factors such as attitude, self-efficacy, motivation and anxiety appear as factors affecting students' learning (Kan, & Akbas, 2006). Self-efficacy affects chemistry attitude positively and directly, which causes an effect on chemistry laboratory anxiety (Kurbanoğlu, & Akın, 2010). Self-efficacy and chemistry anxiety are in a negative relationship as they are in a positive relationship with chemistry attitude (Kurbanoğlu, & Akın, 2012). When the results of the studies carried out related to the affective field are examined, the efforts of the students with high anxiety, low self-efficacy and low motivation decrease while learning a lesson. Mental effort made to understand chemistry issues is more than the effort made on courses such as psychology and sociology. Chemistry content is above average difficulty (Boddey, & de Berg, 2018). For this reason, the affective field factors of the students should be taken into consideration when planning the teaching of difficult courses such as chemistry. Teachers should not only help them create conceptual knowledge, but also develop positive attitudes towards chemistry to ensure students' success in chemistry. Teachers should create learning environments that will enable the interaction of multiple aspects in the classroom to help students' performance in the classroom (Xu, Villafane, & Lewis, 2013). Self-efficacy is seen as an important factor to participate in a chemistry activity in the classroom. In chemistry teaching, learning experiences should be tailored to improve students' self-efficacy (Ramnarain, & Ramaila, 2018). As a way to increase students' motivation, presenting real-life subject contexts and making practical applications in the class can be given (Bennet, Lubben, & Hogarth, 2007). A positive effect of daily life-based practices on the success and attitude of the student has been observed (Altundağ Koçak, 2018). In addition, it is thought that activity-based and affective applications with an interesting context will increase students' motivation and reveal positive feelings about the study of chemistry (Basso, Chiorri, Bracco, Carnasciali, Alloisio, & Grotti, 2018). In order to concentrate on laboratory and application activities in the teaching of chemistry which is one of the important components of science; method-model applications that may be of interest to students should be included. The impact of different learning-teaching models should be examined. For example, appropriate applications; for example, the positive effect of process-based learning on chemistry attitude in chemistry laboratory (Önen Yücel, Koçak Altundağ, &

Mustafaoğlu, 2017), science critical thinking's development of chemistry learning and self-efficacy (Rusmansyah, Yuanita, Ibrahim, Prahani, & Isnawati, 2019), teaching scientific process skills through inquiry-based learning (Mulyeni, Jamaris, & Supriyati, 2019), and increasing academic success through case based learning in analytical chemistry laboratory (Günter, Kılınç Alpat, & Özbayrak Azman, 2019) should be selected considering the content of chemistry course and student characteristics and the results should be shared.
Technological know-how, developments and the increase in researches reveal more complex social challenges. In order to overcome these difficulties, individuals need to have a better understanding of science and technology. Individuals should be encouraged to make science-based decisions and actively and to responsibly participate in knowledge-based innovation (Hazelkorn, Ryan, Beernaert, Constantinou, Deca, Grangeat, Karikorpi, Lazoudis, Casulleras, Pinto´, & Welzel-Breuer, 2015). The need for innovation in the society should be increased and priority should be given to increasing the interest of young people in science by initiating more research and innovation activities (Basso, Chiorri, Bracco, Carnasciali, Alloisio, & Grotti, 2018). The content of the teaching curriculum is important to improve the characteristics of individuals such as science-based decision-making, the need for innovation and interest in science. The science curriculum should be rearranged appropriately based on changes in science and technology. New teaching activities should be developed in line with the needs of the day to help and support teachers and students at all levels of education. This research is important to have knowledge about high school students' chemistry motivation, chemistry laboratory anxiety and chemistry laboratory self-efficacy levels and to determine their variation according to gender, class and school type variables. Knowing students' motivation, anxiety and perception towards a field provides teachers with opportunities to develop their students' behavior in a positive way. In the following studies, the levels of prospective teachers and teachers can be determined by changing the sample group, the change with other variables can be examined and the effect of the method-model applications to be used in the lessons can be revealed.

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