Eğitim ve Bilim
2011, Cilt 36, Sayı 161

Education and Science
2011, Vol. 36, No 161

An Examination of the Factor Structure of the Turkish Version of the Online Learning Environment Survey

Çevrimiçi Öğrenme Ortamları Ölçeği'nin Faktör Yapısının İncelenmesi

Alev ÖZKÖK*
Hacettepe Universty

Halil YURDUGÜL**
Hacettepe Universty

Petek AŞKAR***
Izmir University of Economics

Abstract

The primary aim of this study was to examine the reliability and validity of the Turkish version of the Online Learning Environment Survey (OLES) in postsecondary distance education. The OLES is a 54 item instrument for assessing social-psychological perceptions among distance education students. The second aim was to investigate empirically perception of the online learning environment in Turkish context. This paper consisted of three models explaining online learning environments in the Turkish context. Model I, based on relations of originally item-construct reported by Trinidad, Aldridge & Fraser, (2004), was analyzed with gathered data from Turkey setting by the translation, adaptation, and validation of the Online Learning Environment Survey (OLES) (Trinidad, Aldridge & Fraser, 2004) in a new Turkish-language form. In Model I, the OLES was designed to measure nine dimensions of online educational environment. The fit of the proposed multidimensional factor structure was examined with 902 post-secondary distance education students in two institutions. Model II, based on relations of emprically item-construct which were obtained with principal component analysis, was investigated with first-order confirmatory factor analysis. Model II consist of twelve subconstructs. Model III, with a higher-order construct with twelve first-order factors of OLES-TR, was perfectly represented as a general online learning environments trait rather than the OLES.

Keywords: psychosocial learning environments, second-order factor analysis, high-order factorial structure

Öz

Bu araştırmada, yükseköğretimde uzaktan eğitim programlarına devam eden öğrencilerin, eğitim gördükleri çevrimiçi öğrenme ortamlarına yönelik psikososyal algılarının niteliğinin belirlenmesi amaçlanmaktadır. Bu amaçla, çevrimiçi öğrenme ortamındaki psikososyal niteliği ölçen 54 maddelik Çevrimiçi Öğrenme Ortamları Ölçeği Türkçe uyarlandı. Üç modelden oluşan bu araştırmada I. Modelde Online Learning Environment Survey (OLES) (Trinidad, Aldridge & Fraser, 2004) ölçeğinin geçerlik ve güvenirlik çalışması yapılmıştır. Dokuz faktörden oluşan ölçek, uzaktan eğitim gören 902 üniversite öğrencisi üzerinde uygulanmıştır. II. Modelde, Çevrimiçi Öğrenme Ortamları Ölçeği'nden elde edilen ölçümlerin, ölçeğin özgün boyutlarına uygun olarak birinci ve ikinci sıralı doğrulayıcı faktör modellerine uyumları sınanmıştır. Bu sınamalar sonucunda, ölçümlerin model-veri uyumunu sağlamadığı görülmüştür. Bu nedenle, Türkiye örneklemindeki görgül ölçme modeline ulaşmak için temel bileşenler analizine başvurulmuştur. Bu inceleme sonucu, araştırmada kullanılan ölçümlerin yüksek uyum değerleri ile on iki faktörde toplandığı görülmüştür. III. Modelde, OLES-TR'nin on iki birinci sıralı faktörünün ikinci sıralı faktör analizi ile belirlenen genel çevrimiçi öğrenme ortamları arasındaki bağıntıları ortaya konmuştur.

Anahtar Sözcükler: Psikososyal öğrenme, çevrimiçi öğrenme ortamları, ikinci sıralı faktör analizi, üst düzey faktöriyel yapılar.

* Dr. Alev ÖZKÖK, Faculty of Education of Hacettepe University, ozkok@hacettepe.edu.tr

** Doç. Dr. Halil YURDUGÜL, Faculty of Education of Hacettepe University, yurdugul@hacettepe.edu.tr

*** Prof. Dr. Petek AŞKAR, Izmir University of Economics Faculty of Arts and Sciences, petek.askar@ieu.edu.tr

Introduction

In recent years, studies on online learning environments, one of which is the learning workplace, have contained two divergent research fields. Two previously distinctive fields of study have brought together on theoretical and conceptual basis partly in e-learning research (i.e., blended learning which combines both online and face-to-face approaches, e-learning, web-based learning, technology enhanced learning) and partly in learning environment research within the broader area of psychosocial environment. Theoreticians and researchers who pioneered this emerging field have increasingly focused their attention on the merging structure of both fields of research and examined the role of online learning environments on students' attitudes and achievement over the past decade. Despite a few research and practical applications involving perceptions of psychosocial online learning environment in Turkey, no comprehensive instrument has been developed to assess online learning environments for Turkish higher education.
In the present study, we attempt to fill this gap in Turkish education literature and to facilitate such work by measuring students' perception of psychosocial dimensions of online learning environment. Therefore, we initially decided to adapt one of the recent online learning environment instruments to measure dimensions of online learning environment in Turkish context, using the latest scale adaptation techniques.

Background to the Study

The online learning environment research in relation to its social-psychological context derived primarily from the work of psychologists Walberg (1976) and Moos (1974). Fraser's investigation of the importance of the learning environments in enhancing learning (Goh & Khine, 2002; Fraser & Fisher, 1994) has broadened the development of the field of online learning environment which was initiated approximately 10 years ago. Numerous studies of the online learning environment have shown that student perception with psychosocial aspects of these learning workplaces account for appreciable amounts of variance in learning outcomes (Brown, 2001; Fraser, 2002; Macnish, Trinidad, Fisher & Aldridge 2003; Maor & Fraser, 1996; Stacey & Rice, 2002).

Likewise, studies regarding online learning environments in particular have been conducted in Australia, India, China, Ethiopia, Kenya, Rwanda, Singapore, South Africa, Taiwan, Tanzania, Indonesia and the United States (Margianti, 2003; Koul & Fisher, 2006; Jegede, Fraser, & Fisher, 1995; Liang, 2006; Ntuli, 2003; Teh & Fraser, 1994; Trinidad, Aldridge, & Fraser, 2005).

In the Turkish context, distance education programs have been centralized and controlled by the state. The Higher Education Council (YÖK) is responsible for distance learning implementation in universities (Aşkar, 2005) and the incidence of distance education in Turkish higher education is well confirmed by research and statistics. According to the YÖK (2003), distance education programs are active in Turkey; a total of 35 graduate and 11 undergraduate distance education programs exist in Turkish higher education institutions. Of these, 38 are public institutions and eight (8) are private institutions.

However, in spite of the increased popularity and presence of online learning opportunities, there is a lack of measures in which to evaluate programs and assess what goes on in the distance learning context. Distance education in Turkey is recognized as a method of learning for all levels of education except in primary school (years one to five) (Aşkar, 2005).

Description of the OLES

The OLES is a psychosocial learning environment instrument designed specifically to measure post-secondary online learning environments. The OLES was initially demonstrated as valid and reliable with a mixed international study population (Trinidad, 2005), and it has since been utilized in case study classes using e-learning in Hong Kong and Australia during 2004 and 2005. Preliminary studies have supported the reliability and validity of the total OLES

scores in indexing the degree to which online learning environment features are present (Pearson & Trinidad, 2005; Trinidad, Aldridge & Fraser, 2005; Trinidad, 2005; Pearson, 2005; Trinidad & Pearson, 2004; Pearson &Trinidad, 2004; Trinidad, Fraser, & Aldridge, 2004).

The scales in the OLES were derived and combined conceptually from preliminary work resulting in first-generation learning environment instruments for higher education. The scales are as follows: (1) Computer usage (Scale I, consisting of 6 items) is built upon the work of Aldridge, Dorman and Fraser (TROFLEI; 2004); (2) Teacher support (Scale II, consisting of 8 items) and (3) Equity (Scale VII, consisting of 7 items) are built upon the work of Fraser, Fisher and McRobbie, (WIHIC; 1996); (4) Student interaction and collaboration (Scale III, consisting of 6 items), (5) Authentic learning (Scale V, consisting of 5 items) and (6) Student autonomy (Scale VI, consisting of 5 items) are built upon the work of Walker (DELES; 2004); (7) Personal relevance (Scale IV, consisting of 5 items) is built upon the work of Taylor & Fraser (CLES; 1991); (8) Enjoyment (Scale VIII, consisting of 6 items) is built upon the work of Fraser (TOSRA; 1981); and (9) The Asynchronicity (Scale IX, consisting of 6 items) focuses on information structure and design of online material. The OLES items are commonly associated with online learning environment and consist of 54 items in nine scales. The nine OLES scales are rated on a 5-point scale (1 = Almost Never; 2 = Seldom; 3 = Sometimes; 4 = Often; 5 = Almost Always).

Higher-order structure of OLES

What is the best way to explain the possible generalizability of the OLES, if it exists? Trinidad, Aldridge and Fraser's (2004) nine-factor structure of OLES (2004) suggested multidimensionality. The dimensionality of OLES is important to understand the online learning environment. Research on the OLES has not attempted to examine the existence of a higher-order factorial structure. Can OLES be explained using higher-order factorial structure?

The structure and dimensionality of the learning environment are important theoretical issues that have received considerable attention. These issues have not been fully resolved. Most of this literature focuses on explaining what learning environment is by identifying its components, but the discussion usually suggests that learning environment may be a single construct.

The main reason of application of second-order factor analysis is to gain a broader picture or level of generalization that is not revealed by the first-order factor analysis alone (Bryne, 1998). Thompson (1990, p.579) also noted, "The first-order analysis is a close-up view that focuses on the details of the valleys and the peaks in the mountains. The second-order analysis is like looking at the mountains at a greater distance, and yields a potentially different perspective on the mountains as constituents of a range." As Gorsuch (1983, p. 240) explained, "Primary factors indicate areas of generalizability. In this article, we have launched a debate on the patterns of inter-relationship between the nine dimensions of psychological OLES-TR for a single factor interpretation.

Purpose of the present study

The purpose of the present study was to explore the cross-cultural stability of the factor structure of online learning environment traits as assessed with nine factors of the OLES applied to the Turkish samples. The specific questions addressed by the study are the following:

1. Do the scales of the OLES assessing the online learning environment traits retain their structure, reliability, and coherence when translated into Turkish that can be used in the Turkish higher education context?

2. Do hypothesized model of nine factorial structures of the OLES by Trinidad, Aldridge and Fraser show generalizability of the systematic relationship with the higher-order structure of a general online learning environment that fits the Turkish data?

Methodology

Data Collection

The English version of the OLES was translated into Turkish by three bilingual professionals. A combination of forward and backward translation designs was used. The translated Turkish version and the English version of the OLES were then circulated to eight professionals in the fields of distance education, computer education, and psychology for their comments regarding content validity (i.e., if the items read well, made sense, etc.). A pilot administration was then conducted (N=25). The purpose of the pilot study was to establish if the OLES-TR was understood by Turkish university students. Limited editing was completed after obtaining comments from the pilot administration to establish a final version of the new Turkish OLES.

The Turkish version of the OLES consists of 54 items which are answered on a five-point Likert scale. The nine OLES scales are rated on a 5-point scale (1 = Almost Never; 2 = Seldom; 3 = Sometimes; 4 = Often; 5 = Almost Always). Students perceived that distance education learning environment for each scale actually occurred with a frequency between Almost Neverto Almost Always.

After development, the OLES-TR was administered to 902 students who were studying by distance in two Turkish universities. The instrument was administered through Web-based survey form compiled in an SQL database (Shannon, Johnson, Searcy & Lott, 2002). Respondents were asked to indicate their perceptions of the actual learning environment regarding their distance education experience during their class just completed over the previous 60 days.

Participants

The Turkish sample of respondents consisted of 902 post-secondary students who voluntarily enrolled in online education classes during the study period in academic year 2005-2006 (Table I.). The sample was a non-probability sample of convenience drawn from participants recruited from a public university and a private university in Turkey. The majority of the responses came from students studying in the public university, totaling 682 (76%), while 218 (24%) responses were from a private university. There were 378 (62%) males and 217 (38%) females in the sample. The sub-sample was 46% male and 28% female in the public university, and 15% male and 11% female in the private university.

Table 1.
Sample Distribution by Age, Gender and School Type, N=902

	Age						
	≤20		21-25		£26		
	Female	Male	Female	Male	Female	Male	Total
Public University	96	168	114	145	50	109	682
Private University	13	29	41	21	28	88	220
Total	109	197	155	166	78	197	902

Data Analysis

In order to determine the psychometric properties (reliability and factorial validity) of OLES, the data set of OLES was analyzed for three models separately.

Model I: Theoretical Relations

Measurement models, used in confirmatory factor analytic models are linear or nonlinear statistical functions including relation between item and psychological constructs intended to measure (Yurdugül & Aşkar, 2008). The first measurement model in this study is based on relation of item-construct, reported by Trinidad, Aldridge and Fraser (2004) in OLES and we called as Model I. Also the Model I consist of 9 subscales and totally 54 items and we analyzed this in term of first order confirmatory factor analysis with using LISREL 8.53 (Jöreskog & Sörbom, 2002).

Model II: Empirical Relations

Model II was conducted on the empirical measurement models obtained principal component analysis with varimax rotation. Model II analyzed in terms of first order confirmatory factor analysis. In this model, we used the data set gathered in Turkish sample by OLES, adapted into Turkish language and we named the scale as OLES-TR. The model II consisted of twelve subscales.

Model III: Higher Order Relations

In Model III, second-order CFA was used to investigate higher-order model based on subscales in Model II, and test the fit of hypothesized model against the sample data. Model-data fit and evidence of a higher-order factor were assessed using several goodness-of-fit indexes.

To examine the measurement models, indices of model fit, the Goodness of Fit Index (GFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) fit statistics were selected a priori based upon coverage of diverse dimensions of model fit (Maruyama, 1998) as well as robustness across estimation method and misspecification error (Hu & Bentler, 1999). The traditional chi-square statistic was retained to allow a test of exact fit between the model and observed co-variances. Model Fit Indices which fall in the group had been reported: as absolute fit indices: RMSEA, GFI, and as incremental indices: CFI. To interpret these indices, the following rules were employed: RMSEA values should be as small as possible with perfect fit indicated by an index of zero. Values less than 0.05 indicate good fit (Browne & Cudeck, 1993). GFI values range from 0 to 1 with CFI values above 0.95 indicating good model fit (Byrne, 1998). In assessing model fit, CFI values of .95 and above are considered to indicate a good model fit (Hu & Bentler, 1999). For the RMSEA (Steiger, 1990), values of about .05 are conventionally considered to indicate a close fit. Kızılkaya and Aşkar (2009) gave a more flexible criteria list of fit indices. The internal consistency of the OLES-TR was estimated using the Cronbach's alpha coefficient. Reliability coefficients greater than 0.70 are commonly considered acceptable (i.e.,>0.70; Nunnally, 1978).

Results

The investigation of the factorial validity of the multidimensional OLES and interrelationships among the item-scale and of factor solution relationships are presented in three Model (Model I, Model II, Model III).

Model I

The major goal of this study was to attempt to adapt hypothesized nine factor structures of the OLES 54-survey items. As from first model, toward this goal, we conducted CFA using data from the sample (N=902). For this analysis, the CFA yielded unsatisfactory model fit for the hypothesized factor structure of OLES. Model fit indices revealed relatively unsatisfactory fit indices and lack of fit indices: CFI (0.84), GFI (0.82), and RMSEA (0.053) were much lower than desired (GFI≥0.90, CFI≥0.90, RMSEA≤0.05). All items loaded weakly on their a priori factors. However, internal consistency (coefficient α) in the OLES was acceptable for all scales.

Model II

In order to examine the structural hypotheses, Model II was conducted to explore the relations item-factor validity of factor-solutions extracted from the data collected from the Turkish sample. Model II consists of empirical measurement models on Turkish cultural context, determined by principal component analysis (PCA) with varimax rotation. To determine the best model, we used the number of factors with eigenvalue above 1.0 Kaiser-Guttman criteria (Kim & Mueller, 1988) and parallel analysis in PCA (Horn, 1965). The eigenvalues of data set and scree plot of eigenvalues were given in Appendix I. The criteria suggested that the resultant PCA yielded twelve uncorrelated factor solution called OLES-TR and might be most appropriate in the Turkish sample. Nine of twelve factors of OLES-TR (explained with Model II) were wellfitted to the following OLES (explained with Model I) factors: Teacher Support, Student Interaction and Collaboration, Personal Relevance, Authentic Learning, Student Autonomy and Enjoyment. However, each of the Computer Usage, Equity, and Asynchronicity factors of the OLES subdivided into two parts from PCA. We gave these subfactors of the OLES-TR different labels and symbolic names as follows:

1. The original "Computer Usage" items was split into two different subfactors: "Computer-Mediated Interaction Scale Ia" and "Computer-Mediated Learning Scale Ib" (see Fig. 1);

2. The original "Equity" items was split into two different subfactors: "Service Equality Scale VIIa" and "Equality of Opportunity Scale VIIb" (see Fig. 2);

3. The original "Asynchronicity" items was split into two different subfactors: "Asynchronous Communication Tools With On-Demand Access Scale VIIIa" and "Reflective Thinking In Asynchronous Communication Scale VIIIb" (see Fig. 3);

Table 2.
Items Measured in OLES-TR

Factors	Item (Turkish)	Item (English)
Computer-Mediated Interaction (Scale Ia)	Bilgisayarı, ders hakkında bilgi toplamak için kullanıyorum.	I use the computer to find out information about the course.
Computer-Mediated Learning (Scale Ib)	Bilgisayarı, diğer öğrencilerle birlikte çevrimiçi tartışma ortamlarına katılmak için kullanıyorum.	I use the computer to take part in online discussions with other students.
Teacher Support (TS)	Öğretmen sorularıma zamanında cevap veriyor.	The teacher responds promptly to my questions.
Student Interaction and Collaboration (SIC)	Diğer öğrencilere bilgi alışverişinde bulunuyorum.	I share information with other students.
Personal Relevance (PR)	Öğrendiklerimi, ders dışı yaşantım ile ilişkilendirebilirim	I can relate what I learn to my life outside of this class.
Authentic Learning (AL)	Deneyimlerimi ders etkinliklerinde kullanıyorum.	I apply real world experience to the topic of study.
Student Autonomy (SA)	Neyi nasıl öğreneceğime kendim karar veriyorum.	I make decisions about my learning.
Service Equality (Scale VIIa)	Öğretmen bana da diğer öğrenciler kadar yardımcı oluyor.	I get the same amount of help from the teacher, as do other students.
Equality of Opportunity (Scale VIIb)	Çalışmalarım diğer öğrencilerin çalışmaları kadar değer görüyor.	My work receives as much praise as other students' work.
Enjoyment (EN)	Daha fazla dersim çevrimiçi ortamda olsaydı eğitimim daha zevkli olurdu.	I would enjoy my education if more of my classes were online.
Asynchronous Communication Tools With On-Demand Access (Scale IXa)	E-postalarımı istediğim zaman okuyorum.	I read posted messages at times that are convenient to me.
Reflective Thinking In Asynchronous Communication (Scale IXb)	Eposta ile iletişimin yazma becerilerimi geliştirdiğini düşünüyorum.	I find that posting messages improves my writing skills.

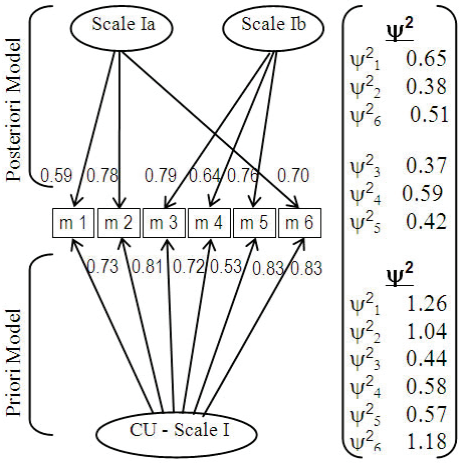

*Figure 1.*Results from the first-order CFA analysis for the Model I (CU-factor) and, the Model II model (Scale Ia, Scale Ib- factors)

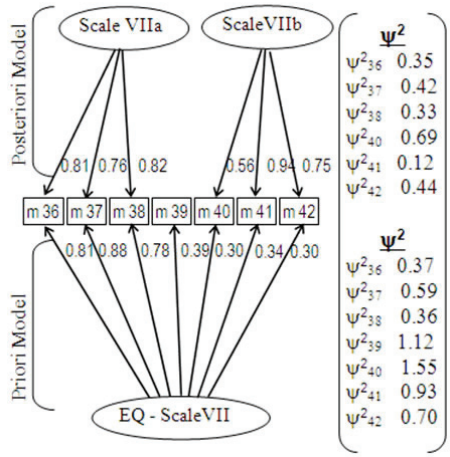

*Figure 2.*Results from the first-order CFA analysis for the Model I (EQ-factor) and, the Model II (Scale VIIa, Scale VIIb- factors)

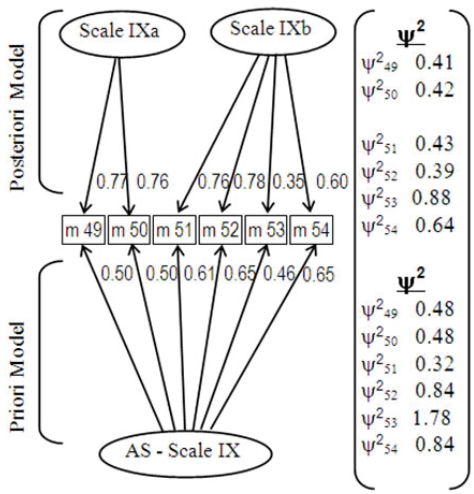

*Figure 3.*Results from the first-order CFA analysis for the Model I (AS-factor) and, the Model II(Scale IXa, Scale IXb- factors)

Table III provides the scale the means, standard deviations (SD), factor loadings (λ) with probabilities (P), errors (ψ^2), and reliability coefficients (Guttman-Cronbach's alpha) for the Model II (OLES-TR). As Table III shows, the fit indexes difference tests were significant, indicating that the twelve-factor OLES-TR (empirical model) fits significantly better than the nine-factor hypothesized Model I (OLES). Thus, Model I OLES-TR is considered a plausible alternative model of underlying data structure.

Given the OLES-TR, our examination suggested a significant improvement using CFA again. The variance-covariance matrices among the OLES-TR subtest scores were submitted for CFA analyses (Benter & Wu, 1995). Examining this model with CFA also provided a test of the necessity of incorporating correlated factors. The standardized maximum likelihood factor loadings of 54 items were found statistically meaningful (RMSEA=0.045; CFI=0.87; GFI=0.86;

(P<0.05) as an indicator of acceptable fit item, except for 39th item of 0.95 and 33rd item of 1.0. The wordings of item 39 suggested that it may tap to Enjoyment scale. Afterwards, we decided to drop item 33 and change item 39 to Enjoyment scale in the OLES-TR.

The CFA with maximum likelihood and subsequent fit indices on the OLES-TR, with twelve factors, provided the excellent fit to the covariances among items in the OLES (RMSEA=0.038; CFI=0.92; GFI=0.93) for standardized parameter estimates indicating the dimension of perception exhibited by Turkish sample. Measurement errors which ranged from 0.12 (item 41) to 0.96 (item 11) indicated that the overall model represented relationships in the data very well (Jöreskog & Sörbom, 1993).

Further, as would be expected, Turkish sample produced higher mean scores of the OLES-TR than the others. The OLES-TR factor structure was proposed by this reasearch by using such a total score, implying that twelve first-order factors are a plausible model of underlying data structure. We concluded that the OLES-TR is most appropriate, but not definitive because OLES-TR model fits the data equally well.

Table 3.

Descriptive Statistics and Internal Reliability Cronbach Alpha Coefficients for the OLES-TR

Factors	Item	Mean	SD	λ	ψ^2	P	α
Computer-Mediated Interaction (Scale Ia)	1	3.42	1.3	0.59	0.65	0.05	0.73
	2	3.14	1.3	0.78	0.38	0.04	
	6	4.13	1	0.70	0.51	0.04	
Computer-Mediated Learning (Scale Ib)	3	4.38	0.9	0.79	0.37	0.03	0.78
	4	3.73	1.1	0.64	0.59	0.03	
	5	2.97	1.4	0.76	0.42	0.03	
Teacher Support (TS)	7	4.14	1	0.64	0.59	0.03	0.86
	8	3.65	1.3	0.63	0.60	0.04	
	9	3.98	1.1	0.64	0.55	0.03	
	10	3.7	1.2	0.65	0.58	0.03	
	11	4.18	1	0.19	0.96	0.03	
	12	3.72	1.3	0.70	0.51	0.04	
	13	3.97	1.2	0.70	0.51	0.03	
	14	3.55	1.3	0.70	0.52	0.04	
Student Interaction and Collaboration (SIC)	15	2.8	1.4	0.81	0.34	0.04	0.91
	16	2.78	1.3	0.80	0.37	0.04	
	17	2.94	1.3	0.79	0.37	0.04	
	18	2.91	1.3	0.80	0.36	0.04	
	19	2.73	1.3	0.85	0.27	0.04	
	20	2.77	3.5	0.32	0.90	0.05	

Personal Relevance (PR)	21	3.8	1.1	0.73	0.46	0.03	0.80
	22	4.26	0.9	0.52	0.73	0.03	
	23	3.21	1.2	0.69	0.53	0.04	
	24	3.61	1.1	0.80	0.36	0.03	
	25	3.6	1.1	0.60	0.63	0.04	
Authentic Learning (AL)	26	3.33	1.1	0.84	0.30	0.03	0.87
	27	3.44	1.1	0.83	0.31	0.03	
	28	3.26	1.2	0.75	0.44	0.03	
	29	3.42	1.1	0.77	0.40	0.03	
	30	3.31	1.2	0.59	0.65	0.04	
Student Autonomy (SA)	31	4.19	0.9	0.65	0.57	0.03	0.76
	32	4.33	0.8	0.52	0.72	0.03	
	34	4.3	0.9	0.79	0.37	0.03	
	35	4.38	0.8	0.70	0.51	0.03	
Service Equality (Scale VIIa)	36	4.24	1	0.81	0.35	0.03	0.83
	37	4.01	1.2	0.76	0.42	0.04	
	38	4.26	1	0.82	0.33	0.03	
Equality of Opportunity Scale VIIb	40	4.11	1.1	0.56	0.69	0.04	0.78
	41	3.86	1.3	0.94	0.12	0.03	
	42	4.32	1	0.75	0.44	0.03	
Enjoyment (EN)	39	4.48	0.9	0.62	0.62	0.04	0.87
	43	3.95	1.1	0.33	0.89	0.04	
	44	3.65	1.3	0.76	0.43	0.04	
	45	4.05	1.1	0.84	0.30	0.03	
	46	3.98	1.2	0.89	0.21	0.03	
	47	3.5	1.4	0.74	0.46	0.04	
	48	3.99	1.1	0.23	0.95	0.03	
Asynchronous Communication Tools With On-Demand Access (Scale IXa)	49	4.17	1	0.77	0.41	0.03	0.74
	50	4.44	0.9	0.76	0.42	0.03	
Reflective Thinking In Asynchronous Communication (Scale IXb)	51	4.37	0.8	0.76	0.43	0.03	0.72
	52	4.14	1.1	0.78	0.39	0.03	
	53	3.22	1.4	0.35	0.88	0.05	
	54	4.01	1.1	0.60	0.64	0.04	

λ : Factor loadings (path coefficients)
ψ : The measurement error.
α: Cronbach's reliability coefficient

The Cronbach's Alpha Coefficient

Estimates of the internal consistency of the OLES-TR were calculated using the Cronbach's alpha (α = 0.94); these were satisfactory than acceptable values for Model II as well as its scales

(Raykov, 1997). The results (see Table II) showed strong reliability coefficients for each construct that coefficient alpha for the OLES-TR factors ranged from 0.72 to 0.91 in the Turkish data. The reliability values were somewhat higher and they indicated good internal consistency (i.e., > 0.80; Nunnally, 1978).

Model III

Accordingly, a second-order factor analysis within the framework of LISREL 8.3 (Jöreskog & Sörbum, 1993) was applied for the analysis of attitudes towards perception on OLES-TR attributes to gain the generalizability of the factor structure. Model III to be tested in the present application also derived from the work of previous model, building on the OLES-TR. In this model, we hypothesized on second-order factorial model, based on covariance matrix (Rindskopf & Rose, 1988), to find the relations between factors of OLES-TR to examine previous analysis to the set of data. This approach was preferred over above analysis because it has the flexibility to test different theoretical models conceptualized the OLES-TR. The second-order OLES-TR was well-suited to that offered by the first-order OLES-TR. Tests indicated perfect model fit and enhanced the utility of the scales as they provide evidence of the validity of the OLES-TR for use with Turkish higher education (Byrne, 1998).

The numerical results of low factor in second-order CFA is same as first-order CFA model given in Table II. In addition to this, numerical results are given on Fig. 4 correlation between first-order factors and second-order general online learning environment trait (latent). The relations between first-order latent and second order general online learning environment latent with factorial structure are given in Fig. 4 The twelve dimensions of online learning environment are latent variables shown in ellipses. These variables are not assessed directly. Rather, each latent variable is assessed indirectly by observed variables (i.e., scale items) shown in rectangles. Model II and Model III were more satisfaction rather than Model I (Fig. 4) The dominant relation with its path coefficient value of 0.80 is obtained between general perception and “Personal Relevance”. Next higher relation obtained on “Authentic Learning” is 0.74. The low level relations range from 0.23 to 0.27.

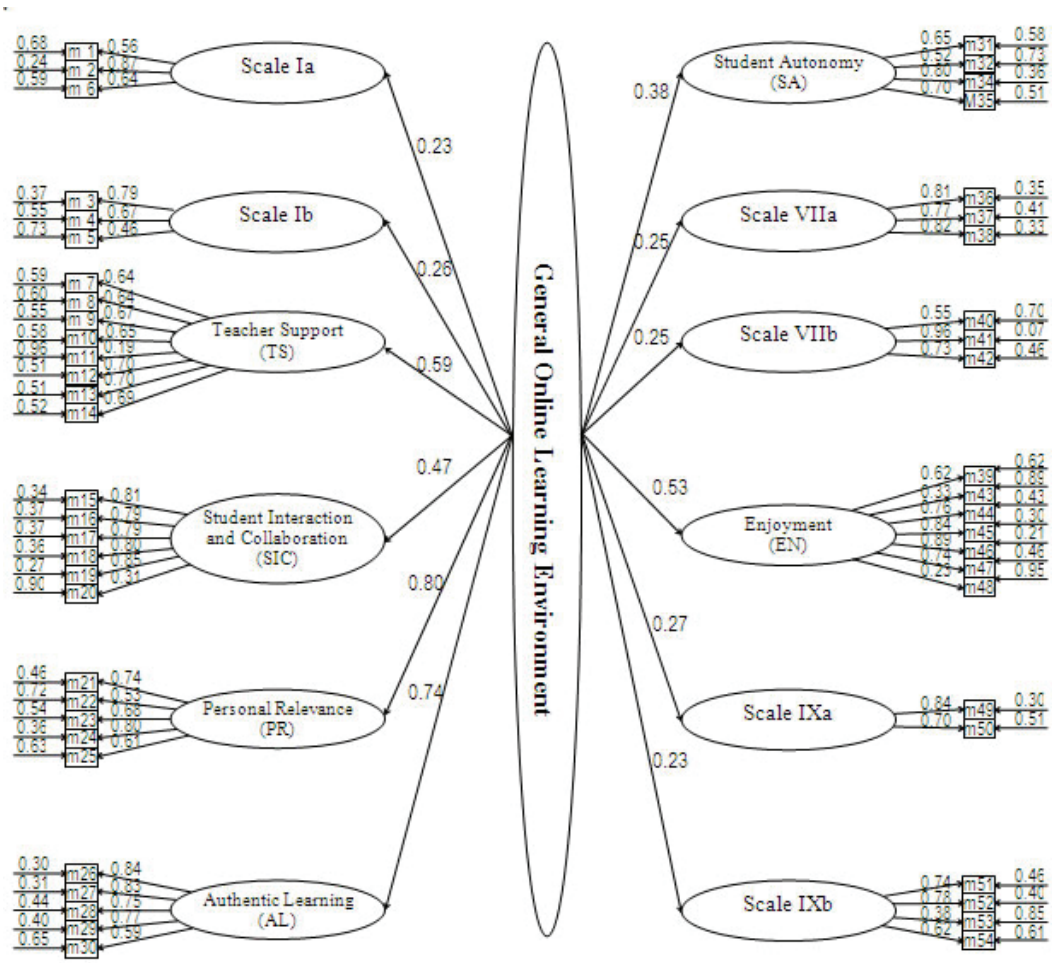

Figure 4. Second-order factorial structure of the OLES-TR

Discussion and Conclusion

The evaluation of application of the Turkish version of the OLES to the pilot sample suggests that the Model II (OLES-TR) is applicable to the perceptions of online learning students rather than Model I (OLES) in Turkish post-secondary education. Our study supports the higher-order factor structure of OLES-TR consistent with a second-order factorial model in which twelve first-order factors yield a single second-order trait of the studied environment.

Our evaluation of statistical findings on three models reveals factorial validity of the Turkish version of OLES and yields four-fold conclusions:

(1) The result of confirmatory factor analysis (CFA) suggests that the Model I (OLES) is not as satisfactory as the original English version as regards model fit and lack of fit indices, given the evidence from CFA that the items weakly represented their priori factors and one of the 54 items needed to be taken out from the scale.

(2) Principal factor analysis (PCA) results also show that the Model II offers a different factor solution from the original English study, both in terms of the number of items and the items constructed of each latent variable. Results suggest that of the models we tested, the twelve factor model appeared to account best for the covariance between OLES items.

New dimensions of OLES-TR were derived from Computer Usage, Equity, and Asynchronicity factors. Each of the three dimensions of original OLES was split into two parts.

We gave symbolic names to each of the new factors of the OLES-TR, which are discussed below.

• Computer-Mediated Interaction (Scale Ia): Based on the results of PCA, three of the six priori Computer Usage items (see Fig. 1) loaded on a new scale, Scale Ia. We also found evidence in these three items for 'a tendency to engage in computer-mediated interaction behavior', which shows the effect of computer usage on student interactions in online learning environment at the post-graduate level.

• Computer-Mediated Learning (Scale Ib): This scale included the other three of the six Computer usage items (see Fig. 2). The degree to which the students and teachers developed close, partnership-style relations confirms interpersonal and social presence in a non-contiguous, technologically mediated learning environment.

• Service Equality (Scale VIIa): This factor included the first three of the seven Equity items. The last three items loaded on Scale VIIb, while the wording of item 39 turned out to tap Enjoyment rather than Equity (see Fig. 2).

• Equality of Opportunity (Scale VIIb): The items in this scale show the degree to which the students' attitudes affect each other in equal social climate of online learning environment. The high degree of student-teacher communication equally makes it a powerful influence on the online learning environment and subsequently the student performance.

• Asynchronous Communication Tools With On-Demand Access (Scale IXa): Two of the Asynchronicity items loaded on Scale VIIIa (see Fig. 3), and reveal the degree to which the students use the asynchronous communication tools with on-demand access methods.

• Reflective Thinking In Asynchronous Communication (Scale IXb): Four of the six Asynchronicity items loaded on a Scale VIIIb. The original OLES does include reflective thinking items in Asynchronicity scale, but these items do not directly assess reflective thinking in asynchronous communication (see Fig. 3).

It is also interesting to compare our results with those from several recent studies that examined the scales of online learning environment features (Chang, 2003; Clayton, 2007; Fraser & Maor, 2000; Levy, 2006; Newhouse, 2001; Taylor & Maor, 2000; Teh & Fraser, 1995; Yeo, Taylor, & Kulski, 2006). In these studies, investigators found similar evidence for Scales Ia, Ib, VIIa, VIIb, VIIIa, and VIIIb scales.

The six new factors of the OLES-TR identified by the present study reflect the fact that research on online learning environment is developing and getting more mature.

(3) Although Trinidad, Aldridge and Fraser (2004) found evidence for fewer factors or dimensions of original OLES, CFA results confirmed an extended factor structure. The CFA provided support for the existence of twelve distinct factors within the OLES-TR.

(4) The item analysis revealed that the OLES-TR is a reliable scale. The output of internal consistency reliability (alpha) suggested that the scale is internally reliable. Furthermore, reliability and validity analyses suggested that the OLES-TR is a reliable and valid measure.

Model III included the development of a higher-order model of online learning environments. To our knowledge, our study is the first provide a sample for the extension of first-order models of online learning environments into a higher-order model. Results suggest that the OLES-TR can be explained to full extent by the higher-order model with a second-order trait (online learning environment) and twelve first-order factors. As illustrated in Fig. 4, the hierarchical model we have developed posits that a second-order general factor is responsible for the covariation among first-order factors, which accounts for the observed variation in subtests.

It is our hope that this study raises awareness of this issue and provides insights into future research which will lead to the development and adaptation of other instruments. Our recommendations for further research include replication of the present study in order to provide further evidence of validity and reliability of the Turkish version of the OLES as a research tool.

In the present study, the lack of parallel instruments in Turkey has made it impossible to perform concurrent validity analysis of the OLES-TR. Although the validity analysis of the OLES-TR in the present investigation satisfactorily met the required criteria, concurrent validity of the OLES is needed if further evidence is to be obtained in support of its explicit use in the investigation of online learning environments.

References

Aşkar, P. (2005). Distance education in Turkey. *Encyclopedia of Distance Learning*, 4, 635-639.

Bentler, P. M. (1976). Multistructural statistical models applied to factor analysis. *Multivariate Behavioral Research*, 11, 3–25.

Bentler, P. M., & Weeks, D. G. (1980). Linear structural equations with latent variables. *Psychometrika*, 452, 289–308.

Bentler, P. M., & Wu, E. J. C. (1995). *EQS/Windows user's guide*. Multivariate Software, Encino, CA.

Brown, R. (2001). The process of community-building in distance learning classes. Journal of Asynchronous Learning Networks, 5, (2). Retrieved from http://www.aln.org/publications/jaln/v5n2/index.asp on May 10, 2007

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing fit. In K. A. Bollen & J.S. Long (Eds.), *Testing structural equation models.* Newbury Park.

Byrne, B. M. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: Basic concepts, applications and programming.* Mahwah, NJ: Erlbaum.

Dorman, J., Fisher, D., & Waldrip, B. (2006). Classroom environment, students' perceptions of assessment, academic efficacy and attitude to science: A LISREL analysis. In D. L. Fisher & M. S. Khine (Eds), Contemporary approaches to research on learning environments: World views (pp. 1–28). Singapore: World Scientific.

Fraser, B. J. (1981). *Tests of Science-Related Attitudes (TOSRA).* Australian Council for Educational Research, Melbourne.

Fraser, B. J. (1998). Classroom environment instruments: Development, validity and applications. *Learning Environments Research: An International Journal*, 1(1), 68–93.

Fraser, B. J. (2002). Learning environments research: Yesterday, today and tomorrow. In S. Goh & M. S. Khine (Eds.), *Studies in educational learning environments: An international perspective* (pp. 1–26). River Edge, NJ: World Scientific.

Fraser, B. J., & Fisher, D. (1994). Assessing and researching the classroom environment. In D. Fisher (Ed.), *The Study of Learning Environments* (Vol. 8, pp. 23–39). Perth: Curtin University of Technology.

Gorsuch, R. L. (1983). Factor analysis (2 ed.). Hillsdale, N. J: Lawrence Erlbaum Associates.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2005). *Multivariate Data Analysis*. Englewood Cliffs, NJ: Prentice-Hall.

Horn, J.L. (1965). A rationale and test for the number of factors in factor analysis. Psychometrika, 30, 179-185.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1–55.

Jöreskog, K., & Sörbom, D. (1993). *LISREL 8: User's reference guide*. Chicago: Scientific Software International.

Kızılkaya, G. & Aşkar, P. (2009). The Development of a Scale on Reflective problem solving skill. Education and Science, 34 (154), 82-92.

Kim, J., & Mueller, C.W. (1978). *Factor analysis: Statistical methods and practical issues*. London: SAGE Publications.

Macnish, J., Trinidad, S., Fisher, D., & Aldridge, J. (2003). *The online learning environment of a technology-rich secondary college.* Paper Presented at the Annual Meeting of the American Educational Research Association, Chicago, IL, April.

Maor, D., & Fraser, B. J. (1996). Use of classroom environment perceptions in evaluating inquiry-based computer assisted learning. *International Journal of Science Education*, 18, 401–421.

Margianti, E. S. (2003). The relationship between attitudes and achievement of university students in computer classrooms in Indonesia. In M. S. Khine & D. Fisher (Eds). *Technlogy-rich learning environments: A future perspective* (71-96). Singapore: World Scientific.

Marsh, H. W., & Hocevar, D. (1985). A new more powerful approach to multitrait-multimethod analysis: Application of second-order confirmatory analysis. *Journal of Applied Psychology*, 73. 107-117.

Maruyama, G. M. (1998). *Basics of structural equation modeling*. Thousand Oaks, CA: Sage Publications, Inc.

Moos, R. H. (1974). *The Social Climate Scales: An overview*. Consulting Psychologists Press, Palo Alto, CA.

Ntuli, S. (2003). *Using a learning environment instrument to improve primary mathematics teaching during distance education teacher training program*. Doctoral dissertation, Curtin University of Technology, Perth, Western Australia.

Nunnally, J. C. (1978). *Psychometric Theory*. New York: McGraw-Hill Inc.

Pearson, J. (2005, July). Evaluating e-learning environments using the Online Learning Environment Survey. *8th IFIP World Conference on Compuiters in Education (WCCE2005),* Jul 4 - Jul 7, Cape Town, South Africa.

Pearson, J., & Trinidad, S. (2004). An evaluation of problem based learning (PBL) as a strategy for designing and implementing an e-learning environment. *In Acquiring and Constructing Knowledge Through Human-Computer Interaction: Creating New Visions for the Future of Learning* (ed. E. McKay), pp. 1101–1109. RMIT University, Melbourne.

Pearson, J., & Trinidad, S. (2005). OLES: An instrument for refining the design of e-learning environments. *Journal of Computer Assisted Learning*, 21, 396-404.

Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied Psychological Measurement*, 21, 173–184.

Rindskopf, D., & Rose, T. (1988). Some theory and applications of confirmatory second-order factor analysis. *Multivariate Behavioral Research*, 23, 51-67.

Shannon, D., Johnson, T., Searcy, S., & Lott, A. (2002). Using electronic surveys: Advice from survey professionals. *Practical Assessment, Research & Evaluation*, 8 (1). Retrieved May 15, 2007, from http://ericae.net/pare/getvn.asp?v=8&n=1.

Stacey, E., & Rice, M. (2002). Evaluating an online learning environment. *Australian Journal of Educational Technology,* 18(3), 323-340.

Steiger, J. H. (1990). Structural model evaluation and modification: an interval estimation approach. *Multivariate Behavioral Research*, 25 (2), 173-80.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn and Bacon.

Teh, G., & Fraser, B. J. (1995). Development and validation of an instrument for assessing the psychosocial environment of computer-assisted learning classrooms. *Journal of Educational Computing Research,* 12, 177-193.

Teh, G., & Fraser, B. J. (1994). An evaluation of computer assisted learning in geography in Singapore. *Australian Journal of Educational Technology*, 10(1), 55-68.

Thompson, B. (1990). SECONDOR: A program that computes a second-order principal components analysis and various interpretation aids. *Educational and Psychological Measurement*, 50, 575-580.

Trinidad, S. (2005, November). Constructive solutions: Improving teaching and learning in e-learning environments. *Australian Association for Research in Education (AARE) 2005*, Parramatta: The University of Western Sydney.

Trinidad, S., Aldridge, J., & Fraser, B. (2004). *Development and use of an online learning environment survey*. Paper presented to the Annual Meeting of the American Educational Research Association AERA 2004, San Diego, CA.

Trinidad, S., Aldridge, J., & Fraser, B. (2005). Development, validation and use of the online learning environment survey. *Australian Journal of Educational Technology*, 21(1), 60-81.

Trinidad, S., & Pearson, J. (2004). Implementing and evaluating e-learning environments. *In Beyond the Comfort Zone: Proceedings of the 21st ASCILITE Conference*, Perth, 5–8 December (eds R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips), pp. 895–903. Retrieved from http://www.asciliate.org.au/conferences/perth04/procs/trinidad.htm on 30 June 2007

Walberg, H. J. (1976). Psychology of learning environments: Behavioral, structural, or perceptual? *Review of Research in Education* 4, 142-178.

Walker, S. L. (2004). A distance education learning environment survey. *Academic Exchange Quarterly*, 8(4), 262-267.

YÖK (2003). Regulations On Inter-University Distance Higher Education Based on Communication and Information Technologies. Retrieved from http://www.yok.gov.tr/english/distance.html August 18, 2007

Yurdugül, H., & Aşkar, P. (2008). Öğrencilerin teknolojiye yönelik tutum ölçeği faktör yapılarının incelenmesi. *İlköğretim Online*, 7(2), 288-309.

APENDIX I.

Components	Eigenvalues	Total Variance Explained (%)	Cumulative Total Variance Explained (%)
1	9,884	18,303	18,303
2	3,859	7,146	25,449
3	3,748	6,941	32,390
4	2,916	5,401	37,791
5	2,496	4,622	42,413
6	2,419	4,479	46,892
7	2,202	4,079	50,971
8	1,870	3,463	54,433
9	1,702	3,152	57,585
10	1,248	2,310	59,895
11	1,153	2,134	62,030
12	1,071	1,983	64,013
13	,937	1,735	65,748
14	,871	1,614	67,362
15	,858	1,588	68,950
16	,786	1,455	70,406
17	,747	1,384	71,790
18	,701	1,299	73,089