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Science Teachers' Self-Efficacy Perceptions on Acid-Base Subject Related to Daily Life in a Science Course

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ABSTRACT

The study aims to investigate the level of science teachers' self-efficacy perceptions on the topic of acid-base chemistry in terms of some variables (gender, the place where the teacher works, and the frequency of using the science laboratory). In this study, a survey method was used, and the sample of the study consists of 138 science teachers. 'Acid-Base Self-Efficacy Perception Scale (ABSPS)', a five-point Likert type, was used as a data gathering tool. The validity and reliability of the ABSPS were calculated for the data obtained from the science teachers in this study. Descriptive and inferential statistics were carried out in examining the data obtained in this research. Results of the study showed that according to mean scores on items, it can be said that the acid-base self-efficacy perception of science teachers is generally at a high level. Also, results show that there was no significant difference in science teachers' self-efficacy perceptions on the topic of acid-base chemistry in terms of gender and the place where the teacher works. On the other hand, it was determined that the teachers had a positive correlation between the frequency of using science laboratories and the acid-base self-efficacy perception level.

Keywords: acid-base, daily life, self-efficacy perception, science teachers, science laboratory

Introduction

The self-efficacy perception is one of the concepts mentioned in the 'Social Learning Theory' belonging to Bandura (1977), who expresses that individuals acquiring behavior are affected by external and internal factors. The self-efficacy perception, different from the inabilities and abilities of individuals, can be defined as the belief regarding whether the individual can deal with any matter (Bandura, 1977). The self-efficacy perception has an impact on a person's approach, behavior, and effort towards events and circumstances (Lee, 2003). Patterson (2011) explains that individuals with a high self-efficacy perception are more successful since they believe deeply in their ability to fulfill the requirements of work. In this context, self-efficacy perception at a low level may complicate dealing with the problems for people (Bussey & Bandura, 1999).

In the study by Bandura (1997), it was stated that the self-efficacy belief has four sources. These are direct experiences, indirect experiences, verbal persuasion, and emotional state. Direct experiences mean an individual's assessment of his/her own behaviors' results, and are the most effective factor on the self-efficacy perception (Bandura, 1997). Vicarious experiences are a type of learning through modelling oneself on the surrounding people (Bandura, 1997; Pajares, 1996). Verbal persuasion refers to the impact of the surrounding people's comments on an individual's motivation

in doing a job (Bandura, 1997; Golightly, 2007). If an individual is persuaded by verbal comments of others about that person's deficiency in some abilities, that individual stays away from expending effort because of the decrease in his/her self-efficacy perception (Bandura, 1994).

Finally, being anxious and stressed, in the context of individuals' emotional state, influences the self-perception manner, and this creates negative effects on coping with a problem (Lewis, 2006). Bandura (1977) analyses the self-efficacy perception as "personal efficacy" and "outcome expectation". Personal efficacy is the belief in one's own abilities regarding the encountered problems, while outcome expectation expresses the beliefs and perceptions about the coping capability before encountering a problem (Ozenoglu Kiremit, 2006).

The literature on self-efficacy shows that research exists to investigate the self-efficacy of teachers (Azar, 2010; O'leary, 2005; Ustuner et al., 2009). Tschannen- Moran et al. (1998) define the self-efficacy of teachers as teachers' belief and judgement on their capability to fulfill professional requirements. In other words, the self-efficacy perception of teachers is their individual judgement on their ability to influence the learning process (Tschannen-Moran & Woolfolk-Hoy, 2001). Several studies have emphasized that the self-efficacy perception of teachers has an impact on the teaching-learning process and the students' development (Miller et al., 2017; Tschannen-Moran et al., 1998; Uzuntiryaki & Aydın, 2009). As the self-efficacy perception of teachers rises, the probability of coping with failures increases (Goddard et al., 2004).

In the literature, the studies on self-efficacy are conducted in the fields of science teaching self-efficacy, perceived self-efficacy and academic self-efficacy (Adetoro et al., 2010; Niehaus et al., 2012). The science teaching self-efficacy belief can be explained as the opinions regarding the abilities to teach science in an effective and efficient way (Dede et al., 2017). Bandura (1977) explained that academic self-efficacy was "personal judgments of one‘s capabilities to organize and execute courses of action to attain designated types of educational performances" (p. 203). Also, Pintrich and Schunk (1996) maintained that academic self-efficacy is a strong predictor of academic performance. In this aspect, perceived self-efficacy according to Bandura (1994) is "concerned with people‘s beliefs in their capabilities to exercise control over their own functioning and over events that affect their lives" (p. 13).

The concepts of self-efficacy perception and self-esteem are frequently confused. Pajares and Schunk (2001) referred that the self-efficacy perception is related to a particular field, to explain the basic difference between those two concepts. The self-efficacy perception of teachers may differ depending on their field (Bandura, 1986). High or low self-efficacy perception is related to an individual's self-perception level in terms of efficacy rather than an individual's efficacy or inefficacy in a specific field. Thus, an individual's self-efficacy perception is not the same for all domains. An individual with a high self-efficacy perception on a specific issue may have a low self-efficacy perception in another one. Therefore, the concept of self-efficacy perception is far from generalizability.

Teachers not only provide instruction on science/chemistry concepts but also provide education. They are responsible for the development of their students in the affective field. In this respect, teachers themselves are expected to have competencies in the affective field. Teachers need to have high self-efficacy beliefs.

Science Teaching Efficacy Belief Instrument (STEBI) developed by Riggs and Enochs (1990) is one of the first measurement tools that reveal self-efficacy beliefs about science e-teaching and learning. Studies on self-efficacy about science are generally studies on a lesson/course or teacher/teaching field (Chemistry, biology, etc.). Studies have been carried out in the fields of self-efficacy in teaching science (Ilhan et al., 2015), chemistry self-efficacy (Uzuntiryaki & Çapa-Aydin, 2009), and biology self-efficacy (Baldwin et al., 1999). However, no scales and survey studies have been found, taking into account science/chemistry subjects and concepts. The present study is important in this respect.

Some subjects/concepts in Science/Chemistry courses include activities, such as laboratory experiments and theoretical information, and the lessons are taught according to these contents. In this case, it is thought that self-efficacy beliefs may change in terms of subjects and concepts. In this respect, it is important to measure self-efficacy beliefs by considering science/chemistry subjects and concepts. Teachers can spend more time on some topics and prefer participating in the activities corresponding to the field they consider themselves to be efficient, according to their self-efficacy perception. Laboratory use has an important place in science education in terms of learning and teaching (Hofstein, 2017; Hofstein & Kind, 2012; Uzuntiryaki & Aydın, 2006). Many studies emphasize the relationship between science laboratory activities and self-efficacy belief (Alkan, 2016; Lee et al., 2019; Uzuntiryaki & Aydın, 2006). In the current study the relationship between the frequency of using the science laboratory by teachers, and their perception of self-efficacy belief, is considered to be an important issue to be investigated.

In recent years, the number of studies determining the self-efficacy perception of teachers and candidate teachers reveal that how self-efficacy perceptions changes concerning certain demographic variables rises (Gercek et al., 2006; Ilhan et al., 2015; Ozdemir, 2008; Saracaloglu & Yenice, 2009). In addition, multiple studies are discovering that self-efficacy perception is affected by some demographic variables (Calıskan et al., 2010; Yalcın, 2011). O'leary (2005) found that the science self-efficacy perception of female teachers was significantly lower than that of male teachers. Cetin (2008) investigated that the science teaching self-efficacy belief of students does not differentiate concerning the gender variable. This situation shows us that science teaching self-efficacy perception can also change according to the cultural contexts or course and subjects. In this respect, it is important to measure the acid-base self-efficacy perception in the present study. Moreover, teachers' working in City center/District center/Village/Rural area and regional differences, their school facilities, and use of course materials may affect their participation in seminars. For these reasons, considering that this situation may also affect science teaching self-efficacy perception, the location of the school is considered as a variable in this study. Teachers' self-efficacy perceptions can change with their teaching experience years by considering Bandura's (1997) theory about their direct experiences as a source of self-efficacy perception. Therefore, in this study, years of teaching experience was also considered as a variable in the current study.

Although certain studies investigate self-efficacy in terms of a specific field, such as science teaching self-efficacy perception (Azar, 2010; Dede et al., 2017; Denizoglu, 2008; Morgil et al., 2004), no study examining the self-efficacy perception in terms of the acid-based topic is found for the teacher. Science teaching self-efficacy belief determined according to certain subjects of science/chemistry; years of teaching experience, gender, teachers use of the laboratory, and location of the school, will contribute to the field. In this respect, it is important to carry out the present study.

The current study investigates the level of self-efficacy perception of science teachers on the topic of acid-base in chemistry. The reason to choose the topic of acid-base for the research is the inability to connect adequately this topic with daily life despite its close connection with the latter (Ayas & Ozmen, 1998; Yildiz et al., 2006), and the existence of misconceptions about this topic (Ozmen & Demircioglu, 2003; Rahayu et al., 2011). Although there are various studies on teaching the topic of acid-base chemistry (Cetin Dindar, 2012; Ozeken & Yildirim, 2011), none of those studies reveals the self-efficacy perception.

Aim

The present study aims to analyze the self-efficacy perception level of science teachers in teaching the topic of acid-base chemistry with certain variables. In this context, the self-efficacy perception of teachers is examined according to gender, the location of the school (city, district, and village) and the frequency of using science laboratories.

Based on these aims, the research questions of the present study investigated the following:

1) What is the self-efficacy perception level of science teachers in teaching the topic of acid-base chemistry?
2) Are there any significant differences in the acid-base self-efficacy perceptions of science teachers about the gender variable and the location of the school (city, district, and village)?
3) Is science teachers' acid-base self-efficacy perception level correlated to the frequency of using the science laboratory by teachers?

Methods

This research was conducted by the survey method which is used for gathering data from mass groups and presenting the data (Buyukozturk, 2012; Gravetter & Wallnau, 2016). The reason for using the survey method is because of the aim and research questions of the study required comparative data and correlations.

Sample and Data Collection

The study sample consists of a total of 138 science teachers, 78 of which are female and 60 are male, who worked in public schools in the fall term of the 2015-2016 academic year and were voluntarily involved in the research. Some demographic attributes of the participating teachers and certain information about the schools the teachers work in are identified through the demographic information form the teachers are asked to fill. The teachers involved in the study work in secondary schools and teach science lessons (subjects of physics, chemistry and biology) at the 5th, 6th, 7th and 8th grade levels. The demographic information about the sample is presented in Table 1. 56.52% of teachers (78 teachers) comprising the sample were female, 43.48% (60) were male. Of the teachers, 44.20% (61 teachers) work in the city center, 40.58% (56 teachers) in district, and 15.22% (21 teachers) in village/rural area. In Gaziantep and Kilis, the majority of the population lives in the city center of the province and a very small part in the villages. The population was taken into account in data collection.

Table 1

Demographic Characteristics of the Sample

Gender		n	%
	Female	78	56.52
	Male	60	43.48
	Total	138	100
Location of School		n	%
	City center	61	44.20
	District center	56	40.58
	Village/Rural area	21	15.22
	Total	138	100
Teacher' years of teaching experience		n	%
	1-5 Year	97	70.29
	6-10 Year	21	15.22
	11-15 Year	17	12.32
	16-20 Year	3	2.17
	Total	138	100

"Acid-Base Self-Efficacy Perception Scale (ABSPS)" was applied to teachers by either contacting one-to-one (79 teachers) or through an online survey by Google Form (59 teachers). The data collected through one-to-one contact were obtained from the teachers working in Gaziantep province (40) and Kilis province (39) from Turkey. The researchers of the present study went to the middle schools to administer the scale to the teachers. Also, data gathered by online contact was taken from 59 teachers working in cities. Convenience sampling was used to collect data and sample the138 science teachers working in City center/District center/Village school in Turkey. Gaziantep and Kilis are two provinces in the south of Turkey. Due to the fact that the second author is a researcher in the Kilis province, data were gathered from Gaziantep and Kilis. The researchers of the present study went to the schools to administer the scale, gather the demographics information from teachers, and collect the data. Participants have been informed that their data will be collected for scientific research purposes only and evaluated anonymously.

Data Gathering Tool

The research data was obtained through 'Acid-Base Self-Efficacy Perception Scale (ABSPS). For this study, the reliability and validity procedures of ABSPS were developed by Ilhan and Cicek (2017). ABSPS is comprised of 14 items with a five-point Likert type (strongly disagree, disagree, neutral, agree, and strongly agree). ABSPS consists of two dimensions entitled "Relating to Daily Life" and "Knowledge on topic and scientific explanation". In the current study, the reliability and validity of the scale were examined again for science teachers. The present study is aimed at determining the science teachers' perception of self-efficacy related to acid-base subjects of science/chemistry. In this respect, the scale used in this study was developed for the study.

Reliability and Validity for Data and Scale

In a previous study, ABSPS developed by Ilhan and Cicek (2017) was used with preservice teachers. In this study, the reliability and validity of the data obtained from the science teachers was assessed. For all of the data in this research (from 138 science teachers), the Cronbach's Alpha reliability coefficient is calculated as 0.827 in the data for all of the items of ABSPS. In addition, the Cronbach's Alpha reliability coefficient is calculated as 0.672 for the sub-dimension of 'Relating to daily life' and 0.742 for the sub-dimension of 'Knowledge on topic and scientific explanation'.

To assess the reliability of data in this study, differences between mean values of data obtained by the researchers by contacting one-to-one and online contact were investigated. Independent samples t-test, used to test differences between mean, showed that a significant difference was not found between the two groups of data ($t(136) = -0.587$, $p>.05$). Thus, the data gathered online was accepted as reliable and is analyzed after being combined with other data.

Confirmatory Factor Analysis (CFA) for Data and Scale

Confirmatory factor analyses for validity were carried out. CFA is a method used for determining the goodness of fit for the model (Tabachnick & Fidell, 2001). In the data of this research, the CFA was performed by the program of Lisrel 8.7 (Linear Structural Relation Statistics Package Program, Joreskog & Sorbom, 2001). CFA results are displayed in Table 2.

In this study, among the most frequently used fit indexes within CFA, root mean square error of approximation (RMSEA), root mean square residual (RMR), standardized root mean square residual (SRMR), the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), comparative fit index (CFI) are considered (Joreskog & Sorbom, 2001).

Table 2

Index Values of the Fit Statistics

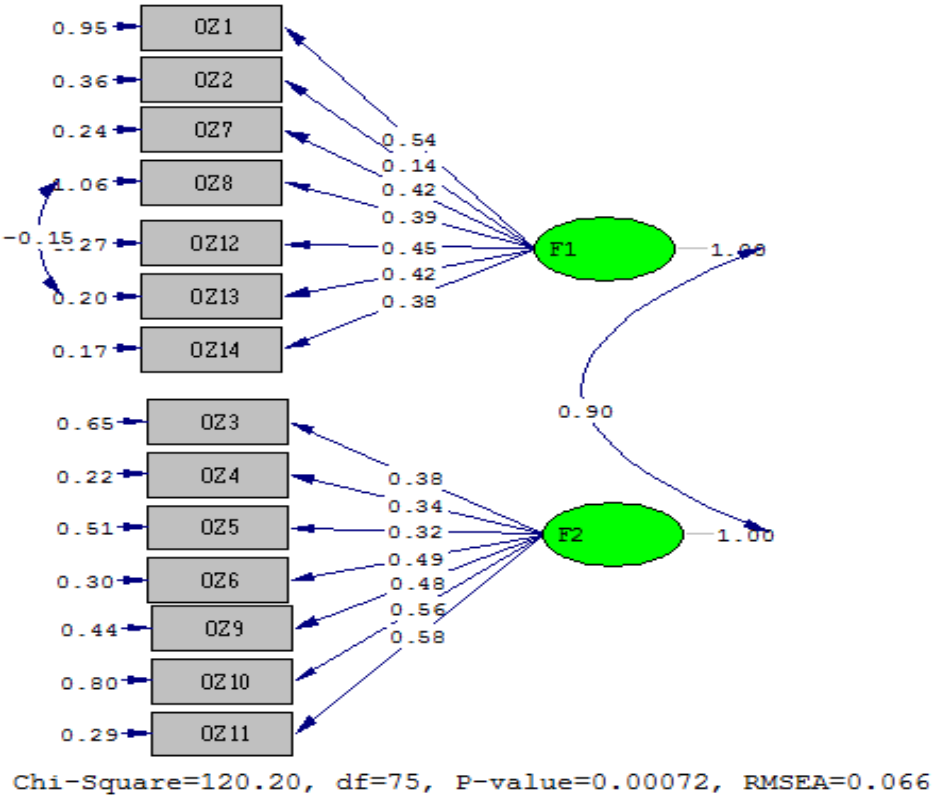
X2	X2\ df	RMSEA	RMR	SRMR	GFI	AGFI	NFI	CFI
120.2	1.60	0.066	0.047	0.064	0.89	0.84	0.90	0.96

As it is shown in Table 2, the value acquired through dividing the chi-square value (120.20) by the degrees of freedom (75) is 1.60. Kline (2005) accepts that a value below 3 is a perfect fit. The value found by this research indicates the perfect fit.

It can be claimed that all the values of RMSEA (0.066), RMR (0.047), SRMR (0.064), GFI (0.89), AGFI (0.84), NFI (0.90), CFI (0.96), among the goodness of fit indexes, for Acid-Base Self-Efficacy Perception Scale are at an acceptable level. The Path Diagram of confirmatory factor analysis for ABSPS is shown in Figure 1.

Figure 1

Path Diagram of CFA for ABSPS



Data Analysis

Statistical data analysis methods were chosen by the purpose and research questions of the present study. The descriptive statistical calculations were carried out in examining the data obtained in this research to detect the variables' distribution according to the sample attributes. For the analysis

of the data for mean scores, independent sample t-test and one way variance analysis were used. Correlation analyses were used to describe the relationships between variables. Independent sample t-test was used in analyzing the acid-base self-efficacy perception of science teachers concerning the gender variable. For its examination concerning the location of school (city, district, village), one way variance analysis (ANOVA) is employed. The correlation analysis was used for examining the relationship between the acid-base self-efficacy perception of science teachers and the frequency of using science laboratories. The data analysis was carried out by using the SPSS statistical program.

Findings

The descriptive statistical values of total scores for the data obtained with ABSPS are given in Table 3. The minimum score is 44 and the maximum is 70. Furthermore, the average score was 60.09, standard deviation was 6.27, kurtosis coefficient was -.37, and skewness coefficient was -0.35. The fact that these values and the kurtosis-skewness coefficient are within -1/+1, indicates that the values have a normal distribution (Buyukozturk, 2012).

Table 3

Descriptive Statistics for Data Gathered with ABSPS

***N*=138**	**Value**
Mean	60.09
Standard Deviation	6.27
Skewness	-.35
Kurtosis	-.37
Range	26
Minimum	44
Maximum	70

Within the data obtained in this research, according to the teaching expressions of science teachers, the mean (M) of items in the ABSPS range between 3.76 and 4.77. For the scale items of ABSPS, the mean of items and standard deviation values are displayed in Table 4. The items on which the teachers have the highest self-efficacy perception are Item two 'I can make interpretation on the acidic/basic substance for consumer products used in daily life (soap, shampoo, wet towel, cosmetics etc.) according to pH values on packages' (*M*=4.77), Item 14 'I can classify the substances I encountered in daily life to their acidic or basic features' (M=4.61). Those on which teachers have the lowest, are Item 8 'I can explain the correlation between temperature and the acidity of coke' (*M*=3.76), and Item 11 'I feel self-efficacious in scientific discussions related to acid-base substances' (*M*=3.86).

Mean scores of acid-base self-efficacy perception level of both male and female teachers in Table 5 show that female teachers' mean score (*M*=60.50, *Sd*= 6.34) is higher than that of male teachers (M=59.57, Sd= 6.20). However, no significant difference was observed between the acid-base self-efficacy perceptions of science teachers about the gender variable ($t(138)= .866$, $p>.05$).

As it is observed in Table 6, the mean score of teachers working in villages, among the teachers comprising the sample, on the acid-base self-efficacy perception (*M*= 61.29, *Sd*= 6.78) is higher than those of teachers working in cities (*M*= 60.64, *Sd*= 5.81) and of teachers working in districts (*M*= 59.05, *Sd*= 6.52).

Table 4

Descriptive Statistics for Items in ABSPS

		Items	*M*	*Sd*	Reliability
Relating to Daily Life	1	I can determine whether the solution formed by the interaction of water with the substances such as Carbon dioxide (CO2), Ammoniac (NH3) is acidic or basic.	4.06	1.12	0.672
	2	I can make interpretations on the acidic/basic substance for consumer products used in daily life (soap, shampoo, wet towel, cosmetics etc.) according to pH values on packages	4.77	0.62	
	7	I can apply the precaution required for safety and health while using acidic and basic substances (bleach, drain opener).	4.51	0.64	
	8	I can explain the correlation between temperature and the acidity of coke.	3.76	1.10	
	12	I can use in daily life my knowledge about the topic of acid-base I learned at school.	4.40	0.69	
	13	I know the storage conditions of the acid-base substances I encountered in daily life (hydrochloric acid, vinegar, bleach).	4.49	0.62	
	14	I can classify the substances I encountered in daily life to their acidic or basic features.	4.61	0.56	
Knowledge on topic and scientific explanation	3	I can explain the features of chemical substances used in order to remove the calcification of kitchen tools and rust on metal wares.	4.20	0.89	0.742
	4	I have enough knowledge about the features of acid-base substances.	4.51	0.58	
	5	I can scientifically explain the reason for color change appearing when red cabbage juice is dripped over lemon, vinegar, tooth paste, and carbonate.	4.47	0.78	
	6	I can scientifically explain how the stomach and teeth are damaged by acidic food and drink.	4.43	0.73	
	9	I can explain the essential use areas of acidic and basic substances in the industry (food, water purification, petrol).	3.99	0.81	
	10	I know how to conduct an experiment in the laboratory for measuring the pH values of an aqueous solution of salt.	4.00	1.05	
	11	I feel efficacious in scientific discussions related to acid base substances.	3.86	0.79	
		Total	4.29	0.45	0.827

Table 5

Self-efficacy Perception According to Gender Variable

Gender	N	M	Sd	Df	T	P
Female	78	60.50	6.34	136	.866	.566
Male	60	59.57	6.20			

Table 6

Science Teachers' Acid-base Self-efficacy Perception According to Location of School

Location of School	N	M	Sd
City center	61	60.64	5.81
District center	56	59.05	6.52
Village/Rural	21	61.29	6.78
Total	138	60.09	6.27

The results of a one-way ANOVA performed to determine whether the differences between the mean scores of science teachers on acid-base self-efficacy perception were significant about the place of schools are shown in Table 7.

Table 7

One-way ANOVA Test Results According to Location of School

Source	Sum of square	Df	Mean square	*F*	*p*
Between groups	108.585	2	54.292	1.388	.253
Within groups	5279.191	135	39.105		
Total	5387.775	137			

The assessment of Table 7 reveals that there is no significant difference between the acid-base self-efficacy perception of science teachers concerning the place of schools (city, district, village) ($F(2\text{-}135) = 1.388$, $p>.05$).

The teachers are asked to determine their frequency of using the laboratory weekly during science classes within one academic year by assigning it a grade between 1 (I quite rarely use it) and 5 (I always use it). Of the teachers, 6.52% (9 teachers) express that they quite rarely use it, 13.04% (18 teachers) that they always use it, and 27.54% (38 teachers) that they never use it (see Table 8).

Table 8

The Frequency With Which the Teachers Use the Weekly Laboratory

Using the weekly laboratory	Frequency (f)	%
1	9	6.52
2	18	13.04
3	31	22.46
4	24	17.40
5	18	13.04
Not using	38	27.54
Total	138	100

Also, it can be observed in Table 9 that there is a positive significant correlation between the frequency of using the science laboratory by teachers and their acid-base self-efficacy perception level ($r = .364$, $p<.01$).

Table 9

Correlation between the Frequency of Using the Laboratory and Self-efficacy Perception

Variables	1	2
Frequency of using laboratory	-	.364**
Self-efficacy perception	.364**	-

Note. N=138. **p<0.01. **Correlation is significant at the.01 level (two-tailed).

Results and Discussion

This study investigated the acid-base self-efficacy perception of science teachers about gender, the place of school (city, district, village), and the frequency of using the science laboratory. Within the framework of the study, the data was collected through the ABSPS. The validity and reliability of the ABSPS was calculated for the data obtained from the science teachers in this study. Also, the value of Cronbach's Alpha reliability coefficient of the ABSPS demonstrated the reliability. The results of confirmatory factor analysis show that the ABSPS has two dimensions ('Relating to Daily Life' and 'Knowledge on topic and scientific explanation'). These findings acquired from the reliability and validity analyses for science teachers are in congruence with the findings of the scale developed for preservice teachers (Ilhan & Cicek, 2017).

The mean scores were calculated for each item on the ABSPS within the study. The examination of mean scores on items shows that the mean score of teachers on the acid-base self-efficacy perception range is between 3.76 and 4.77, and the overall mean of items is 4.29. According to these scores, it can be said that the acid-base self-efficacy perception of science teachers is generally at a high level. In the study made on the acid-base self-efficacy perception of preservice science teachers by Ilhan & Cicek (2017), it was detected that the mean scores on the items of ABSPS differentiate between 3.28 and 4.14. The comparison of the present study to the study of Ilhan & Cicek (2017) may lead that the acid-base self-efficacy level of teachers is higher than that of preservice teachers. This state may be connected with the fact that teachers are more experienced than the preservice teachers, by considering Bandura's (1997) theory about the direct experiences as a source of self-efficacy perception.

The results of this study reveal that the mean score of female science teachers on the acid-base self-efficacy perception is higher than that of male teachers. However, no significant difference was found between the average scores of teachers on the acid-base self-efficacy perception concerning the gender variable. So, it can be concluded that the gender variable is not influential on the acid-base self-efficacy perception of teachers.

In the study made by Ilhan and Cicek (2017), it was revealed that levels of self-efficacy perceptions on the acid-base topics of the female pre-service science teachers were significantly higher than the male pre-service science teachers. In terms of levels of self-efficacy perceptions, it differs between the results of this study, conducted with science teachers and the results of the study conducted by Ilhan and Cicek (2017) with pre-service science teachers. O'leary (2005) examined the science self-efficacy perception level of science teachers about the gender variable and found that the science self-efficacy perception of female teachers was significantly lower than that of male teachers. Smist (1993) revealed that females have a lower self-efficacy perception on the experimental studies about general chemistry than males, according to the data obtained from the working group aged 17-48. Cetin (2008) investigated that the science teaching self-efficacy belief of students in the department of teaching does not differentiate concerning the gender variable in terms of the aspects of personal science teaching and outcome expectation in science teaching. While certain studies found a difference in terms of the science teaching self-efficacy perception, others did not. This situation shows that science teaching self-efficacy perception can also change according to the cultural contexts or course and subjects. It can be said that measuring the perception of self-efficacy according to the course and subjects is important in this respect. Since no other studies investigating the self-efficacy perceptions of the subject concepts of science/chemistry exist, such discussions have not been given much consideration. In this respect, it is important to measure the acid-base self-efficacy perception in the present study. It is considered that measuring the self-efficacy perception in similar chemistry topics would contribute to the literature.

As the mean scores on the acid-base self-efficacy perception level of science teachers working in a city, district or village are examined, it was found that the mean score of teachers working in a

village is higher than that of teachers working in a city or district according to the results of the study. This finding shows that the place of school (city, district, and village) is not a determinant for the acid-base self-efficacy perception of science teachers.

Furthermore, it was identified that there is a significant positive but weak correlation between the frequency of using science laboratories and the acid-base self-efficacy perception of science teachers. After starting their professional life, teachers make lessons on acid-base chemistry in a laboratory and their experiments enhance the learning experience. The direct experiences about acid-base chemistry, provided in these ways, may have a positive impact on the self-efficacy perception of teachers.

Many studies emphasize that science methods courses improve pre-service teachers' science teaching self-efficacy (Menon, 2020; Naidoo & Naidoo, 2021). These courses can be taught as optional or compulsory courses in teacher education programs. It is important to examine the effects of science teaching methods courses that will prepare science teachers and teacher candidates by arranging them in relation to science subjects (such as acid-base).

In the present study, the relationship between using the laboratory and science teaching self-efficacy perception were revealed. Although the relationship between laboratory use and self-sufficiency is emphasized in the literature (Alkan, 2016; Lee et al., 2019; Uzuntiryaki & Aydın, 2006), studies that reveal the relationship have not been found. In this respect, new results that contribute to the field have been revealed. When evaluated from the point of view of teachers, this discloses the importance of enriching the courses and their contents for the use of laboratories in science teacher preparation programs.

Limitations and Suggestions

One of the limitations of this study was that the sample was not very large. As it is known, it is difficult to make an appointment and go from school to school to collect data from teachers. However, the study may be a resource for researchers studying the self-efficacy perceptions of science teachers in various topics. High self-efficacy of teachers is important, since it leads to high motivation and better performance. The results obtained in this research may provide an insight for researchers, teachers, managers, and teachers training programs concerning the things to do to develop the self-efficacy perception of teachers. Moreover, the environments can be created or activities can be organized to improve the self-efficacy perception level of teachers in various topics, by measuring it frequently.

In Turkey, the subjects in middle/secondary science programs/courses can be covered by use of the laboratory. Although there are laboratories in schools, the use of laboratories is not compulsory. The present study results show that there is a relationship between the use of laboratories in science teaching and acid-base self-efficacy perception of science teachers. In teacher training programs and in-service training programs, more emphasis should be placed on increasing teachers' laboratory skills.

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