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KİMYA ÖĞRETMEN ADAYLARININ YAPILANDIRMACI ÖĞRENME ORTAMI OLUŞTURMAYA YÖNELİK TERCİHLERİNİN İNCELENMESİ

EXAMINATION OF PRE-SERVICE CHEMISTRY TEACHERS' PREFERENCES FOR CREATING CONSTRUCTIVIST LEARNING ENVIRONMENT

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ÖZET: Bu çalışmanın amacı kimya öğretmen adaylarının gelecekte yapılandırmacı öğrenme ortamı oluşturmaya yönelik tercihlerini belirlemektir. Bu amaç doğrultusunda, Yapılandırmacı Öğrenme Ortamı Ölçeği (YÖOÖ) öğretmen adayları için Türkçe'ye uyarlanmış ve geçerlik çalışması doğrulayıcı ve açıklayıcı faktör analizleri kullanılarak yapılmıştır. Veri analizi LISREL 8.71 ve SPSS 15. 0 programları kullanılarak gerçekleştirilmiştir. Sonuçlar beş faktörlü ölçeğin yapısını desteklemektedir. Ayrıca, her bir alt boyutun güvenirlik değerleri yeterince yüksektir. YÖOÖ' nün geçerli ve güvenilir Türkçe formunun kimya öğretmen adaylarına uygulanması sonucu "düşüncelerini serbestçe ifade etmeyi öğrenme" alt boyutunda en yüksek ortalama değeri gözlenmiştir (25.44). *Dünya hakkında öğrenme* (24.94) ve *iletişim kurmayı öğrenme* (24.33) alt boyutlarının ortalama değerleri *öğrenmeyi öğrenme* (22.12) ve *fen hakkında öğrenme* (21.07) alt boyutlarının ortalama değerlerinden daha yüksektir. Sonuçlar tartışılmış ve öğretmen eğitimi için öneriler sunulmuştur.

Anahtar sözcükler: Yapılandırmacı Öğrenme Ortamı Ölçeği (YÖOÖ), yapılandırmacılık, öğretmen adayı.

ABSTRACT: The purpose of the study was to examine pre-service chemistry teachers' preferences for creating constructivist learning environment in their future class. For the specified purpose, Constructivist Learning Environment Scale (CLES) was adapted to Turkish and validated for pre-service chemistry teachers by conducting Confirmatory and Exploratory Factor Analyses. The data analyses were carried out utilizing LISREL 8.71 and SPSS 15.0 programs. Results supported 5-factor structure of CLES. Moreover, Cronbach's alpha value for each scale was found to be sufficiently high. Administration of Turkish version of the CLES as a valid and reliable instrument revealed that *learning to speak out* subscale of the CLES had the highest mean value *(M=25.44)*. The mean of *learn about the world* (M=24.94), and *learn to communicate* (M= 24.33) subscales were higher than that of *learn to learn (M=22.12)* and *learn about science* (M= 21.07) subscales. Discussion of the results and suggestions for teacher education were provided.

Keywords: Constructivist Learning Environment Scale (CLES), constructivism, pre-service teachers.

1. INTRODUCTION

Although describing learning environment is a bit problematic due to its nature, Wilson (1996) describes learning environment as "a place where people can draw upon resources to make sense out of things and construct meaningful solutions to problem" (p.3). According to Wilson, learner and the setting are two basic elements of the learning environment which is a significant construct affecting students' learning and affective variables (McRobbie & Fraser, 1993; Fraser, 1998). Fraser (2001) emphasized the time spent in school "[b]ecause students spend approximately 20,000 hours in classrooms by the time that they have graduated from university, students' reaction to their teaching-learning experiences are of considerable importance" (p.1). Additionally, attaining the educational objectives is conditional upon the quality of classroom learning environment (Fraser, 2001). However, the significance of learning environment on learning does not take notice of teachers.

Learning environment consists of two levels, namely, school level environment and class level environment (Fraser & Rentoul, 1982, as cited in Fraser, 1998). School level environment is related to educational administration whereas the class level one is related to teaching and learning environment of the class. The focus of the present study is the latter one. Pre-service chemistry teachers' preferences for creating learning environment in their future classes will be examined in this research.

1.1. Related Literature

There have been different lines of research studies carried out regarding the learning environment (Aldridge, Fraser, Taylor & Chen, 2000). For example, learning environment instruments have been used to examine the relationship between student outcomes and environment, to evaluate

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the educational innovations, to examine differences between students' and teachers' perceptions of the same classrooms, to investigate whether students achieve better in their preferred environments, and to conduct cross-national studies.

Several research studies indicated an association between learning environment and students' cognitive and affective outcomes (McRobbie & Fraser, 1993). To illustrate; it was found that classroom learning environment was the strongest predictor of attitude toward science (Simpson & Oliver, 1990), which indicates the importance of consideration of the learning environment by teachers.

1.2. Instruments Assessing Learning Environment

To assess learning environment, several instruments have been developed, for instance, *Learning Environment Inventory (LEI)* (Walberg & Anderson, 1968), *Classroom Environment Scale (CES)* (Moos, 1979), *My Class Inventory (MCI)* (Fisher & Fraser, 1981), *Individualized Classroom Environment Questionnaire (ICEQ)* (Fraser, 1990), *What is Happening in this Class (WIHIC) Questionnaire* (Fraser, McRobbie, & Fisher, 1996) and *Constructivist Learning Environment Survey (CLES)* (Taylor & Fraser, 1991; Taylor, Fraser, & Fisher, 1997).

1.3. Constructivist Learning Environment Survey

One of the instruments measuring the learning environment is the CLES. "[It] was developed to assist researchers and teachers to assess the degree to which a particular classroom's environment is consistent with a constructivist epistemology, and to help teachers to reflect on their epistemological assumptions and reshape their teaching practice" (Fraser, 2007, p.107). CLES has been validated in several countries such as Korea (Lee & Taylor, 2001), Taiwan (Aldridge et al., 2000), Australia (Taylor et al., 1997), and United States of America (Dryden & Fraser, 1998).

The original scale includes 30 items under five subscales that are learning about the world (from item 1 to 6), learning about science (7 to 12), learning to speak out (13 to 18), learning to learn (19 to 24), and learning to communicate (25 to 30). The scale is 5-point Likert type scale ranging from 1= almost never to 5= almost always.

1.4. Constructivism

With the new perspectives in learning theories, changes in instruments measuring learning environment have taken place (Tobin & Fraser, 1998). Constructivist view of learning has become popular from the late 1980s in all around the world (Duit & Treagust, 1998). Constructivist view of learning states that learners should actively be involved in learning process. Moreover, knowledge construction should be through their experiences and prior knowledge, rather than receiving knowledge told by teachers. In this view, the role of the teacher is to guide learners in this process and provide appropriate experiences to learners. In addition, social interaction, collaboration between both teachers and students, and students and students, are also important for knowledge construction (Driscoll, 2005).

1.5. Significance of the Study

Classroom environment, also referred as climate, atmosphere or ambience, is an important concept that needs to be considered for students' learning process. First, in order to get a complete picture of the educational process, it is vital to assess the classroom environment as well as learning outcomes (Fraser & Wubbels, 1995; Fraser, 1998, 2001). Second, classroom environment research is also important in teacher education since assessment of pre-service teachers' preferences for their ideal classroom environment would give feedback about teacher education programs. Third, elementary and high school curricula have been changed in Turkey recently. The new ones are based on constructivist view. In the curricula, developers recommend students' active participation to the learning process, discussions, and sharing ideas in the class. In other words, the importance of preparing and providing a learning environment that is parallel with constructivism is also emphasized (National Ministry of Education, 2006). To sum up, curricula reform in Turkey requires teachers change their teaching strategies towards more constructivist ones, which necessitates the change in the learning environment as well.

Though the constructivist learning environment survey has been adapted for high school students in Turkey (Yilmaz-Tuzun, Cakiroglu, & Boone, 2006, as cited in Arısoy, 2007), to the best of our knowledge, there has been no study related to the adaptation of this survey for pre-service teachers. Therefore, the purpose of this study was to adapt Constructivist CLES into Turkish for pre-service chemistry teachers and to find out pre-service chemistry teachers' preferences of learning environment in their future classes.

1.6. Research Questions

In light of the purposes aforementioned, the research questions directed the study were:

- Is the CLES a valid and reliable instrument in Turkish language?
- What are the preferences of pre-service chemistry teachers for creating constructivist learning environment in their future classes?

2. METHOD

The type of this study is survey (Frankel & Wallen, 2006). To examine pre-service chemistry teachers' preferences for creating constructivist learning environment in their future class, CLES was administered to the participants. Details of the methodology of the research will be provided below.

2.1. Sample

286 pre-service teachers enrolled in the Department of Secondary Science and Mathematics Education of three different universities constituted the sample of the study. These universities were among the top universities in terms of accepting students with high scores taken from the university entrance examination. The type of the selection of these universities was chosen on the basis of convenience (Frankel &Wallen, 2006). Due to the ethical considerations, the names of the universities were not provided. All participants were at the same major that is Chemistry Education. The pre-service teachers were enrolled in different academic year of their program that is from grade 1 to 5.

2.2. Instrument

Teacher preferred version of CLES developed by Taylor et al., (1997) was used in this study. The "*preferred*" indicates pre-service chemistry teachers' preferences for creating learning environment in their future classroom. The scale is 5-point Likert type scale ranging from 1= almost never to 5= almost always. The data were gathered in the spring of 2009. The original scale includes 30 items under five subscales. The five subscales are described in details and an example item for each subscale was provided for each subscale in Table 1 shown below:

Table 1: Subscales, Descriptions of them, and Example Items from Each Subscale of the CLES

Subscales	Subscale's description	Example items
Learning about the World (Personal Relevance) (from item 1 to 6)	**The extent to which school science and students' daily life experiences are related**	**Students could learn how science can be part of their out-of-school lives**
Learning about Science (Uncertainty) (from item 7 to 12)	**The extent to which students learn the properties of science such as subjectivity**	**Students would learn that science has changed over time**
Learning to Speak out (Critical Voice) (from item 13 to 18)	**The extent to which students have right to question the teacher about some classroom affairs**	**It was OK for students to ask me "why do I have to learn this?"**
Learning to Learn (Shared Control) (from item 19 to 24)	**The extent to which students are responsible for their learning**	**Students helped me to decide how well they are learning**
Learning to Communicate (Student Negotiation) (from item 25 to 30)	**The extent to which students' negotiation is allowed**	**Students talked with other students about how to solve problems**

The table is adapted from (Taylor & Fraser, 1991).

2.3. Adaptation of the CLES into Turkish

CLES was constructed in English originally by Taylor et al., (1997). In our country, many researchers have been studying the effect of constructivist teaching methods on achievement and other variables (i.e. attitude towards science). Therefore, we need to have this kind of scale in Turkish. However, an adaptation of a scale into another language is not a simple process:

> Adaptation includes all the activities from deciding whether or not a test could measure the same construct in a different language and culture, to selecting translators, to deciding on appropriate accommodations to be made in the preparing a test for use in a second language, to adapting the test and checking its equivalence in the adapted form. (Hambleton, 2005, p.4)

Hambleton (1993) suggests that, for a successful translation, the translator should be knowledgeable about the subject matter, have experience in both languages, and test construction process. Following the suggestions, the original version of the CLES was adapted into Turkish independently by a bilingual researcher who had a PhD in education. Then the translated version of the scale was examined by three science education experts. Translated and original version's equivalence was checked by three researchers. Group discussions were carried out whether the two versions are equivalent. After discussions and changes on the initial version, the translator's opinion was taken. After reaching consensus, the final version of the scale in Turkish was formed. In the present study, back translation method was not used because it is quite possible that back translators do a good translation although the original translators did a poor translation, leading to non-equivalent items. In addition, the errors made during the original translation can be made again during back translation. More specifically, during back translation of an item, translators can use "insightful guesses to make it appear equivalent to the source item even though it may not be (Hambleton & Bollwark, 1991). Table 2 shows some example items from the Turkish version of CLES.

Table 2: Example Items from Each Subscale of Turkish Version of CLES

CLES Subscales	*Example Items*
Learning about the world	**1. Sınıfımda öğrencilerimin okul dışındaki hayatla ilgili öğrenmelerini isterim.**
Learning about science	**7. Sınıfımda öğrencilerin kimyanın problemlere mükemmel çözümler üretemeyeceğini öğrenmelerini isterim.**
Learning to speak out	**15. Sınıfımda öğrencilerin karışık bulduğu etkinliklerle ilgili şikayette bulunmalarında sakınca yoktur.**
Learning to learn	**22. Sınıfımda öğrencilerin etkinliklere ne kadar zaman harcamaları gerektiğine karar verirken bana yardımcı olmalarını isterim.**
Learning to communicate	**29. Sınıfımda öğrencilerin birbirlerine fikirlerini sormalarını isterim.**

2.4. Analysis of the Data

In this study, confirmatory factor analysis was conducted with utilizing LISREL 8.71 for Windows with SIMPLIS command language. For exploratory factor analysis and descriptive statistics, SPSS 15.0 was used.

3. RESULTS

3.1. Validation of CLES: Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA)

In order to identify factor structure for the set of CLES items, EFA was conducted. Initially, The Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (BTS) were examined whether the data gathered were suitable for EFA. KMO index was .82. The BTS was 3223.4 ($p < .05$). The indexes showed that the data were suitable for running EFA. According to EFA, there were seven factors that had Eigen values larger than 1. However, the original version of CLES has five factors. Therefore, EFA was run again by fixing the factor number with five. The results showed that item factor loadings were between .409 and .835 (Table-3). As can be seen from the Table-3, all factor loadings are larger

than .40. Moreover, all items loaded to the corresponding factor as in the original version of CLES. Additionally, 52.53% total variance was explained. The Eigen values of the factors were between 6.7 and 1.7. These results supported the presence of five factors in the CLES.

Table 3: Factor Loadings from EFA

	Factor Loadings				
Items	LW	LS	LSO	LL	LC
1	**.56**				
2	**.47**				
3	**.58**				
4	**.70**				
5	**.74**				
6	**.62**				
7		**.51**			
8		**.51**			
9		**.78**			
10		**.77**			
11		**.56**			
12		**.52**			
13			**.62**		
14			**.70**		
15			**.74**		
16			**.77**		
17			**.77**		
18			**.70**		
19				**.76**	
20				**.65**	
21				**.78**	
22				**.72**	
23				**.70**	
24				**.71**	
25					**.41**
26					**.67**
27					**.73**
28					**.83**
29					**.84**
30					**.74**
Variance	**12.1**	**12.0**	**11.4**	**8.7**	**8.2**
Eigen value	**6.7**	**2.7**	**2.5**	**2.2**	**1.7**

To provide further validity evidence for the factor structure based on theoretical and empirical foundation, CFA was utilized. Fit indices revealed good model-fit (i.e., Root-Mean-Square Error of Approximation (RMSEA) = .054, Comparative-Fit-Index (CFI) = .95 and Standardized Root Mean Square Residual (SRMR) = .06). The 90% confidence interval of RMSEA was .047 - .060. Additionally, chi-square was found to be χ^2= 896.46 (df=395, p<.05) with χ^2/ df= 2.27. The ratio of (χ^2/ df) below 3 indicates that the model has a good fit to the data. Moreover, RMSEA values less than 0.08 and SRMR values less than .10 are considered to be acceptable (Kline, 1998). Also, CFI greater than .95 indicates a good fit (Arbuckle & Wothke, 1999). Moreover, as seen from Table 4 showing the standardized coefficients for the five-factor CLES, most of the standardized loadings were above 0.50 indicating the adequate loadings.

Table 4: Standardized Coefficients for the Five-Factor CLES

Item	Factor	λ
Item 1	**Learning about the world**	**0.54**
Item 2	**Learning about the world**	**0.33**
Item 3	**Learning about the world**	**0.44**
Item 4	**Learning about the world**	**0.65**
Item 5	**Learning about the world**	**0.69**
Item 6	**Learning about the world**	**0.56**
Item 7	**Learning about science**	**0.43**
Item 8	**Learning about science**	**0.47**
Item 9	**Learning about science**	**0.75**
Item 10	**Learning about science**	**0.69**
Item 11	**Learning about science**	**0.48**
Item 12	**Learning about science**	**0.47**
Item 13	**Learning to speak out**	**0.52**
Item 14	**Learning to speak out**	**0.74**
Item 15	**Learning to speak out**	**0.78**
Item 16	**Learning to speak out**	**0.78**
Item 17	**Learning to speak out**	**0.74**
Item 18	**Learning to speak out**	**0.69**
Item 19	**Learning to learn**	**0.72**
Item 20	**Learning to learn**	**0.66**
Item 21	**Learning to learn**	**0.80**
Item 22	**Learning to learn**	**0.72**
Item 23	**Learning to learn**	**0.70**
Item 24	**Learning to learn**	**0.66**
Item 25	**Learning to communicate**	**0.37**
Item 26	**Learning to communicate**	**0.57**
Item 27	**Learning to communicate**	**0.65**
Item 28	**Learning to communicate**	**0.91**
Item 29	**Learning to communicate**	**0.85**
Item 30	**Learning to communicate**	**0.68**

Furthermore, as seen from Table 5, correlations among the factors (Phi estimates) were between the values of 0.22 and 0.40. These values indicated small to moderate effect size (Cohen, 1988).

Table 5: Phi Estimates (Correlations among the Factors)

	2	3	4	5
1. Learning about the world	**0.40**	**0.22**	**0.23**	**0.27**
2. Learning about science		**0.22**	**0.25**	**0.24**
3. Learning to speak out			**0.46**	**0.35**
4. Learning to learn				**0.39**
5. Learning to communicate				

3.2. Reliability Analysis of CLES

The reliability coefficient should be at least .70 (Frankel & Wallen, 2006). For the present study, the Cronbach's alpha coefficient was .71 for the learning about the world (LW), .71 for learning about science (LS), .84 for learning to speak out (LSO), .86 for learning to learn (LL), and .83 for learning to communicate (LC). The reliability of the CLES was found as .87 as overall. All reliability

coefficients were higher than the minimum value, which indicates that CLES is a reliable instrument in Turkish.

3.3. Pre-Service Chemistry Teachers' Preferences for Creating a Constructivist Learning Environment

Descriptive statistics was conducted to find out pre-service teachers' preferences for creating constructivist learning environment in their future classes. The mean values for each factor of the CLES were presented in Table 6. It seems that pre-service chemistry teachers prefer their students to have a voice in the class and question the teacher because *learning to speak out* had the highest mean value. Additionally, the participants prefer the students to learn about the world and daily life relevance. However, as indicated by the mean values, both learning about science and learning to learn subscales were lower than the mean value of others. Participants' answers made us think that they prefer their students to learn to speak out (M=25.44), learn about the world (M=24.94), and learn to communicate (M=24.33) more than learn to learn (M=22.12), and learn about science (M=21.07).

Table 6: Mean Values and Standard Deviations of each Subscale of CLES

Subscales	M	SD
Learning about the world	**24.94**	**3.51**
Learning about science	**21.07**	**4.23**
Learning to speak out	**25.44**	**4.40**
Learning to learn	**22.12**	**4.56**
Learning to communicate	**24.33**	**3.94**

The descriptive statistic was also carried out for the items. Table 7 indicates the frequency distribution of participants' responses to sample items with highest mean scores. As seen from Table 7, three of the four items with the highest mean score were under the learning to speak out subscale whereas one item belonged to learning about the world subscale. For example, approximately 70 % of the pre-service chemistry teachers stated that almost always it would be OK for their students to express their opinions in their chemistry classes.

Table 7: Frequency Distribution of Participants' Responses to Sample Items with Highest Mean

Items	Subscale	Mean	Almost never (%)	Seldom (%)	Sometimes (%)	Often (%)	Almost Always (%)
It was OK for students to express their opinions.	**Learning to speak out**	**4.57**	**1,4**	**1,7**	**4,5**	**23,1**	**69,2**
Students could learn how science can be part of their out-of-school lives.	**Learning about the world**	**4.54**	**1,4**	**1,1**	**3,5**	**29,7**	**64,3**
It was OK for students to speak up for their rights.	**Learning to speak out**	**4.50**	**1,4**	**2, 5**	**6, 0**	**24, 9**	**65, 3**
It was OK for students to complain about anything that prevents them from learning	**Learning to speak out**	**4.35**	**3.1**	**2.4**	**9.4**	**26.2**	**58.7**

Table 8 shows the frequency distribution of participants' responses to sample items with lowest mean values. Items under learning to learn and learning to communicate subscales did not have high means as much as items under other subscales. In addition to that, three of the items which had the lowest mean scores were under the learning about science subscale whereas one of them belonged to the learning to learn subscale. Percentage of the participants selecting "*almost always*" option to the

related items was low. For instance, only 10.6 % of the participants reported that they would teach to students that science cannot provide perfect answers to problems in their class (see table 8).

Table 8: Frequency Distribution of Participants' Responses to Sample Items with Lowest Mean

Items	Subscale	Mean	Almost never (%)	Seldom (%)	Sometimes (%)	Often (%)	Almost Always (%)
Students would learn that science cannot provide perfect answers to problems.	**Learning about science**	**2.96**	**12,7**	**18,4**	**39,6**	**18,7**	**10,6**
Students would learn about the different sciences used by people in other cultures.	**Learning about science**	**3.12**	**14,0**	**17,5**	**26,2**	**26,9**	**15,4**
Students would learn that science is influenced by people's values and opinions	**Learning about science**	**3.15**	**14.4**	**14.4**	**27.1**	**29.2**	**14.8**
Students helped me to assess their learning.	**Learning to learn**	**3.50**	**6,1**	**12,5**	**27,1**	**33, 9**	**20, 4**

4. DISCUSSION and CONCLUSION

In the present study, pre-service chemistry teachers' preferences for constructivist learning environment were examined using Turkish version of the CLES. For validation of CLES for pre-service chemistry teachers, CFA and EFA were conducted and Cronbach's alpha coefficients were computed. Results showed that Turkish version of the CLES is a valid and reliable instrument to assess pre-service chemistry teachers' preferences for creating constructivist learning environment in their future class in five subscales, namely, learning about the world, learning about science, learning to speak out, learning to learn, and learning to communicate.

The descriptive statistics for each subscale revealed that while learning to speak out, learning to communicate, and learning about the world subscales had high means, learning about science and learning to learn subscales had relatively low means. Learning about science subscale includes items related to nature of science (NOS). Therefore, low mean scores of this subscale may be related to the pre-service chemistry teachers' inadequate understanding of NOS (Lederman, 2007). According to Abd-El-Khalick, Bell, and Lederman (1998), NOS understanding is not enough for pre-service teachers to reflect NOS to the classroom practices. For this reason, what NOS means and importance of NOS should be provided to the pre-service teachers in teacher education programs. Teaching method courses should be enriched with the NOS aspects and how to teach NOS (Abd-El-Khalick, 2005). However, classroom management, time necessary for planning, and inexperience are some of the factors that impede pre-service teachers from teaching NOS. As stated in Abd-El-Khalick, et al. (1998):

> The crucial translation of preservice teachers' conceptions of the NOS into classroom practice needs to be reinforced by the culture of teacher preparation. First, teacher preparation programs should help prospective teachers develop an understanding of the rationale behind, and a comprehension of, the importance of emphasizing the NOS in their teaching that goes beyond the customary discourse. (p.432)

To help pre-service teachers teach NOS in their future classrooms, more teaching experience can be provided to them during teaching experience courses. Furthermore, necessary support during the teaching experience should be provided to them by the instructors (Abd-El-Khalick, et al., 1998).

Another subscale with low mean values was the learning to learn, which includes items about the extent to which students are responsible for their learning (Taylor & Fraser, 1991). One of possible reasons for the low mean score of the learning to learn subscale may be related to the pre-service teachers' low metacognitive awareness of their own learning. Research has indicated that pre-service teachers do not have high metacognitive awareness (Özsoy & Günindi, 2011). If they are not aware of their own learning process, they may not realize the importance of students' responsibility on their learning; therefore, they may not think that it is an important part of learning environment that they

will create in the future. Second, in a recent research Acat, Anılan, and Anagun (2010) examined experienced in-service classroom teachers problems related to creating constructivist learning environment. Results showed that participant teachers had difficulty in creating a classroom environment in which students share the control, decide the learning activities, and share the responsibility of learning with teacher. "The fact that students cannot assist the teacher in planning what to teach because they lack the relevant knowledge and do not know what they should know exactly" (p.216) Acat et al. (2010) related that point with also Turkish education system which gives much responsibility to teachers. In other words, students have a difficulty to get used to decide what to learn and how to learn. In the pre-service teachers case; when they were students, elementary and high school curricula were much more teacher centered and the teacher was the only decision maker in the class. Consequently, they have not had such an experience in a class with constructivist learning environment, which may be another reason that explains the low mean score of learning to learn subscale. Due to the lack of experience in such a class, they might think that they cannot achieve it because they have not had a role model in neither elementary/high school nor university. To sum up, in order to help pre-service teachers to have a class in which students have a chance to decide for their learning, they should have that kind of experience. Instructors in college of education should provide such an opportunity to pre-service teachers, which may assist them to realize the significance of giving responsibility to students in their own learning. Finally, metacognitive awareness of own learning should also be highlighted as well because if they see the relevancy of it in their learning, they will be most probably be motivated to apply it in their future class.

To sum up, construct validity and reliability indices showed that Turkish version of the CLES is valid and reliable instrument. At present, constructivist teaching strategies are utilized frequently. Additionally, new Turkish Elementary Science and Technology, and High School Chemistry curricula are based on constructivist view. As stated in Fraser (2007), the authors believe that CLES's Turkish version will be very useful for researchers who study constructivist teaching methods and teacher education. Moreover, CLES's Turkish version can be used in teacher education programs to determine pre-service teachers' preferences for creating learning environment. Furthermore, the measure of CLES can be correlated with other related measures such as preferences for classroom management strategies, or student engagement to class. Additionally, CLES may be used to measure teaching method courses' influence on pre-service teachers' preferences for constructivist learning environment in their future class. In teaching method courses pre-service teachers are taught how to apply teaching methods many of which are based on constructivism. Therefore, CLES results are supposed to give feedback related to pre-service teachers' preferences for learning environment. Finally, the translated version of the scale will make available cross-cultural studies. In addition to those suggestions, research studies should include qualitative part to understand participants' preferences related to constructivist learning environment of their classes. In this study, although we noticed that pre-service teachers had low mean scores in learning about science and learning to learn subscales, we do not know the real reasons behind it. Therefore, interviews are supposed to provide much richer information why they preferred some items or subscales less or more than the others. Furthermore, observation of participants' classes to compare and contrast their answers to the scale and actual practice will provide information how their preferences and practice similar and/or different. In addition to that, comparison of CLES scores for pre-service teachers at different grades and longitudinal study on the changes in pre-service teachers' preferences for constructivist learning environment are expected to provide useful information related to the influence of teacher education programs. As Fraser (2001) stated learning environment is an important factor that influences students' learning, it should not be ignored by teachers, instructors and educational researchers.

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Genişletilmiş Özet

"Öğrenciler üniversiteden mezun oluncaya kadar yaklaşık olarak sınıflarında 20.000 saat geçirdiklerinden, öğrencilerin öğretme-öğrenme deneyimleri üzerine bakış açıları oldukça önemlidir" (Fraser, 2001, p.1). Buna rağmen, öğrenme ortamının öğrenme üzerindeki önemi öğretmenlerin dikkatini çekmemektedir. Günümüzde yapılandırmacı öğrenme ortamını ele alan pek çok araştırma bulunmaktadır (Aldridge ve ark., 2000). Öğrenme ortamı ölçme araçları, çeşitli alanlarda ilişki kurulmasında kullanılmaktadır; örneğin, öğrenci çıktıları ve ortam arasındaki ilişkiyi tespit etmekte, eğitimsel yeniliklerin değerlendirilmesinde, öğrencilerin ve öğretmenlerin sınıf algıları arasındaki farklılıkları belirlenmesinde, öğrencilerin kendi tercih ettikleri ortamlarda daha başarılı olup olmadıklarınının belirlenmesinde ve uluslararası karşılaştırma çalışmalarında. Alan yazında pek çok çalışma, öğrenme ortamı ve öğrencilerin bilişsel ve duyuşsal çıktıları arasındaki ilişkiye dikkat çekmektedir (McRobbie ve Fraser, 1993). Örneğin sınıf öğrenme ortamının fene karşı tutumu belirleyen güçlü bir belirleyici olduğu tespit edilmiştir (Simpson ve Oliver, 1990). Bu sonuç, öğrenme ortamının öğretmenler tarafından önemsenmesi gerektiğini göstermektedir. Öğrenme ortamını ölçmek için çeşitli ölçme araçları geliştirilmiştir. Walberg ve Anderson (1968) tarafından geliştirilen *Öğrenme Ortamı Envanteri (ÖOE);* Moos (1979) tarafından geliştirilen *Sınıf Ortamı Ölçeği (SOÖ)*; Fisher ve Fraser (1981) tarafından geliştirilen *Benim Sınıfım Envanteri (BSE)*; Fraser, McRobbie ve Fisher (1996) tarafından geliştirilen *Bu Sınıfta Neler Oluyor Ölçeği (BSNOÖ)*; Taylor ve Fraser (1991), Taylor ve ark. (1997) tarafından geliştirilen *Yapılandırmacı Öğrenme Ortamı Ölçeği (YÖOÖ) ölçekleri ilgili alan yazında yerini almıştır*. "YÖOÖ öğretmenlere kendi epistemolojik varsayımlarını yansıtmaları ve öğretim uygulamalarını tekrar yapılandırmalarına yardımcı olmak için geliştirilmiştir" (Fraser, 2007, p.107). YÖOÖ'nin geçerliliği, Kore (Lee & Taylor, 2001), Avustralya (Taylor ve ark., 1997) ve Amerika Birleşik Devletleri (Dryden ve Fraser, 1998) gibi çeşitli ülkelerde sağlanmıştır. Orjinal ölçek, toplamda 30 maddeden oluşan beş alt boyut içermektedir. Bunlar, dünya hakkında öğrenme (madde 1-6), fen hakkında öğrenme (madde 7-12), düşüncelerini serbestçe ifade etmeyi öğrenme (madde 13-18), öğrenmeyi öğrenme (madde 19-24), iletişim kurmayı öğrenme (madde 25-30) alt boyutlarıdır. YÖOÖ, neredeyse hiç (1)'den neredeyse her zaman (5)'e doğru puanlanan beşli Likert tipi bir ölçektir. Yapılandırmacılık, öğrenenlerin kendi deneyimleri ve önceki bilgileri yoluyla bilgiyi yapılandırarak öğrenme sürecine aktif olarak katıldıklarını savunan bir yaklaşımdır. Ayrıca, sosyal etkileşim ile hem öğretmenlerin öğrencilerle hem de öğrencilerin öğrencilerle işbirliği, öğrencilerin bilgiyi yapılandırmalarında önemlidir (Driscoll, 2005). Eğitim sürecinin tam resmini elde etmede, öğrenme çıktıları kadar sınıf ortamının da değerlendirilmesi önemlidir (Fraser, 1998; 2001). Öğretmen adaylarının kendi ideal sınıf ortamı tercihlerini değerlendirmek, öğretmen eğitimi araştırmacılarına öğretmen eğitimi programları hakkında dönüt vereceği için, sınıf ortamı araştırmaları öğretmen eğitiminde önemlidir. Ayrıca, Türkiye'de son yıllarda ilköğretim ve ortaöğretim programlarında reformlar yapılmıştır. Yeni programlar yapılandırmacı yaklaşımı temel almaktadır. Program geliştiriciler, programda öğrencilerin öğrenme sürecine aktif katılımını ve sınıf tartışmalarının kullanımını önermektedirler. Programda yapılandırmacı yaklaşım ile paralel olan öğrenme ortamı hazırlama ve sağlamanın önemi vurgulanmaktadır (Milli Eğitim Bakanlığı, 2006). Sonuç olarak, Türkiye'de program reformu, öğretmenlerin öğretim stratejilerini daha çok yapılandırmacı yaklaşıma paralel olacak şekilde değiştirmelerini gerektirmektedir. Bu durum, öğrenme ortamında da değişiklik yapılmasını gerektirmektedir. Ayrıca bu durum, gelecekte birer öğretmen olacak olan öğretmen adaylarının da öğrenme ortamı tercihlerinin ortaya çıkarılmasını önemli bir hale getirmektedir. Bu çalışmanın amacı, kimya öğretmen adaylarının gelecekteki sınıflarında oluşturmayı tercih edecekleri öğrenme ortamlarını incelemektir. YÖOÖ, üç farklı üniversitenin Ortaöğretim Fen ve Matematik Öğretmenliği Bölümü'ne kayıtlı 286 öğretmen adayına uygulanmıştır. Orjinal YÖOÖ, eğitim alanında doktora derecesine sahip ve Türkçe ve İngilizce'ye hâkim bir araştırmacı tarafından Türkçe'ye çevrilmiştir. Daha sonra, ölçeğin Türkçe'ye çevrilmiş sürümü Fen Eğitimi alanında uzman üç araştırmacı tarafından incelenmiştir. Ölçeğin orijinal hali ve Türkçe'ye çevrilmiş halinin birbirine uyum derecesi, üç araştırmacı tarafından incelenmiş ve iki ölçeğin eşdeğer olup olmadığı hakkında grup tartışmaları yapılmıştır. Uzman grup tartışmalarından sonra, ölçeğin ilk hali üzerinde bazı değişiklikler yapılmıştır. Son olarak, çeviren araştırmacının uzman grubun ölçekte yaptığı değişiklikler hakkında hemfikir olup olmadığı tekrar tartışılmış ve ölçeğin son sürümü böylece oluşturulmuştur. YÖOÖ'nın geçerliliğini sağlamak için, doğrulayıcı ve açıklayıcı faktör analizleri yapılmıştır. Veri analizinde LISREL 8.71 ve SPSS 15.0 programları kullanılmıştır. Sonuçlara göre, ölçek beş faktör yapısına sahiptir. Bu çalışmada RMSEA .054'tür. SRMR ise, .06 yani kabul edilebilir

seviyededir. Ek olarak, CFI .95'tir. Tüm alt ölçeklerin güvenirlik katsayıları .70'in üzerinde olup, Cronbach alfa güvenirlik katsayısı, .71 ve .86 arasındadır. Sonuç olarak, ölçeğin yapı geçerliliği ve güvenirlik değerlerine göre YÖOÖ Türkçe sürümünün geçerli ve güvenilir bir ölçektir. Çalışmada betimsel istatistiksel analizi de yapılmıştır. Düşüncelerini serbestçe ifade etmeyi öğrenme ve dünya hakkında öğrenme alt boyutları hayli yüksek ortalama sahipken, fen hakkında öğrenme ve öğrenmeyi öğrenme alt boyutları düşük ortalama puanlara sahiptir. Bu sonuçların nedeni tam olarak bilinememekle birlikte, Lederman' ın (2007) belirttiği gibi öğretmen adaylarının bilimin doğası hakkında yeterli bilgiye sahip olamamalarından kaynaklanabileceği akla gelmektedir. Bu yüzden öğretmen adaylarının bilimin doğasını anlamaları öğretmen eğitimi boyunca sağlanmalıdır. Öğretim metotlarına ilişkin dersler bilimin doğası ile zenginleştirilmelidir (Abd-El-Khalick, 2005). Ayrıca, öğrenmeyi öğrenme alt boyutunda bu sonucun olası sebebi öğretmen adaylarının üst bilişsel farkındalık düzeylerinin yeterince yüksek olmaması olabilmektedir (Özsoy ve Günindi, 2011). Diğer olası bir sebep öğretmen adaylarının öğrenmeyi öğrenme konusundaki yetersiz deneyimleri olabileceği düşünülmektedir. Katılımcıların ilk ve ortaöğrenimlerini aldıkları yıllarda ülkemizde öğrencilerin dersin ve etkinliklerin planlanmasında söz sahibi olabilecekleri bir eğitim programı kullanımda olmadığı için bu sonuçlar elde edilmiş olabilir. Acat, Anılan ve Anagün (2010) günümüzde bile öğrencilerin öğrenmeyi öğrenme kısmında sorun yaşadıkları ve bu boyutta ne yapmaları gerektiğini anlamadıklarını belirtmiştir. Öğretmen adaylarının öğrencilerin kendi öğrenmeleri ile ilgili olarak sorumluluk almalarının ne kadar önemli olduğunu anlamaları için eğitim fakültelerinde aldıkları derslerde kendilerine bu fırsat sunulmalıdır. Buradan hareketle öğrencinin öğrenme sırasında aldığı sorumluluğun öğrenciye katkısını yaşayarak öğrenen öğretmen adaylarının bu boyutu gelecekteki sınıflarında tercih etmeleri beklenmektedir. Yazarlar Türkçe YÖOÖ'nin yapılandırmacı öğretim yöntemlerini çalışacak araştırmacılar için çok yararlı olacağına inanmaktadırlar. Türkçe YÖOÖ, öğretmen adaylarının zihinlerindeki öğrenme ortamı ile ilişkili tercihlerini belirlemek için öğretmen eğitimi programlarında da kullanılabilir. Türkçe YÖOÖ uluslararası karşılaştırmaların amaçlandığı çalışmalarda da kullanılabilecektir. Son olarak, yapılandırmacı sınıf ortamına yönelik çalışmalarda, öğretmen eğitimi programı boyunca bu tercihlerin değişimi incelenmelidir. Ayrıca, bu tercihlerin nedenini öğrenebilmek için nitel ya da karma yöntem çalışmalar yapılarak alan yazına detaylı bilgi sunulmalıdır.