A Scale Development Study for the Teachers on Out of School Learning Environments

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ABSTRACT

When teachers organize planned and systematical out-of-school learning activities, students can understand the abstract and complex terms and topics better and therefore meaningful and deeper learning can occur. Within this context this study aims to develop a valid and reliable scale to determine the attitudes, behaviors, efficiency and competence of the teachers while teaching science on using the out-of-school learning environments supporting the in-class educational activities. The scale was administered to 520 teachers to evaluate the validity and reliability. An expert opinion was asked for the face and content validity of the scale and exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were made for the construct validity. The results of the EFA displayed that the scale includes 24 items under 4 different factors. After the EFA, CFA was made to verify the structures of the scale. The fit indexes obtained from CFA were acceptable. Therefore, it was inferred that the items of the scale were in accordance with the related models. Besides, the Cronbach's Alpha coefficient was calculated as .89. The analyses and obtained values revealed that the scale is valid and reliable.

Keywords: *Out-of-School Learning, Scale Development, Teachers, Test Validity*

INTRODUCTION

Individuals learn, develop attitudes and gain experiences after their daily activities. Obtaining new information and having experiences unintentionally is defined as informal learning (Smith, 1999). Informal learning occurs unplanned in an out-of-school environment unlike the formal learning (Wellington, 1990). This kind of learning formed within the frame of personal needs and interests can occur in the everyday life in the society. Mass media such as television, radio, magazines and Internet and social areas such as botanical gardens, family gatherings, zoos, shopping centers, books, virtual museums, gyms, outdoor laboratories, factories, supermarkets, aquariums, libraries, houses, science centers, natural environments (caves, lakes, rivers, beaches etc.) are some of the examples of informal learning environments (Hannu, 1993; Kelly, 2000; Pedretti, 2004). In short, any place where there is a human being can be an informal learning environment.

When informal learning environments which assist permanent and deep learning are included within the educational activities, the educational environment is carried to the outside of the classroom. Including the informal environments within the formal education during after school hours brings out out-of-school learning (Salmi, 1993). Informal learning environments are especially seen in science classes which contain many concrete terms and which includes various practices. Since formal educational environments such as classrooms are not always enough for fulfilling the goals of the education programs, formal education should be supported by informal learning environments. Educational activities conducted in this kind of learning environments help the students learn with their own senses and experiences, learn many topics at the same time with interaction and develop different attitudes and values (Ramey- Gassert, 1997; Rivkin, 2000). Besides supporting meaningful and permanent learning, informal learning environments develop the affective, psychomotor and communication skills (Pace and Tesi, 2004; Lakin, 2006), the awareness and recollection levels for the new terms (Fisman, 2005), and the creativity, imagination and problem solving abilities (Folta, 2010) of the students. Moreover, as these environments establish a connection between the daily life and the curriculum, they contribute majorly to science classes (Chin, 2004; Bozdoğan, 2007). Informal learning environments are called as out-of-school learning environments for providing interaction between the required skills and science terms and topics (Hannu, 1993). The benefits of the informal learning environments can be crucial because of the positive effect on the students.

The updated Turkish science curriculum of 2013 based on research oriented learning strategy frequently emphasizes the out-of-school learning environments (MEB, 2013). Learning environments supporting interesting and intriguing topics not only positively affect the attitudes and interests of the students but also encourages them to find their own solutions by presenting them with current problems of their society and to gain new experiences (Melber and Abraham, 1999). These out-of-school learning environments can help science classes meet the learning targets of the curriculum. Including out-of-school learning environments in the educational environment can lead to scientifically literate students by providing meaningful learning experiences.

Although several studies have suggested that informal learning environments develop cognitive, affective, psychomotor and communication skills of the students, teachers do not tend to use them during the classes for a variety of reasons. (Orion et al., 1997; Moseley, Reinke and Bookout, 2002; Carrier, 2009; A and A , 2012). Nevertheless, Andrew, Maggie and Sarah (2010) stated that the carefully designed activities and the practices for out-of-school learning environments can considerably assist the goals of the curriculum. Accordingly, it could be important to determine the background, attitude, behavior, efficiency and competence of the teachers who is supposed to run this process. Griffin and Symington (1997) emphasized that unorganized and unplanned activities of the out-of-school learning environments cannot meet the targets. Therefore, effective and successful activities for these environments can be possible with training teachers who know their responsibilities and informing the existing teachers about the requirements. Smith-Sebasto and Smith (1997) mentioned that most of the teachers do not have enough or sufficient knowledge and skills about out-of-school education. Likewise, in his study Thomson (2010) mentioned that since teachers do not have adequate knowledge, skills and experiences on the topic, they have difficulties in controlling the students in out-of-school environments. McComas (2006) concluded that teachers do not know how to use the necessary information in these settings and they cannot make a connection between the materials and the activities and the requirements of the curriculum. Finally, Griffin (1994) pointed out that teachers only make the vital preparations during the organization phase. When the studies in the literature was examined, it can be seen that as most of the teachers have little information on including out-of-school learning environments in education, they need to be trained on the necessities and requirements. Hence eliminating the various obstacles hindering the attitude, behavior, efficiency and competence of the teachers on the out-of-school learning environments can ensure the success and efficacy of the related activities and practices for student development. However, scales determining the attitudes, behaviors, efficiency and competence of the teachers are very rare. When the teachers run the educational activities in out-of-school learning environments carefully and systematically, students can learn more meaningfully and thoroughly by comprehending the concrete and complex terms and subjects that they couldn't fully understand in the classroom. In this context, the aim of this study is to develop a valid and a reliable scale determining the attitude, behavior, efficiency and competence of the teachers on including out-of-school learning environments supporting in-class educational activities.

METHODOLOGY OF STUDY

This is a study of developing a scale that can be used in determining the attitudes, behaviors, efficiencies and competencies of the teachers teaching and guiding science classes on including out-of-school learning environments in educational activities and science curriculum. This study was completed during the 2014-2015 academic year. The phases of the "out-of-school learning environment scale" and the characteristics of the study group are presented in the following sections.

Study Group

The study group consist of 520 teachers. All of teachers teach science classes. Demographic information for these 520 teachers is given in Table 1.

Table 1 Demographic information of teachers

	CFA Sample	EFA Sample	Total
Female	218	164	382
Male	82	56	138
Total	300	220	520

Table 1 displays that there are 220 teachers for exploratory factor analysis and there are 300 teachers for confirmatory factor analysis. 382 teachers are female and 138 teachers are male. While there are 218 female teachers and 82 male teachers in CFA, there are 164 female teachers and 56 male teachers in EFA.

Data Collecting Tools

In developing the scale the research on out-of-school learning environments was reviewed. Also, the semi-structured interviews were done with 36 science teachers. After the research literature review and the interviews an item pool including 60 items (attitude, behavior, efficiency and competence) were written. Expert opinions were taken to determine the sufficiency of the items in terms of quality and quantity and to ensure the face validity and the content validity (Büyüköztürk, 2011). The preliminary sketch including the above mentioned 60 items were given to 3 science educator and 1 primary science teacher for their expert opinions. In accordance with their feedback 8 items were removed from the preliminary sketch because of ambiguity and lack of expression, and some of the items were reorganized. Then the final form of the scale was created.

The draft scale was organized as 5 point Likert scale which has 52 items: 12 for attitude, 12 for behavior, 14 for the efficiency and 14 for the competence. The expressions of the preliminary form were graded as follows: (5) Strongly Agree, (4) Agree, (3) Undecided, (2) Disagree, (1) Strongly Disagree. A detailed instruction helping the teachers fill the form was added to the sketch as well. 6 items have negative sentences and 45 items have positive sentences.

Data analysis

The data of the study were collected in two different ways: giving hard copy forms to the teachers and asking the teachers to fill in the online form. Then the data collected from 520 participants were downloaded to SPSS and LISREL programs to analyze the validity and reliability of the scale. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used for the construct validity of the scale.

With EFA: The results of the Kaiser Meyer Olkin (KMO) and Bartlett's tests obtained with statistical analyses were used to decide whether exploratory factor analysis can run or not. In order to determine the construct validity of the scale obtained results were analyzed with EFA and the relationships between the items and the factors were found out. Then the common variance values to be decided for the items of the scale were defined and it was concluded that the 40% of the minimum variance will be explained (Kline, 1994). Moreover, the items with factor loads less than .30, the items which had more than one factors and the factor load differences were 0.10 or less were removed from the analysis. Finally, in order to determine the validity of the scale Cronbach's Alpha value, which is a measure of internal consistency, was calculated.

With CFA**:** It is aimed to verify the factor structures of the scale obtained with EFA. In accordance with this aim CFA was done on the data collected from another sample group aside from the participants in EFA. In order to evaluate the model-data fit analysis, goodness of fit values of Chi-Square ($\chi 2$) / Degree of Freedom (df), Adjusted Goodness of Fit Index (AGFI), Goodness of Fit Index (GFI), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI) and Root-Mean-Square Error of Approximation (RMSEA) were controlled with LISREL program. Obtained values were interpreted by comparing them with the current criteria. Thus, the appropriateness of the model obtained with EFA was tested.

RESULTS OF RESEARCH

Exploratory and confirmatory factor analyses were used to test the construct validity of the scale on out-of-school learning environments in this phase and Cronbach's Alpha value, which is a measure of internal consistency for reliability, was calculated.

Exploratory Factor Analysis (EFA)

Before the factor analysis it should be underlined that the number of the participants is sufficient for this study. Kline (1994) said that research done with 200 participants reliable results can be obtained in factor analysis and even this number can be reduced to 100 if the factor structure is clear and less. Accordingly, exploratory factor analysis was done with the data obtained from 220 participants. Exploratory factor analysis was used to evalaute the construct validity of the scale . In order to run the factor analysis first the Kaiser-Mayer-Olkin (KMO) coefficient testing the sufficiency of the sample was calculated. The KMO value for this study was found as .888. Then the results of the Bartlett's test of sphericity were checked and statistically significant differences were observed [$\chi 2$ (276)=3337.58, p=0.00]. According to Green and Salkind (2005) in order to make a factor analysis KMO coefficient should be more than .70 and Bartlett's test of sphericity should be meaningful ($p<.05$). When the findings obtained at the end of the research were compared to these values, it was seen that factor analysis can be made with the data.

Varimax rotation was used to interpret the factors more easily and to find the items displaying higher relationship. Varimax rotation aims to round up the load value of the items to 1.0 in one factor and to 0.0 in the others (Büyüköztürk, 2011). Therefore, principal components analysis and Varimax rotation were used to make the eigen value of the 24 items in the scale 1. The results of the analysis presented that there are 4 factors eigen value of which are higher than 1 and the total variance of these 4 factors was 65.64%. The findings are presented in Table 2.

Table 2 Eigen values and variance percentages of the factors of the scale.

Factor	Eigen Values	Variance Percentages	Total Variance Percentage
Factor 1	*8.89*	*23.02*	23.02
Factor 2	*2.80*	*18.04*	41.06
Factor 3	*2.30*	*14.00*	55.06
Factor 4	*1.78*	*10.58*	65.64

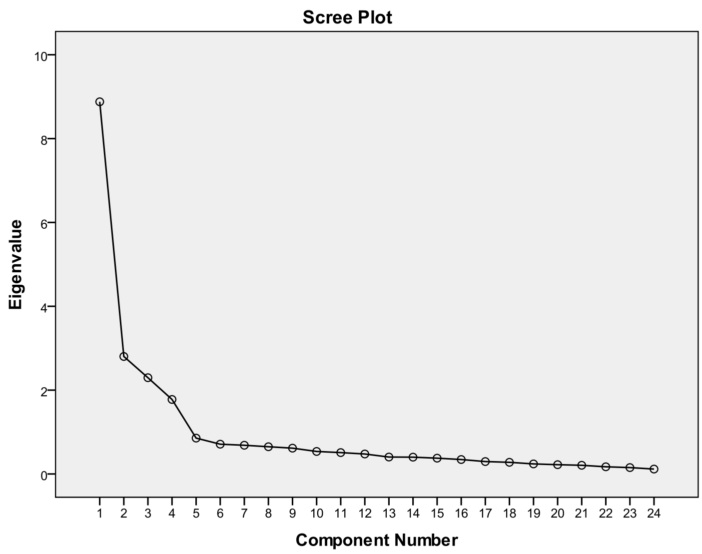

Figure. 1 **Scree plot for the eigen value and component number.**

As one can see from Figure 1 the result of the factor analysis the eigen value of which is 1, displays that according to the scree plot the number of the factors of the scale is four.

As it is planned that the scale measures four different dimensions, – attitude, behavior, efficiency and competence – the factor analysis was limited to four. After the analysis 28 items with factor loads less than .30 and explaining more than one aspect were removed from the analysis. Then the factor analysis was repeated. The results of the factor analysis run for the factor loads of the items in the scale were presented in Table 3.

Table 3 Factor loads of the items in the scale.

Item #	F1	F2	F3	F4
31	.82			
33	.81			
34	.80			
28	.78			
27	.77			
26	.76			
36	.74			
38	.71			
8		.82		
7		.79		
3		.77		
9		.76		
10		.74		
6		.73		
16			.80	
21			.76	
15			.71	
22			.71	
14			.68	
23			.61	
40				.87
39				.78
41				.72
45				.71

It is seen in Table 3 that there are 8 items (26, 27, 28, 31, 33, 34, 36, 38) in the first factor explaining the efficiency dimension, there are 6 items (3, 6, 7, 8, 9, 10) in the second factor explaining the attitude dimension, there are 6 items (14, 15, 16, 21, 22, 23) in the third factor explaining the behavior dimension and there are 4 items (39, 40, 41, 45) in the last and the fourth factor competence dimension in the scale. EFA results showed that the load factors of the items are as follows: in the first factor the load factor is between .82 and.71, in the second factor the load factor is between .82 and .73, in the third factor the load factor is between .80 and .61 and in the last factor the load factor is between .87 and .71.

The results of the exploratory factor analysis revealed that the final version of the scale had 24 items and 4 factors. Since 4 items out of 24 (39, 40, 41, 45) has a negative expression, they have to be coded reversely while calculating.

Reliability Analysis

For the reliability calculation of the scale the Cronbach's Alpha coefficient, which means internal consistency, was calculated as .89. Similarly, the Cronbach's Alpha coefficient was calculated as .92 for the efficiency dimension, .92 for the attitude dimension, .83 for the behavior dimension and .79 for the competence dimension. According to Nunnally and Bernstein (1994) a coefficient of at least .70 proves that the recently developed scale is reliable. Therefore, it can be concluded that this scale is a reliable one developed for the out-of-school learning environments.

Table 4 Item-total correlation coefficients, correlation coefficients and cronbach's alpha values if the item deleted

Factor	Item #	Item-total correlation coefficients	Cronbach's Alpha values if the item deleted	Factor	Item #	Item-total correlation coefficients	Cronbach's Alpha values if the item deleted
ATTITUDE	m3	.548	.882	EFFICIENCY	m26	.670	.878
	m6	.601	.880		m27	.658	.879
	m7	.666	.879		m28	.709	.877
	m8	.643	.879		m31	.605	.880
	m9	.633	.879		m33	.667	.879
	m10	.571	.881		m34	.675	.878
BEHAVIOR	m14	.514	.882		m36	.578	.881
	m15	.470	.883		m38	.157	.902
	m16	.396	.885	COMPETENCE	m39	.334	.887
	m21	.431	.884		m40	.270	.889
	m22	.526	.882		m41	.259	.889
	m23	.239	.889		m45	.112	.893

Table 4 which displays the item-total correlation coefficients of the 24 items in the scale also demonstrates that the coefficients are between the range of .112 and .709. At the same time, by looking at the table the Cronbach's Alpha Values if the item deleted can be seen as well. These values indicate that a single item develops the reliability coefficient of the scale.

Confirmatory Factor Analysis (CFA)

After EFA, confirmatory factor analysis was done in order to verify the factor structures of the scale which include 24 items and 4 factors. To do so, confirmatory factor analysis was conducted to the data collected from a group of 300 participants.

For CFI, NFI, NNFI, RFI and IFI indexes a value of ≥.90 refers an acceptable fit and a value of ≥.95 refers perfect fit (Bentler, 1980; Bentler & Bonett, 1980; Hu & Bentler, 1999; Marsh, Hau, Artelt, Baumert & Peschar, 2006). For RMSEA, a value of ≤.06 refers an acceptable fit and a value of ≥.05 refers perfect fit. For SRMR, a value of ≤.05 refers a perfect fit and a value of ≥.80 refers an acceptable fit (Hu & Bentler, 1999; Brown, 2006). For $\chi 2$ / df, a value of ≤2 refers a perfect fit (Tabachnick and Fidell, 2001). The results of the confirmatory factor analysis which was run without any constraints yielded the following fit index values: $\chi 2$= 464.20 (N=300, df=246, p= .00), $\chi 2$ / df= 1.89 RMSEA= 0.054, SRMR= 0.065, CFI=0.98, RFI=0.95, NFI=0.96, IFI=0.98 and NNFI= 0.97. Comparison of the fit index values obtained with confirmatory factor analysis to the criteria infers that the fit indexes are at an acceptable level. Thus, it is concluded that the items of the scale were in accordance with the related models.

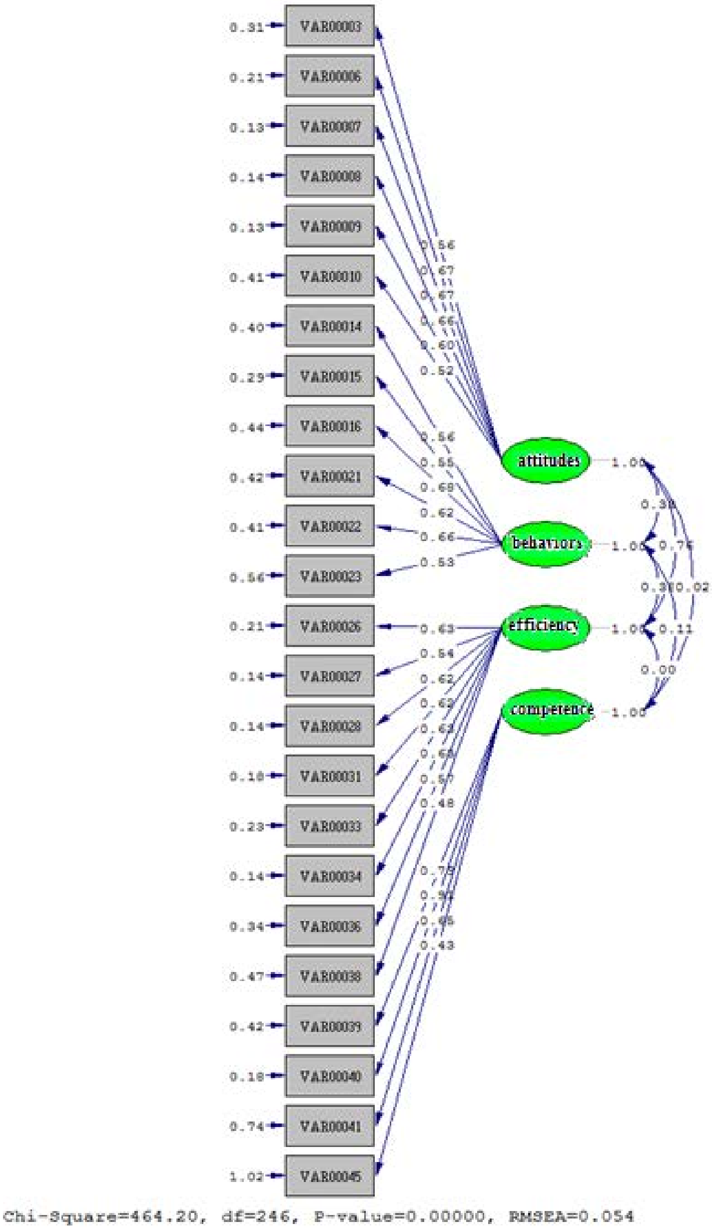

Figure. 2 **Diagram of the confirmatory factor analysis of the scale**

In Figure 2, one can find the diagram for the factor loads of the scale's model with four aspects which displays that the factor load of the attitude dimension is between the range of .52 and .67, the factor load of the behavior dimension is between the range of .53 and. 68, the factor load of the efficiency dimension is between the range of .48 and .63 and the factor load of the competence dimension is between the range of .43 and .92.

DISCUSSION

Research oriented and inquiry based science curriculum emphasizes the out-of-school learning environments to support deep and permanent learning for the students (MEB, 2013). Including out-of-school learning environments to educational activities leads to a more interesting and intriguing learning environment. By this means informal learning environments let the students face the real world problems and find their own solutions, gain experiences and finally structure their own learning process (Melber and

Abraham, 1999). Since the significance of these learning environments within the educational process has increased gradually, teachers are supposed to be aware of the different aspects of these environments. Therefore, determining the attitude, behavior, efficiency and competence levels of the teachers on including the out-of-school learning environments in educational activities help the teacher use them more effectively and sufficiently. This can yield to scientifically literate students as the science curriculum requires.

When the literature of studies on developing scales for out-of-school learning environments is searched it has been noticed that there aren't many researches on this topic. Orion and Hofstein (1991) developed a 4 point Likert scale which has 32 items to measure the attitudes of the students on a scientific field trip in their studies called Students' Attitude Scale towards Scientific Field Trips. The scale has 5 dimensions: learning tool aspect, individualized learning aspect, social aspect, adventure aspect and environmental aspect. The Cronbach's Alpha coefficient for the attitude scale developed for the scientific field trip was calculated as .86. Tortop (2013) adapted the attitude scale developed by Orion and Hofstein (1991) to Turkish to determine the attitudes of the secondary and high school students in Turkey on field trips. In the Turkish version since items of the individualized learning aspect were negative within the item total correlation and had values below .30, this aspect was eliminated from the scale and a new 4 dimensional structure, which included learning tool aspect, social aspect, adventure aspect and environmental aspect, was created. The Cronbach's Alpha reliability coefficients of these aspects were calculated respectively as .67, .66, .54 and .63.

As teachers are the individuals preparing the appropriate learning environment for the students, determining the attitudes of the teachers – just like the attitudes of the students – is extremely important for the field trips. In his study Tortop (2012) developed a two dimensional scale with 15 items to determine the attitudes of the teachers on field trips. The Cronbach's Alpha reliability coefficients of these dimensions were calculated respectively as .86 and .70 whereas for the whole scale the value was .75. Likewise, in his study Öztürk (2008) developed a scale for measuring the self-efficacy belief levels of the prospective social science teachers on using the field trip and observation techniques for teaching topics on geography within the social science classes. At the end of the study a one dimensional 5 point Likert scale which has 24 items was developed. Considering the scarcity of this kind of studies in the literature, the above mentioned scale is outstanding. Moreover, since it is aimed to determine the attitudes and self-efficacy levels of the students and the teachers on this topic in the existing scale development studies, it is crucial to develop scales measuring different factors about out-of-school learning environments.

As there are not adequate scales measuring various aspects in the literature, an out-of-school learning environments scale determining the attitude, behavior, efficiency and competence of the science teachers on including out-of-school learning environments within the science curriculum was developed. There are four factors – attitude, behavior, efficiency and competence – in this 5 point Likert scale which has 24 items. There are 8 items (26, 27, 28, 31, 33, 34, 36, 38) in the first factor explaining the efficiency dimension, there are 6 items (3, 6, 7, 8, 9, 10) in the second factor explaining the attitude dimension, there are 6 items (14, 15, 16, 21, 22, 23) in the third factor explaining the behavior dimension and there are 4 items (39, 40, 41, 45) in the last and the fourth factor competence dimension in the scale. Total variance of these 4 factors was calculated as 65.64%. For the reliability calculation of the scale the Cronbach's Alpha coefficient, which means internal consistency, was calculated as .89. Similarly, the Cronbach's Alpha coefficient was calculated as .92 for the efficiency dimension, .92 for the attitude dimension, .83 for the behavior dimension and .79 for the competence dimension. Since 4 items out of 24 (39, 40, 41, 45) has a negative expression, they have to be coded reversely while calculating. Therefore, the highest point of the scale can be 120 and the lowest can be 24.

The KMO value testing the adequacy of the sample to run EFA was found as .888 and statistically significant differences were observed [$\chi 2$ (276)=3337.58, p=0.00] after Bartlett's test of sphericity. EFA results showed that the load factors of the items are as follows: in the first factor the load factor is between .82 and.71, in the second factor the load factor is between .82 and .73, in the third factor the load factor is between .80 and .61 and in the last factor the load factor is between .87 and .71.

The results of the confirmatory factor analysis which was run without any constraints yielded the following fit index values: $\chi 2$= 464.20 (N=300, df=246, p= .00), $\chi 2$ / df= 1.89 RMSEA= 0.054, SRMR= 0.065, CFI=0.98, RFI=0.95, NFI=0.96, IFI=0.98 and NNFI= 0.97. Comparison of the fit index values obtained with confirmatory factor analysis to the criteria infers that the fit indexes are at an acceptable level. Thus, it is concluded that the items of the scale were in accordance with the related models. On looking at the model diagram of the scale the following factor loads can be seen: the factor loads of the attitude dimension is between the range of .52 and .67, the factor load of the behavior dimension is between the range of .53 and. 68, the factor load of the efficiency dimension is between the range of .48 and .63 and the factor load of the competence dimension is between the range of .43 and .92. The analysis revealed that the scale is valid and reliable.

CONCLUSIONS AND IMPLICATIONS

With this study it is intended to develop a valid and reliable scale on determining the attitude, behavior, efficiency and competence of the teachers teaching terms and topics of the science classes on using out-of-school learning environments supporting in-class educational activities. Consequently, according to the obtained results, out-of-school learning environment scale is a valid and reliable one to determine the attitudes, behaviors, efficiency and competence of the teachers on including the out-of-school learning environments. In the existing system this scale, which contributes to the literature, can be used by the teachers which teach science. This scale is thought to be useful for the studies to be conducted on out-of-school learning environments. The developed scale can be found in the Appendix.

Besides, more studies for the validity and reliability of the scale for different groups can be conducted. Also, it can be recommended that various scales with different dimensions on out-of-school learning environments should be developed.

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APPENDIX

ITEMS	STRONGLY AGREE	AGREE	UNDECIDED	DISAGHREE	STRONGLY DISAGREE
ATTITUDE					
3. The activities done within out-of-school learning environments are fun.					
6. Out-of-school learning environments reinforce the recently learned information.					
7. Out-of-school learning environments help students love science classes.					
8. Out-of-school learning environments help students enjoy the educational activities.					
9. Out-of-school learning environments enable students learn and have fun together.					
10. Out-of-school learning environments eliminate the boredom of the science classes.					
BEHAVIOR					
14. I search for the out-of-school learning environments.					
15. I share my experiences from out-of-school learning environments with my friends and colleagues.					
16. I suggest alternative solutions to the authorities for the problems encountered while using out-of-school learning environments.					
21. I follow the studies on out-of-school learning environments.					
22. I discuss the alternative solutions for solving the problems of including informal learning environments to science classes with the school administration and with my colleagues.					
23. I try to emphasize the requirements of the curriculum on using out-of-school learning environments.					
EFFICIENCY					
26. Out-of-school learning environments help the students learn by using their 5 senses.					
27. The activities done in out-of-school learning environments help students reinforce the in-class knowledge.					
28. The activities done in out-of-school learning environments help students learn better.					
31. Out-of-school learning environments help students interact with each other.					
33. Out-of-school learning environments improve the problem solving abilities of the students.					

ITEMS	STRONGLY AGREE	AGREE	UNDECIDED	DISAGHREE	STRONGLY DISAGREE
34. Out-of-school learning environments give a different point of view to the students.					
36. Out-of-school learning environments improve the general knowledge levels of the students.					
38. Out-of-school learning environments enable the students establish a connection between science and daily life.					
COMPETENCE					
39. I do not have enough knowledge about the out-of-school learning environments for science classes.					
40. I do not have enough knowledge about the topics and equipments to be used in out-of-school learning environments.					
41. I am not aware of the out-of-school learning environments in the neighborhood.					
45. I don't know anything about the correspondences about the process of including out-of-school learning environments.					