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DEVELOPMENT OF CHEMISTRY LABORATORY SELF-EFFICACY BELIEFS SCALE

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Abstract. *Chemistry self-efficacy beliefs have been defined as someone's beliefs about his or her own capability to perform a given chemistry task. These beliefs, one of the affective variables in the laboratory practices which are quite effective for learning science, affect individuals' accomplishment, motivation and anxiety. Self-efficacy is task and domain specific. Therefore, self-efficacy beliefs gathered through chemistry self-efficacy scales cannot be accepted as a predictor of chemistry laboratory self-efficacy beliefs. In this research, an instrument, Chemistry Laboratory Self-Efficacy Beliefs Scale, was developed in order to determine students' self-efficacy beliefs toward chemistry laboratory. Data were collected from 1095 high school students. Validity analysis was examined with Exploratory Factor Analysis, then Confirmatory Factor Analysis was made. The factor analysis revealed 2 factors: psychomotor self-efficacy and cognitive self-efficacy. The reliability analysis was computed with Cronbach alpha coefficient, for the whole instrument it was 0.885. The analyses resulted in the development of a two-factor scale of 14 items that was shown to be valid and reliable. At the same time, this instrument is also the first original instrument developed for determining the students' self-efficacy beliefs toward chemistry laboratory.*

Key words: *chemistry laboratory, high school students, self-efficacy beliefs.*

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Introduction

Self-efficacy is described as the beliefs of individuals about their abilities to successfully complete an action. It is a part of social cognitive theory. Self-efficacy implies that individuals generally believe in doing actions, which they can successfully complete and they do not try the things that they think they will not achieve (Bandura, 1994). While self-efficacy is defined as the judgments of individuals about themselves on how successful they will be in dealing with difficult situations they may encounter (Senemoğlu, 1997), it is related to the beliefs of people about these skills rather than the skills (Akkoyunlu, Orhan & Umay, 2005). Bandura (1986) also describes self-efficacy as the individuals' beliefs in their capacity to organize necessary activities to produce an effective quality in forming the behaviors and performance attainments, and to achieve the goals. Self-efficacy includes the beliefs in performance capabilities of a person rather than physical or psychological characteristics (Zimmerman, 1995). Self-efficacy beliefs of an individual determine his or her feelings, thoughts, behaviors and motivation strategies.

Self-efficacy beliefs are related to individual judgments about how well the necessary actions can be performed to handle possible situations (Hazır-Bıkmaz, 2004). These beliefs affect the choice of activities an individual wants to do, the level of the efforts and the performance (Ekici, 2006). According to Bandura, self-efficacy is highly important for the emergence of individuals' behaviors and the formation of new behaviors. People with strong self-efficacy beliefs can even complete difficult tasks easily. These people see challenges to be mastered, rather than threats to be avoided (Bandura, 1994). It is stated that people with a strong sense of self-efficacy maintain strong efforts to achieve the goals and they are persistent and patient (Aşkar & Umay, 2001). They are alleged to approach a difficult situation as something which must be overcome, rather than avoiding doing it (Hazır-Bıkmaz, 2004). Self-efficacy beliefs are crucial as they are effective factors in the performance and choices of the people. Self-efficacy beliefs determine the quality of the actions we do and our goals in the life (Kapıcı-Zengin, 2003).

It is possible to remark that self-efficacy is related to the situations such as previous experiences, indirect experiences and positive feedbacks (Yıldırım & İlhan, 2010). Learners with strong self-efficacy beliefs aim at new tasks, show stability in these tasks and achieve ultimate success (Britner, 2008; Zeldin & Pajares, 2000). This kind of learners trust in their abilities when they confront with problems and motivate themselves (Bandura, 1986; Schunk, 1989). Self-efficacy beliefs are multidimensional and associated with various areas. For example, self-efficacy beliefs in mathematics course differ from those in English course (Zimmerman, 1995). Therefore, self-efficacy beliefs gathered through chemistry self-efficacy scales cannot be accepted as a predictor of chemistry laboratory self-efficacy beliefs.

The most outstanding feature that distinguishes natural sciences from other types of science is that it enables learners to improve their questioning, searching, hypothesizing and interpreting skills by emphasizing the importance of doing experiments, observing and discovering. Laboratories provide unique opportunities that facilitate attainments which are difficult to gain through other ways for learners and teachers. They contribute to the development of learners' skills such as observation, thinking, generating ideas and interpretation. The laboratory is an effective learning environment in which learners can gain the target subject or the concept via experiencing or demonstration. Laboratory work affects reasoning, critical thinking and understanding the science and teaches learners the ways to produce knowledge (Akdeniz, Çepni & Azar, 1998). For this reason, laboratory work is one of the focal points of science teaching. Science educators express that "carrying out science activities" is an efficient way for learners to learn, to store and to use the scientific knowledge (Seifert, Fenster, Dilts & Temple, 2009). Science laboratory applications are defined as learning experiences in which learners interact with tools and/or models to observe and understand the natural world (Hofstein & Lunetta, 2004). The laboratory method is described as the pathway the learners follow to learn by investigating in groups or individually through techniques such as observation, experiments, learning by doing and demonstration in laboratories or specially equipped classrooms (Ergün & Özdaş, 1997). Science laboratory applications provide rich experiences for students to transfer into their business life (Omiko, 2015). Applied activities and laboratory experiences have a significant place in facilitating science achievement and mental development (Niaz & Lawson, 1985; etc.: Ertepınar & Geban, 1996).

Affective and social factors as well as cognitive factors are effective in learning science concepts. Students' needs, interests, goals and expectations play an important role in interpreting the knowledge. The related research shows that positive emotions such as affection for learning ensure high motivation and achievement (Laukenmann, Bleicher, Fuss, Gläser-Zikuda, Mayring & von Rhöneck, 2003). There are numerous studies highlighting the effectiveness of another affective factor, self-efficacy beliefs, on motivation, learning, achievement, stress and anxiety (Pintrich & De Groot, 1990; Pajares & Miller, 1994; Schunk, 1995; Pajares, 1996; Pajares, Britner & Valiante, 2000; Pajares & Schunk, 2001; Cavallo, Potter, & Rozman, 2004; Britner & Pajares, 2006). When the learners who are suspicious of their learning abilities and those who think they will be efficient in learning or performing a task are compared, it is seen that the learners in the latter can easily participate in the tasks, study harder and they are more persistent and successful when confronted with difficulties (Schunk & Pajares, 2001). Self-efficacy beliefs have a strong effect which can be noticed by learners themselves in their achievement levels. A strong sense of self-efficacy increases the levels of individuals such as achievement and being good (Pajares & Schunk, 2001). In the fields where laboratory applications are employed, self-efficacy beliefs of people influence their motivation, anxiety, attitudes and achievements. The related literature shows that many scales such as high school chemistry self-efficacy scale (Çapa-Aydın & Uzuntiryaki, 2009), college chemistry self-efficacy scale (Uzuntiryaki & Çapa-Aydın, 2009), chemistry attitudes and experiences questionnaire (Dalgety, Coll & Jones, 2003) have been developed to determine the chemistry self-efficacy beliefs of learners. Yet, there is no scale developed for identifying chemistry laboratory self-efficacy beliefs.

Research Focus

People's beliefs about their ability predict the subsequent behaviour better than their knowledge or prior attainments (Bandura, 1994). Therefore, individuals' perceptions of their abilities are powerful motivators that affect the choices they make, the effort and persistence they put forth, and the resilience they show in overcoming obstacles. Self-efficacy beliefs also play a mediational role in that they serve as filters between prior achievements or abilities and subsequent behavior (Zeldin, Birtner & Pajares, 2008). In particular, students' choices of science-related activities, their efforts to perform them successfully, and their persistence and resilience in overcoming obstacles are more affected by their self-efficacy beliefs than by their prior knowledge. Students with high self-efficacy beliefs are likely to select more challenging tasks and show more effort and persistence to accomplish them. This explains the reason of the difference in the academic performance of students of similar ability (Pajares, 1996). In addition, self-efficacy is task and domain specific. For example, students' high self-efficacy in chemistry does not mean that they have high self-efficacy to chemistry laboratory. Therefore, researchers should be careful in assessing and interpreting students' judgments about their abilities to perform required tasks within a specific domain (Uzuntiryaki, 2008). The literature review indicates that there are many scales developed with the aim of investigating chemistry self-efficacy beliefs of learners. But with these scales it is not possible to determine the chemistry laboratory self-efficacy beliefs. Because self-efficacy is specific to the field. However, it has been ascertained that there is no scale to determine chemistry laboratory self-efficacy beliefs. Based on this, the aim of the current research is to develop a scale to identify chemistry laboratory self-efficacy beliefs. Firstly, an item pool was created, it was administered to the sample group and the data were analyzed.

Methodology of Research

Development of the Instrument

To develop the chemistry laboratory self-efficacy beliefs in a Likert format, an extensive review of the literature on general self-efficacy, science self-efficacy and chemistry self-efficacy was carried out. Furthermore, literature on self-efficacy beliefs was also reviewed to identify instruments used in research studies. The literature was firstly reviewed in the process of developing chemistry laboratory self-efficacy beliefs scale. Within the scope of our research, literature relevant to high school chemistry self-efficacy scale (Çapa-Aydın & Uzuntiryaki, 2009), college chemistry self-efficacy scale (Uzuntiryaki & Çapa-Aydın, 2009), chemistry attitudes and experiences questionnaire (Dalgety, Coll & Jones, 2003) have been developed to determine the chemistry self-efficacy beliefs of learners. According to past studies, there was no tool available to measure students' chemistry laboratory self-efficacy beliefs. Therefore, a tool to measure the chemistry laboratory self-efficacy beliefs of high school students was developed. This stage was followed by writing the items to measure the chemistry laboratory self-efficacy beliefs. An item pool was created utilizing the information obtained. These expressions were examined by the experts in assessment evaluation, attitudes, measuring attitudes and the field. In line with the expert opinions, the items in the item pool went through preselection and were prepared for the trial application of draft scale with 20 items. The draft scale with 10 positive and 10 negative items was edited in order not to cause any bias. The items in the "Chemistry Laboratory Self-Efficacy Beliefs Scale" were graded by using a Likert type scale with 5 points. The positive items in the scale were scored from 5 to 1 with the choices "I totally agree= 5", "I agree= 4", "I partly agree= 3", "I don't agree= 2" and "I strongly disagree= 1", and the negative items were scored from 1 to 5 with quite the opposite choices. The same group of experts was consulted for conformity with the operational structure determined based on the theoretical framework, and thus the content validity of the scale was achieved qualitatively.

Sample of Research

The sample size is very important in the scale development process. Tabachnick and Fidelle (2007) described as 300 persons "good", 500 people "very good" and "1000" persons "excellent" for factor analysis and it allows for statistical analysis on data obtained from these candidates. Therefore, the sample size for the research was decided to be over 1,000. The sample of the research comprised of 1200 high school students receiving education in Ankara. The high school students who participated the research were selected from four different district in Ankara. High school students participated to scale application as volunteers. 1095 of the questionnaires administered to students were returned as usable and evaluated.

Procedures

Chemistry laboratory self-efficacy beliefs scale, consisting of 20 items five-point Likert format, has been applied in Ankara district. The permission to carry out the research was obtained from the head of the chemistry department in the schools; students were given the information leaflet regarding the research. The participation was voluntary and students' confidentiality was guaranteed throughout the process. During the application, the scale was administered to the students during chemistry lessons. The entire scale took them about 20 minutes to complete. During the administration of the scale, both the chemistry teachers and the researcher explained the objective of the research to the students again. While students were answering the scale, the teacher and the researcher were there to deal with the students' questions as they were completing the scale.

Data Analysis

Validity and reliability analyses were carried out according to 1095 data gathered through chemistry laboratory self-efficacy beliefs scale. Construct validity of the scale was examined with Exploratory Factor Analysis. With exploratory factor analysis is determined the factor structure of the scale. After that confirmatory factor analysis was used to determine whether the specified factor structure is valid or not. Reliability levels of the whole scale and sub-factors were calculated by Cronbach-alpha internal consistency coefficient. In order to prove that the two sub-factors of the chemistry laboratory self-efficacy scale assessed the same feature, Pearson Correlation Coefficients were calculated.

Results of Research

Validity

Construct validity of the scale was analyzed through the Exploratory Factor Analysis. The data was controlled via Kaiser-Meyer-Olkin (KMO) Measures of Sampling Adequacy and Bartlett's Sphericity Test. The data was found appropriate for the factor analysis as Kaiser-Meyer-Olkin (KMO) value was computed as higher than .60 and Bartlett's Sphericity Test result was significant (Tabachnick & Fidell, 2007). Principal component analysis was conducted to the 20 items. In determining the number of factors varimax rotation was used. Eigenvalues statistics values of factors which were higher than 1 were evaluated as significant. Moreover, when deciding for an item to take place in the scale, it was important that the factor loading values needed to be .45 or higher and the covariance values (communalities) needed to be .30 or more. KMO value for the scale involving chemistry laboratory self-efficacy beliefs was computed .94 and the Bartlett's Sphericity Test significance level was 0.0001 ($p<0.0001$). These findings indicate that the data were appropriate for the factor analysis.

As a result of the exploratory factor analysis, 6 items, which were not suitable for the structure of the scale and loaded into multiple factors, were excluded from the scale. It was ascertained that remaining 14 items had two-factor structure. While the factor which included the expressions representing the self-efficacy beliefs of students regarding the laboratory skills out of the items in the Chemistry Laboratory Self-Efficacy Beliefs Scale was called as *psychomotor self-efficacy beliefs*, the factor involving the statements about the self-efficacy beliefs in the abilities of using data gathered through the experiments was named as *cognitive self-efficacy beliefs*. The factor analysis of the chemistry laboratory self-efficacy beliefs scale is given in Table 1.

Table 1. The exploratory factor analysis results and descriptive statistics of the Chemistry Laboratory Self-Efficacy Beliefs Scale.

	M	SD	Factor Loading
1. Psychomotor self-efficacy beliefs			
5. I can record the data that I obtain from the experiments in the laboratory.	3.45	1.17	.742
7. I can use the glassware in the laboratory properly.	3.39	1.17	.753
8. I can set the laboratory experimental setup myself.	3.28	1.17	.647
11. I can do the basic measurement procedures (temperature, weighing,,) applied in the laboratory.	3.39	1.18	.714
12. I can easily solve a problem that I encounter in the laboratory.	3.19	1.11	.488
13. It is not difficult for me to achieve my goals in the laboratory.	3.28	1.12	.714
14. I know how to work with dangerous chemicals in the laboratory.	3.28	1.19	.712

	M	SD	Factor Loading
2. Cognitive self-efficacy beliefs			
1. I cannot use the knowledge I learn in the Chemistry class when laboratory testing.	3.15	1.22	.677
2. I have problems in converting the units used in the chemistry into each other in the laboratory.	3.12	1.09	.661
3. I cannot remember the formulas of chemical compounds used in the laboratory.	3.17	1.09	.512
4. I cannot interpret the data obtained from the experiments in the laboratory.	3.16	1.14	.553
6. I cannot know the chemistry terms used commonly in the laboratory.	3.15	1.14	.711
9. I cannot use the equipment in the laboratory (scales, heater,,,).	3.18	1.25	.705
10. I cannot draw the graphs about the findings of the experiments in the laboratory.	3.15	1.22	.709

According to the table, the first sub-factor named as psychomotor self-efficacy beliefs is composed of 7 items. This sub-factor alone explains 26.6% of the total variance. The second sub-factor is comprised of 7 items and called as cognitive self-efficacy beliefs. This sub-factor alone explains 23.8% of the total variance. As 30% or more variance in the single factor scales is seen adequate in the scale development studies, it is expected that the variance needs to be higher in multiple factor scales (Büyüköztürk, 2004). Two-factor structure of the scale as psychomotor self-efficacy beliefs and cognitive self-efficacy beliefs explains 50.4% of the variance related to the chemistry laboratory self-efficacy beliefs. Factor loadings of the items forming the scale vary between 0.49 and 0.75.

The Results of the Confirmatory Factor Analysis

The first and second order Confirmatory Factor Analysis in LISREL 8.7 program were used to test whether two-factor structure of the scale specified as a result of the exploratory factor analysis of the chemistry laboratory self-efficacy beliefs scale was valid. Chi-square statistics fit indexes were computed as χ^2=423.6 (sd=76, p<.000) as a result of the first order confirmatory factor analysis. Fit indexes were (χ^2/sd)=5.57, GFI=0.95, AGFI=0.93, NFI=0.97, CFI=0.97, SRMR=0.041, RMSEA=0.065. According to the literature, the values from fit indexes do not meet χ^2/sd value, and other fit indexes have the CFI absolute fit and GFI, AGFI, NFI, SRMR and RMSEA relative fit indexes (Kline, 2005; Sümer, 2000; Tabachnick & Fidell, 2007; Jöreskog & Sörbom, 1993). The modification index which was proposed as a result of the first order confirmatory factor analysis was examined and modification was done between V9 and V10 items explained by the same factor. New fit indexes of second order confirmatory factor analysis were (χ^2/sd)=4.84, GFI=0.95, AGFI=0.94, NFI=0.97, CFI=0.98, SRMR=0.038, RMSEA=0.059. It was revealed that this modification provided a significant contribution to the model fit. The investigation of the scale fit indexes indicated that the fit indexes were at an acceptable level. The results of confirmatory factor analysis of the scale supported the fact that it had a two-factor structure. The construct validity of the scale is ensured thanks to these findings. Confirmatory factor analysis results of the chemistry laboratory self-efficacy beliefs scale are given in Figure 1.

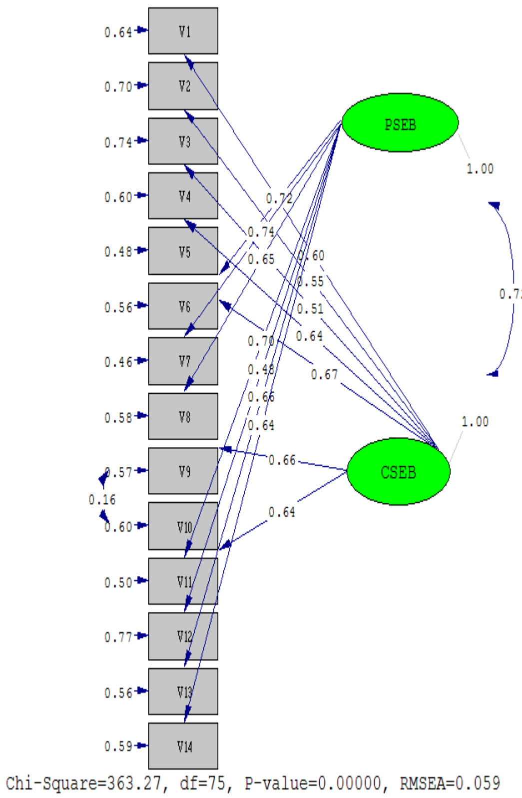

Figure 1: The confirmatory factor analysis model of the Chemistry Laboratory Self-Efficacy Beliefs Scale (Standardized Values).

Reliability

Cronbach alpha reliability coefficient for the whole scale and each sub-factor was calculated for the reliability of the chemistry laboratory self-efficacy beliefs scale. Cronbach alpha reliability coefficient and item test correlation were computed for the reliability and homogeneity of the scale.

Table 2: The reliability results of the Chemistry Laboratory Self-Efficacy Beliefs Scale.

Scale	α
Sub-Factor	0.847
Sub-Factor	0.818
Totaly scale	**0.885**

According to the Table 2, it is clear that Cronbach alpha reliability coefficient for the overall scale is 0.885, the reliability for the first factor is 0.847, and the reliability for the second factor is 0.818. All these findings prove that the scale has reliability at a satisfactory level. The scale is highly reliable and its alpha value is higher than 0.80 which is an accepted value for the research in social sciences (Nunnally, 1967).

The correlation analysis between the sub-factors of the chemistry laboratory self-efficacy beliefs scale is presented in Table 3.

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Table 3. The correlation analysis between the sub-factors.

	1. Sub-Factor.	2. Sub-Factor.
1. Sub-Factor Pearson Correlation	1	.607**
Sig. (2-tailed)		.000
N	1095	1095
2. Sub-Factor Pearson Correlation	.607**	1
Sig. (2-tailed)	.000	
N	1095	1095

***Correlation is significant at the 0.01 level (2-tailed).*

The correlation between the values of sub-factors in the scale is 0.607 and correlation coefficient is significant at 0.001. When the relationship between the correlation analysis and the factors is examined, it is clear that a significant positive correlation is found between the first and the second factor (0.607) ($p<0.001$). The analysis results highlight that positive and significant correlations ($p<0.001$) exist between the factor values of the chemistry laboratory self-efficacy beliefs scale and these two factors are the components of the chemistry laboratory self-efficacy beliefs. The consistent factor structure of the scale developed supports its validity as well. In other words, the factor variables could be evaluated as complementary to each other.

Discussion

Self-efficacy has been defined as one's perception of his/her own ability to perform a given task with a certain level of competency. This construct is relevant to student learning because, according to the theory, if a student does not feel able to do the tasks necessary for learning a subject, he/she will try to avoid those tasks (Bandura, 1986). When a student's self-efficacy is stronger, the student will choose hard learning tasks, will hold to them and finally will complete them successfully (Britner & Pajares, 2001; Zeldin et al., 2008). A positive sense of self-efficacy enhances motivation, ensures to cope with new and difficult tasks and makes willing to endeavor, low levels of self-efficacy cause failure in treating people with one's own initiative or giving up without accomplishing a task (Jerusalem, 2002). High self-efficacy beliefs improve the achievement and thus the happiness of individuals (Kiremit, 2006). Self-efficacy influences thought patterns and emotions that enable classroom actions (Pendergast, Garvis, & Keogh, 2011). There are many motivational constructs, self-efficacy is one that is the key to promoting students' engagement and learning. Self-efficacy is discussed in terms of how it may facilitate behavioral, cognitive, and motivational engagement in the classroom (Linnenbrink & Pintrich, 2003).

One important aspect of the construct of self-efficacy is that it is task specific and context specific feature; therefore, students' perceptions of their ability to perform well on like chemistry related tasks in a particular course would be measured by their chemistry self-efficacy while taking that course (Villafañe, 2015). Chemistry self-efficacy has been defined as a student's beliefs about his or her own capability to perform a given chemistry task. These chemistry self-efficacy beliefs can be influenced by students' experiences in a course, and eventually, these beliefs could affect students' decisions to continue in their careers (Villafañe, Garcia, & Lewis, 2014). It has been assumed that a well-designed preparatory chemistry course should lead to increases in chemistry content knowledge as well as in chemistry self-efficacy (Schmid, Youl, George, & Read, 2012). Chemistry laboratories for chemistry education are vital learning environments (Singer, Hilton, & Schweingruber, 2005). Hofstein and Lunetta (2004) noted that the primary emphasis of laboratories should not be limited to learning certain scientific methods or laboratory techniques, but rather laboratories should allow students to investigate phenomena by using the methods and procedures of science there by enabling them to solve problems. Laboratory experience including developing scientific reasoning; realizing the complexity and ambiguity of empirical work; having a more contemporary view of the nature of science; and developing collaborative skills (Singer et al., 2005). Students are incorporated in a questioning environment where they can be effective through not only hands on experiences but also minds on experiences in the well-planned laboratory and simulation practices (Lunetta, Hofstein & Clough, 2007). Self-efficacy beliefs which are the beliefs in a learner's own abilities to participate in laboratory practices where questioning is operative and in successfully completing the laboratory practices need to be high. Learners' perceptions towards their abilities, i.e. self-efficacy beliefs, are a powerful motive affecting their efforts, persistence and achievement to overcome the problems that can emerge in the future. Self-efficacy beliefs, which are factors influencing learners' choice, stability, motivation and achievement, are also crucial in chemistry laboratories as they are applied in sciences. Therefore, it is needed to develop a measurement tool to determine the effect of self-efficacy beliefs on the chemistry laboratory.

The aim of the current research is to develop a reliable and valid measurement tool to determine the chemistry laboratory self-efficacy beliefs. For this purpose, a draft scale was prepared and administered to high school students. For validity, reliability and homogeneity of the scale data were analyzed. At the end of analyzing the data, it was found out that the scale had two-factor structure, named psychomotor self-efficacy beliefs and cognitive self-efficacy beliefs. Confirmatory factor analysis was carried out in order to determine, whether the model obtained as a result of the exploratory factor analysis would support the expected theoretical structure. When the fit indexes of the two-factor scale are analyzed via the confirmatory factor analysis, it is evident that these fit indexes are at an acceptable level. According to the findings of the confirmatory factor analysis and the exploratory factor analysis, construct validity of the scale is ensured. Cronbach alpha reliability coefficient and item test correlations were computed for the reliability and homogeneity of the scale. Cronbach alpha reliability for the whole scale was 0.885, Cronbach alpha reliability for the psychomotor self-efficacy beliefs factor was 0.847, and Cronbach alpha reliability for the cognitive self-efficacy beliefs was calculated as 0.818. The correlation analysis of the relationship between the factors indicated that there was a positive and significant relationship between the psychomotor and cognitive self-efficacy beliefs. This finding prove that psychomotor self-efficacy beliefs and cognitive self-efficacy beliefs are the components of the chemistry laboratory self-efficacy beliefs. When the findings of the research and those in the literature are compared, two-factor structure of the chemistry laboratory self-efficacy beliefs scale is verified, and a reliable and valid measurement tool has been developed.

Conclusions

Changes in learners' knowledge are firstly taken into account while assessing the effectiveness of educational programs. The objective of the educational programs is to create permanent and desired behavioral changes in individuals through their experiences. It will be useful for the educators in this process to know the level of self-efficacy and to determine the change in the level of self-efficacy. Thus, the opportunity to evaluate the educational programs in terms of the capacity of providing not only knowledge but also experiences will emerge.

Self-efficacy beliefs, one of the affective variables in the laboratory practices which are quite effective for learning science, affect individuals' accomplishment, motivation and anxiety. When the purpose of the chemistry laboratory experience understood well it can be a valuable learning environment. In order for individuals to develop self-efficacy beliefs in any field, they first need to have sufficient knowledge and subsequently the experiences. From this point of view, if the chemistry laboratory self-efficacy beliefs of learners are desired to be improved, their participation in the laboratory practices should be ensured and their experiences need to be enhanced in this way. A measurement tool is needed to investigate the change in learners' self-efficacy beliefs. The present research has conducted a scale of chemistry laboratory self-efficacy beliefs of students at high schools. A reliable and valid scale with 2 factors and 14 items has been developed as a result of the research. Reliability coefficient of the measurement has been achieved at a desired level. Therefore, it can be claimed that the items in the scale measure the target structure accurately. On the other hand, it is concluded that the scale items predict the target structure in terms of construct validity.

This research has been carried out on a sample composed of only high school students. It may also be investigated whether the structure emerged through the sample of high school students can be verified in other various groups as well. Also, the relationships between the chemistry laboratory self-efficacy beliefs and other variables can be studied.

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