Barriers in Information and Communication Technology (ICT) Use in Educational Environments Scale

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Abstract

Integration of technology into teaching-learning process is crucial for effective and permanent learning. This importance has been increasing through the development and extension of information and communication technologies (ICTs) and has become obligatory. However, it cannot be said that technology has reached the desirable level in integration into teaching-learning environments. Although there are numberless factors which affect this case, the literature has highlighted educators' attitudes, self efficacy perceptions, insufficient incentives, lack of hardware and so on. There have been validity and reliability studies in the literature that aimed at integration of instructional technologies into classrooms in Turkey and at exploration of barriers to use of technology, but no Turkish scale has been found. This is the main reason for the research which aims at validity and reliability analyses of the "Difficulties in ICT Use in Educational Environments Scale". As a result of the study, a measurement tool is developed. The tool is called "Difficulties in ICT Use in Educational Environments Scale", which consists of a total of 13 items grouped under the following headings: "Poor Infrastructure/Hardware", "Insufficient Information Resources" and "Personal Incapability".

Keywords: Instructional technologies, integration of technology, barriers to use of technology

Introduction

Today, information and communication technologies have long been used in education as in other fields since they provide different opportunities for creating learning environments ideal for student needs. The current case requires integration of technology into educational environments. Educational organizations need to develop prospective goals and strategies and put them into practice in a planned manner in the light of the current case to provide effective integration of ICTs into educational environments and maximum use of technologies (Göktaş, 2006; Yiğit, Zayit and Yıldırım, 2002). The prior condition for integration of technology is solid infrastructure, but that is not enough on its own. Teachers need to adopt instructional technologies (Zayim, Yıldırım, Saka, 2005).

Teachers have the greatest role in this sense. Without teacher involvement, students cannot benefit from the available technology on their own. Teachers need to play roles such as guiding for effective use of ICTs in education, helping students and leading them (Kınık, Altınkaya and Ertepınar, 2012). Achievement in the process can be accomplished thanks to effective integration of technology into lessons by teachers. Ertmer and et al. (1999) have suggested that there are problems in synchronization of ICTs with teaching-learning process although the number of ICTs in schools has increased. The followings are barriers to ICTs which limit their use in schools: teachers' incapability to diversify the available teaching methods with the help of instructional technologies, lack of satisfactory educational software in schools, lack of technical support, negative attitudes of teachers towards instructional technologies and so on (Buttler and Sellbom, 2002; Ertmer and et al., 1999). A study has concluded that primary school teachers hardly use new instructional technologies in schools, computers and computer technologies that facilitate student learning by creating various opportunities in teaching-learning process. The same research has also shown that the greatest factors that hinder classroom teachers' use of ICTs in primary schools are crowded classrooms, arrangement of classrooms, teachers' lack of information and skills, and negative attitudes of school administration (Adıgüzel, 2010; Yıldırım, 2007). Also, Yıldırım (2007) has reminded that low attitudes of teachers towards use of technologies and lack of technical support are among the factors that hinder use of instructional technologies in schools. It is stated in the literature that Turkish teachers do not have enough information about developing quality educational software eligible for use in teaching process and assessing software for educational intentions (Cüre and Özdener, 2008; Çakıroğlu, Güven and Akkan, 2008; Kuşkaya-Mumcu and Koçak-Usluel, 2004).

In a study, Schoepp (2005) defines difficulties of technology integration into teaching-learning process under different headings. These are inadequate computers, lack of quality software, insufficient time, technical problems, teacher attitudes towards computers, economic issues, poor belief in teachers, resistance to change, poor support by school administration, ineffective computer skills, computer program full adjustment difficulty, insufficient incentives, programming difficulties, poor educational opportunities and lack of vision.

It is possible to see that factors that influence integration of technology into teaching process and effective use in classrooms are variously categorized in different sources. Another categorization is grouped under the following headings: "resistance to change", "teacher attitudes" and "professional development" (Kerka, 1998; Semary, 2011).

When all the negative factors are considered, it can be suggested that teachers face various difficulties in the integration process of ICTs into educational environments. Expressions of these difficulties by teachers as implementers in educational environments are important in terms of constructive suggestions for overcoming difficulties.

When modern curricula are examined, we see that teachers are asked to create learning environments ideal for students with different experiences, characteristics and skills by using ICTs because different fields entail different contents and teaching these contents requires variable pedagogical approaches (Bozkurt and Cilavdaroğlu, 2011). Teachers are expected to have competency (MEB, 2009). In order to achieve this, teachers need to be open to changes in integration of technological opportunities into classroom activities, notice the role of ICTs in teaching environments, have computer skills as well as information and skills for instructional use of information and communication technologies, and cooperate with colleagues for instructional use of ICTs (Becker, 1994; Chiero, 1997; Evans-Andris, 1995).

For integration of technology into education, exploring difficulties of ICT use in teaching-learning process experienced by teachers might make significant contributions to pre-service or in-service training program development to support ICT skills. Furthermore, revealing such difficulties in practice faced by teachers will enrich the literature that mostly searches teacher attitudes towards ICTs. Although teachers have positive expectations and perceptions about technology, exploring reasons why technology is not used in teaching-learning process at a desirable level will lead to both a more meaningful use of those technologies and a more rational ongoing cost management (Gür, Özoğlu and Başer, 2010). As the number of computers in schools increases, exploring computer use levels and factors that hinder computer use for educational purposes becomes more significant. When the literature is reviewed, it is obvious that there has not been a valid, reliable measurement tool in this field.

The research aims at validity and reliability analyses of the scale developed to explore difficulties of ICT use in educational environments experienced by teachers.

Method

In this section, the development process and validity and reliability analyses of the "Difficulties in ICT Use in Educational Environments Scale" are presented.

Study Group

The study group consisted of 286 teachers randomly chosen among primary and secondary school teachers working in Kocaeli, Aydın, Van and Muş provinces during the spring semester of the 2012-2013 academic year. The participants were included in the research based on voluntarism. 68 (23,8%) of the teachers included in the sample worked in Aydın; 97 (33,9%) in Kocaeli; 56 (19,6%) in Van and 65 (22,7%) in Muş. 130 (45,5%) of the participants included in the sample were male, and 156 (54,5%) were female teachers. A total of 286 teachers were included in the sample.

Data Gathering Tool Development

The study made use of a 3-point-Likert type survey items developed by Zayim, Yıldırım and Saka, (2005; 2006) and Gülbahar and Güven (2008) for their research. The survey items designed to explore the main sources of barriers to use of technology in teacher training were rearranged for research purposes. The number of items in the prepared form in the research was 19. The 3-point-form including response options of “I disagree”, “I am not sure” and “I agree” were directly given to 286 teachers in the study group and all the forms were received for consideration.

Exploratory factor analysis based on principal component analysis was employed to study construct validity of the scale. In the analysis, the minimum factor loadings of the items to be included in the scale was 0, 40 (Çokluk, Şekercioğlu and Büyüköztürk, 2012). In order to study construct validity, first the obtained data were tested for factor analysis. To this end, Kaiser-Meyer-Olkin (KMO) coefficient was calculated. Also, Bartlett test was employed to examine whether the given data were presenting a multivariable normal distribution. The minimum factor loading to decide whether the items should stay in the scale was .40 in the exploratory factor analysis. There is a common view in the literature that the minimum factor loading of an item should be 0.30, but some other theorists claim that should be 0.40 (Şencan, 2005).

The model defined by the exploratory factor analysis results was tested by confirmatory factor analysis and confirmatory factor analysis was employed to decide whether the construct was valid.

In the research, structural equation modeling was used to decide to what extent correlational structures between items were matching the actual data. The most widely used fit indexes for model fit assessment are as follows: Chi Square Goodness of Fit Test (χ^2) Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI) (Jöreskog and Sorbom, 1993; Cited by Anıl, 2011). Other goodness of fit measurers are Comparative Fit Index (CFI), Non Normed Fit Index (NNFI) values (Cheng, 2001; Cited by Anıl, 2011). As a result of confirmatory factor analysis of the “Difficulties in ICT use in Educational Environments Scale”, χ^2/df ratio was assessed taking RMSEA, NNFI, CFI and GFI/AGFI into consideration.

The acceptable range suggested by Schermelleh-Engel, Moosbrugger & Müler (2003) for goodness of fit indexes in the data-model fit assessment and confirmatory process of a given hypothesis (Anıl, 2011) is presented in Table 1. Suggested acceptable ranges for goodness of fit indexes in the data-model fit assessment and confirmatory process of a given hypothesis

Table 1. *Standard Goodness of Fit Criteria*

Fit Indexes	**Good Fit**	**Acceptable Fit**
χ^2/df	$0 \leq \chi^2/df \leq 2$	$2 \leq \chi^2/ df \leq 3$
p	$0,05 < p \leq 1,00$	$0,01 \leq p \leq 0,05$
RMSEA	$0 \leq RMSEA \leq 0,05$	$0,05 \leq RMSEA \leq 0,10$
NNFI	$0,97 \leq NNFI \leq 1,00$	$0,95 \leq NNFI \leq 0,97$
CFI	$0,95 \leq CFI \leq 1,00$	$0,90 \leq CFI \leq 0,95$
GFI	$0,95 \leq GFI \leq 1,00$	$0,90 \leq GFI \leq 0,95$
AGFI	$0,90 \leq AGFI \leq 1,00$	$0,85 \leq AGFI \leq 0,90$

(*Source*: Schermelleh-Engel, Moosbrugger & Müler, 2003)

Cronbach-Alpha internal consistency coefficient was calculated to decide sub-factoral reliability of the scale of “Barries to Technology Use in Education”.

Findings

Validity and reliability analyses were respectively performed for the data obtained from the study group in order to develop the “Difficulties in ICT Use in Educational Environments Scale”. First of all, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity results were examined to test whether the data were eligible for factor analysis. Tavşancıl (2005) highlights the fact that KMO value ranging from 0.70 to 0.80 can be considered as “moderate”, “good” from 0.80 to 0.90 and “excellent” above 0.90. In the study, KMO value was taken as 0,89 (Table 2). Bartlett's Test of Sphericity value was found significant [χ^2=1934,142; p<0,001]. As a result of these obtained values, it was decided that the data set was eligible for exploratory factor analysis.

Table 2. *KMO and Bartlett's Test Results*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**,892**
Bartlett's Test of Sphericity	Approx. Chi-Square	1934,142
	df	171
	Sig.	,000

Exploratory factor analysis and confirmatory factor analysis were respectively employed to study construct validity of the “Difficulties in ICT Use in Educational Environments Scale”. Results of exploratory factor analysis of the “Difficulties in ICT Use in Educational Environments Scale” are presented in Table 3. The table shows factor construction, eigenvalues of the factors, explained variance and rotated factor loadings of the items with Varimax rotation method, all obtained as a result of the performed exploratory factor analysis. The table also presents corrected item-total correlations.

As it is clear from Table 3, there are seven items in “Poor Infrastructure/Hardware”, the first defined factor of the “Difficulties in ICT Use in Educational Environments Scale”. Factor loadings rotated with Varimax rotation method ranged from 0.56 to 0.81. When the item-total correlations of the items in this factor are examined, it is seen that they ranged from 0.54 to 0.70.

Table 3. *Exploratory factor analysis results for Difficulties in ICT Use in Educational Environments Scale*

	Rotated Factor Loadings Factor 1	Factor 2	Factor 3	Corrected Item-Total Correlations
Poor Infrastructure/Hardware				
M1.	,81			,67
M2.	,80			,70
M3.	,77			,67
M4.	,74			,65
M5.	,61			,62
M6.	,59			,54
M7.	,56			,57
Cronbach's Alpha : ,86 Eigenvalue : 3,76 Explained Variance : 28,95				
Insufficient Information Resources				
M8.		,80		,55
M9.		,80		,55
M10.		,62		,46
Cronbach's Alpha : 0,70 Eigenvalue : 2,14 Explained Variance : 16,52				
Personal Incapability				
M11.			,77	,37
M12.			,74	,50
M13.			,64	,40
Cronbach's Alpha : 0,62 Eigenvalue : 1,82 Explained Variance : 14,02				

Explained variance of the factor was 28,95%. Cronbach's Alpha reliability coefficient was found 0,86. There are totally three items in "Insufficient Information Resources", the second factor of the scale. Factor loadings rotated with Varimax rotation method ranged from 0,62 to 0,80. Item-total correlations of the items in this factor ranged from 0,46 to 0,55. Explained variance of the factor was 16,52%. Cronbach Alpha reliability coefficient of the second factor was 0,70.

There are totally three items in "Personal Incapability", the third defined factor of the scale. Rotated factor loadings of this factor ranged from 0,64 to 0,78. Item-total correlation coefficients ranged from 0,37 to 0,51. Explained variance of the factor was found 14,02%. Cronbach Alpha reliability coefficient of the third factor was calculated as 0,62. Total explained variance of the scale was found 59,5. When the scientific research in the literature is generally considered, it is seen that categorization of difficulties in technology use in education overlaps with the factors of the study defined as difficulties caused by Poor Infrastructure/Hardware, Insufficient Information Resources, and Personal Incapability.

Confirmatory factor analysis of the "Difficulties in ICT Use in Educational Environments Scale"

As a result of the exploratory factor analysis of the "Difficulties in ICT Use in Educational Environments Scale", as mentioned above, a total of three factors that consisted of 13 items appeared. When the exploratory factor analysis results of the 13-item-scale construction were assessed, χ^2/df ratio was found 2.56 (χ2/df=158,82/62). When considered with the given table, it is seen that χ^2/df=2.56 falls into the acceptable goodness of fit range, as suggested by Schermelleh-Engel, Moosbrugger and Müler (2003).

Root Mean Square Error of Approximation (RMSEA) was found = 0,074. The value had an acceptable goodness of fit since it was in the range of 0,05-0,10. As a result of the exploratory factor analysis, Goodness of Fit Index (GFI) was found 0,921. It could be suggested that the value had an acceptable goodness of fit as it was in the range of 0,90-0,95. Adjusted Goodness of Fit Index (AGFI) was found 0.884. The value had an acceptable goodness of fit as it was in the range of 0,85-0,90. Comparative Fit Index (CFI), another goodness of fit measurer, was found 0.967. The model was considered to have goodness of fit since the value was in the range of 0,95-1,00. As a result of the analysis, Non Normed Fit Index (NNFI) was found 0.959. It could be suggested that the value had an acceptable goodness of fit as it was in the range of 0,95-0,97.

When the correlations between the factors are examined (Chart 1), it is seen that there is a two way correlation of 0,88 between "Poor Infrastructure/Hardware" (F1) and "Insufficient Information Resources" (F2). Again, there is a two way correlation of 0,94 between "Insufficient Information Resources" and "Personal Incapability" (F3) and another of 0,80 between "Poor Infrastructure/Hardware" and "Personal Incapability".

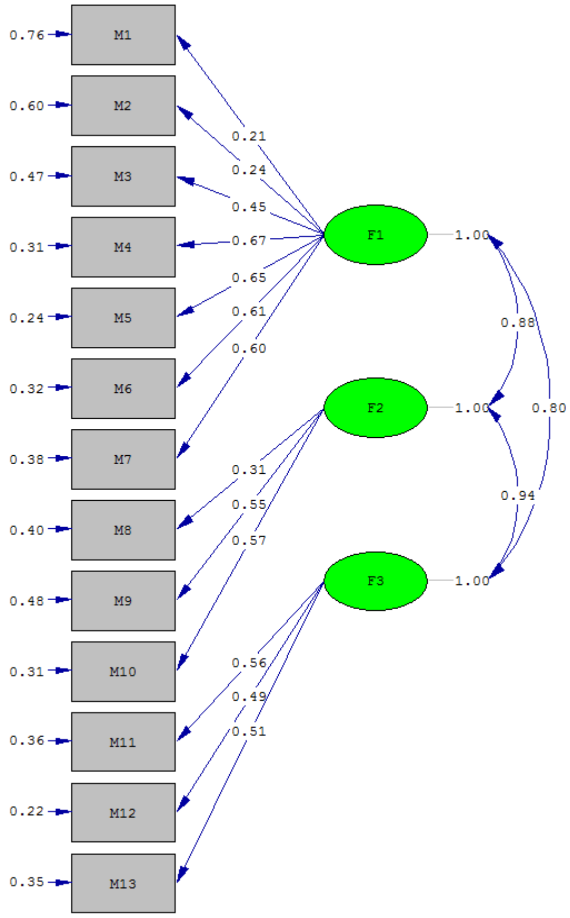

Figure 1. *Pattern Chart of "Difficulties in ICT Use in Educational Environments Scale"*

Results

The research aimed at the development of a valid, reliable data gathering tool to explore difficulties in ICT use in educational environments experienced by teachers. The scale was applied to 286 teachers in Kocaeli, Aydın, Van and Muş provinces.

Validity and reliability analyses of the scale were performed with the obtained data. As a result of exploratory factor analysis, it was determined that the scale items were grouped under three factors; Poor Infrastructure/Hardware (7items), Insufficient Information Resources (3 items) and Personal Incapability (3 items).

Confirmatory factor analysis was performed over the 13-item-construction of the "Difficulties in ICT Use in Educational Environments Scale", grouped under three factors as a result of the exploratory factor analysis. As a result of the confirmatory factor analysis of the scale, χ^2/df ratio was evaluated through GFI/AGFI, RMSEA, CFI and NNFI and all the indexes were proved to be enough for the model fit. Hence, it was decided that the revealed construction was confirmed. Also, the calculated internal consistency coefficients (0,86 for "Poor Infrastructure/Hardware"; 0,70 for "Insufficient Information Resources" and 0,62 for "Personal Incapability") showed that the scale was reliable.

As a result, the "Difficulties in ICT Use in Educational Environments Scale" has a total of 13 items and all the items are graded as "I agree (1), I am not sure (2), I disagree (3)". With an overall assessment of the data for validity and reliability of the scale, it could be suggested that the scale is a valid, reliable tool that can be used to explore difficulties in ICT use in educational environments experienced by teachers. It can also be said that the scale developed according to the obtained findings will fill the gap in the literature and is a sufficient measurement tool for further studies. It is thought that the available scale can be used to explore difficulties in ICT use in educational environments experienced by teachers and to determine whether these difficulties vary according to demographic factors.

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