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# Education Technology Standards Self-Efficacy (ETSSE) Scale: A Validity and Reliability Study[1]

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## Abstract

*Problem Statement*: The educational technology standards which are set by International Society for Technology in Education standards for teachers (the ISTE Standards-T) represent important framework in point of using technology effectively in teaching and learning processes and are used in widespread by universities, educational institutions and schools. The contemporary ISTE standards for teachers those proposed in 2008 have five dimensions. As the standards created a vision to the educational technology field, to determine how prospective teachers or in-service teachers meet these standards need to be measured with valid and reliable instruments.

*Purpose of the Study*: The purpose of this study was to develop and validate education technology standards self-efficacy (ETSSE) scale which is based on the ISTE Standards-T.

*Method*: Confirmatory factor analyses were conducted in order to determine the factor structure of the scale. The scale items were constructed based on the ISTE Standards-T and performance indicators, later to define the content validity values of the items in the scale, views of 12 academics who were specialist of the area were collected. The data of the study is collected from prospective teachers (CFA1 group, n=473) and

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teachers (CFA2 group, n=394). Owing to the fact that the theoretical structure of the standards defined by ISTE, both first order and second order confirmatory factor analyses were applied to the datasets of the CFA1 and CFA2 groups separately without exploratory factor analysis.

*Findings*: Through two CFAs the ETSSE scale was validated in five dimensions as ISTE Standards-T 2008 identified. According to the results of the first order and second order CFAs of the two different groups, it is concluded that the scale is acceptable (CFA1 1st order [$\chi^2$ (734, n= 473)= 1857.23, p< .000, RMSEA=.057, S-RMR=.053, NFI= .95, NNFI=.97, CFI=.97, IFI=.97]; CFA2 1st order [$\chi^2$ (727, n= 394)= 1886.31, p< .000, RMSEA=.064, S-RMR=.056, NFI = .95, NNFI=.97, CFI=.97, IFI=.97]). Concurrent validity results showed positive and significant correlation between the two scales.83 (p<.01). The reliability of Cronbach Alpha is .95 and McDonalds Omega is .96. The item analyses showed that all the items in the scale discriminated both for prospective teachers and teachers (Corrected Item-Total Correlation >.30). Independent group t-test results for 27% upper and 27% lower groups in the five sub-factors showed significant difference (p<.01).

*Conclusion and Recommendations*: The research results have demonstrated that the developed ETSSE scale consisting 40 items and five subscales is valid and reliable, and can be used both with teachers and prospective teachers.

*Keywords*: Education technology standards, ISTE standards, scale development, confirmatory factor analysis

## Introduction

Qualified educational institutions, providing international standards will be replacing the ones lagging behind in keeping up with the times in near future (Özcan, 2013). Researches on what current theoretical frameworks say about 21st century skills identify the skills as standards that students, teachers and administrators should have and take effective use of ICT as the basic skill among the 21st century skills (Voogt & Roblin, 2010; Voogt & Roblin, 2012).

Training of teachers who are in key position of integrating ICT in instructional processes (Kabakci & Odabasi, 2007; Ilgaz & Usluel, 2011; Kabakci Yurdakul, 2013; Goktas, Yildirim & Yildirim, 2009) is as important as equipping educational institutions with the technological resouces (Akpinar, 2003). The International Society for Technology in Education [ISTE] carrying out international level researches on standardization of educational technology skills for using technology effectively in education for different people groups (students, teachers, administrators etc.). This society emphasizes on effective use of technology in educational settings and sets standards related to integration of technological knowledge, pedagogical knowledge and content knowledge for teachers in their

courses. ISTE has provided certain standards and performance indicators for teachers and prospective teachers pertaining to using technology especially in instructional processes and in teaching subject area (ISTE, 2014; Seferoglu, 2009; Coklar & Odabasi, 2009; Morphew, 2012). The educational technology standards which are set by the ISTE Standards-T represent important framework in point of using technology effectively in teaching and learning processes and are used in widespread by universities, educational institutions and schools (ISTE, 2000). Performance indicators in the standards are specific, measurable outcomes that assess what teachers should be able to do to show that they have achieved competency in the standard (Morphew, 2012).

According to the ISTE Standards-T which proposed in 2008, teachers should be able to (ISTE, 2014);

1. Facilitate and inspire student learning and creativity: Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

2. Design and develop digital age learning experiences and assessments: Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the ISTE standards for students.

3. Model digital age work and learning: Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society

4. Promote and model digital citizenship and responsibility: Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

5. Engage in professional growth and leadership: Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources.

These standards can be taken as 21st teacher competencies (ISTE, 2014). On account of the fact that digital learners demand digital teaching, competent teachers who are adequate enough to meet the requirements of the learners of 21st century should be trained to international standards (Skoretz & Cottle, 2011; Ozcan, 2013). It is an important step for the modern transformation of the education system to deal with effective technology integration models in the classroom and to configure the curriculum accordingly by considering the international standards in gaining proficiency in educational technology. Thus, it will provide a positive contribution to the teacher training policies to appropriately customize the standards set by international size to cultural context.

As theoretical constructs of the ISTE Standards-T that cannot be observed directly, the aforementioned standards, factors or phenomena should be tested on both prospective teachers and in-service teachers in point of reliability and validity. The purpose of this study is to develop and validate five factored structure of education technology standards self-efficacy (ETSSE) scale which is based on the ISTE Standards-T defined in 2008.

## Method

*Study Groups*

Study groups of the research consist of junior (third year) and senior (fourth year) prospective teachers (CFA1 group; n=473) studying at a faculty of education of a state university, and teachers (CFA2 group; n=394) who study at secondary schools or high schools in the center districts of Diyarbakır in the spring semester of 2014-2015 academic year in Turkey. A total of 510 forms were distributed to prospective teachers, 480 appropriate responses were obtained and 473 (for the CFA1 group) of them were investigated in the data analysis process. Similarly, 431 forms were distributed to the teachers, 408 of them which were completed the forms precisely investigated and finally 394 (for the CFA2 group) observations were taken into account in the data analysis process.

**Table 1.**

*Demographic Characteristics of the Participants in CFA1 and CFA2 Groups*

| CFA1 (Prospective Teachers) | | f | % | CFA2 (Teachers) | | f | % |
|---|---|---|---|---|---|---|---|
| Gender | Female | 277 | 58.6 | Gender | Female | 151 | 38.3 |
| | Male | 196 | 41.4 | | Male | 243 | 61.7 |
| Departments | Preschool Ed. | 79 | 16.7 | Branches | Physical Ed. | 15 | 3.8 |
| | Elementary teacher Ed. | 32 | 6.8 | | Information technology | 17 | 4.3 |
| | Foreign language (English) | 31 | 6.6 | | Science and math fields | 96 | 24.5 |
| | Social studies | 82 | 17.3 | | Arts | 13 | 3.3 |
| | Turkish language and literature | 34 | 7.2 | | English | 33 | 8.4 |
| | Geography | 31 | 6.6 | | Vocational and technical | 35 | 8.9 |
| | Secondary mathematics | 16 | 3.4 | | Music's | 7 | 1.8 |
| | Turkish | 37 | 7.8 | | Psychological counseling and guidance | 14 | 3.6 |
| | Physics | 11 | 2.3 | | Health education | 2 | 0.5 |

Table 2 Continued

| CFA1 (Prospective Teachers) | | f | % | CFA2 (Teachers) | | f | % |
|---|---|---|---|---|---|---|---|
| Departments | Chemistry | 28 | 5.9 | Branches | Social science fields | 137 | 34.9 |
| | Biology | 27 | 5.7 | | Technology and design | 16 | 4.1 |
| | Philosophy | 29 | 6.1 | | Others | 7 | 1.8 |
| | Pedagogical formation mathematics | 36 | 7.6 | | | | |
| Level | Junior (3rd year) | 241 | 51 | School Stage | Secondary | 239 | 60.7 |
| | Senior (4th year) | 232 | 49 | | High School | 155 | 39.3 |
| Program | Faculty of education | 342 | 72.3 | Teaching experience | 1 – 5 year | 65 | 17.1 |
| | Pedagogical formation | 131 | 27.7 | | 6 – 10 year | 93 | 24.5 |
| | | | | | 11 – 15 year | 102 | 26.8 |
| | | | | | 16 – 20 year | 72 | 18.9 |
| | | | | | 20 year up | 48 | 12.6 |

The demographic characteristics of the prospective teachers (the CFA1 group) indicate that the majority of the participants were female (%58.6), the participation of junior and senior level prospective teachers was very close (%49, %51), the ratio of prospective teachers who were registered to pedagogical formation program (27.7) was quite lower than faculty of education program (%72.3). The CFA1 group which involves 13 different departments has the most participation by Social Studies department (%17.3) and the least by Physics (%2.3).

As to the CFA2 group comprising of in-service teachers; male teachers (%61.7) were more than female teachers, secondary school teachers (%60.7) were more than high school teachers and teachers from 34 different branches grouped in 12 branches participated in the research. The most participation was by social science fields' teachers (%34.9).

*Research Instrument and Procedure*

Based on the purpose of the scale, initially the related literature reviewed and an item pool generated regarding to the ISTE Standards-T. Some items were eliminated based on lack of clarity, questionable relevance or undesirable similarity to other items. The next step in the process was asking a group of people who are specialist in the content area to review the item pool. This review serves multiple purposes related to maximizing the content validity of the scale (DeVellis, 2003). The scale, which was designed in accordance with experts' opinions, was graded as a five point likert type; Strongly Disagree (1), Disagree (2), Mildly Agree (3), Agree (4) and Strongly Agree (5). The ETSSE scale consisted of 40 items and five sub dimensions and took 8-10 minutes to fill and had no reverse scoring items. The sub scales of the ETSSE scale are (F1) Facilitating and inspiring student learning and creativity (F2) Designing and developing digital age learning experiences and assessments (F3)

Modelling digital age work and learning (F4) Promoting and modelling digital citizenship and responsibility (F5) Engaging in professional growth and leadership.

*Data Analysis*

Owing to the fact that the theoretical structure of the standards defined by ISTE, both first order and second order confirmatory factor analyses were applied to the datasets of the CFA1 and CFA2 groups separately to define construct validity without exploratory factor analysis. In EFA, the underlying latent variable structure is not known. Thus, the focus of the investigation is directed toward uncovering the minimal number of factors that underlie the observed variables. In CFA, on the other hand, the researcher has some knowledge of the underlying latent variable structure (Byrn, 1989). CFA is a version of factor analysis in which specific hypotheses about structure and relations between the latent variables that underlie the data are tested (Field, 2009). A fundamental feature of CFA is its hypothesis-driven nature and based on past evidence and theory, of the number of factors that exist in the data, of which indicators are related to which factors, and so forth (Brown, 2006).

Researchers typically use CFA after an instrument has already been assessed using EFA, and they want to know if the factor structure produced by EFA fits the data from a new sample. An alternative, less typical approach, is to perform CFA to confirm a theoretically driven item set without the prior use of EFA. Worthington and Whittaker (2006) stated that rather than producing a CFA that would ultimately need to be followed by a second CFA. Thus two CFAs implemented in two different samples in this research.

Chi-square ($\chi^2$), RMSEA, RMR, S-RMR, NFI, CFI and IFI fit values were considered to evaluate good fit model of the ETSSE scales' sub factors and their relation to the overall scale. To identify the reliability, Cronbach Alpha and McDonald Omega internal consistency coefficients were investigated. In order to identify the item discrimination, corrected item total correlation was analyzed. For internal criterion discriminant validity, upper and lower distinct group based t-test was conducted and means difference between upper 27% and lower 27% identified.

Concurrent validity, reliability studies and item analyses were performed by using PASW Statistics (formerly SPSS) 18 Software package. LISREL 8.54 Software package was used to calculate CFAs.

## Results

*Findings Regarding Validity*

*Content validity.* Primarily a literature review related to ISTE standards for teachers was reviewed to specify the extent to define set of items that will reflect the ETSSE content. Next, an item pool containing 86 declarative sentences was designed by the researcher by taking into consideration of the studies of Morphew (2012) and Cennamo, Ross and Ertmer (2010) representing ISTE-T (2008) standards and performance indicators. 24 were eliminated from the item pool based on lack of

clarity, questionable relevance or undesirable similarity to other items. Initial item pool with a total of 62 items were presented to 12 experts in the content area to determine the content validity.

Content validity concerns item sampling adequacy-that is, the extent to which a specific set of items reflects a content domain (DeVellis, 2003). Usually, an instrument's standing with respect to content validity is determined simply by having experts carefully compare the content of the test against a syllabus or outline that specifies the instrument's claimed domain (Huck, 2012). Croker and Algina (1986) claimed that the most commonly used method is to consult on the expert views in the process of determining the content validity (As cited in: Kan, 2007) and it is important to understand the content consistency among the expert views (Yurdugul, 2005). While many indexes are developed to define the content validity, Lawshe's (1975) content validity ratio (CVR) technic is calculated by quantifying subject matter experts' responses in the way that "Essential, Useful but not essential or Not necessary" (Lawshe, 1975; Yurdugul, 2005; Kan, 2007). The minimum value of the CVR is 0.56 for 12 experts at a .05 level of significance (Lawshe, 1975).

A total of 22 items were eliminated after domain experts assessed the 62 items related to educational technology standards self-efficacy. The whole content validity indexes of the 40 items and five sub dimensions of the initial scale are respectively as follows; F1=.80, F2=.72, F3=.80, F4=.75, F5=.74. The entire content validity indexes of the five sub dimensions of the initial ETSSE scale are above the minimum value of the CVR.

*Construct validity.* In this research before implementing CFA, the assumptions which specified by Tabachnick and Fidell (2007) were examined for the datasets of the two CFA groups.

*1. Sample size and missing data.* Kass and Tinsley (1979) recommended having between 5 and 10 participants per variable up to a total of 300 (as cited in Field, 2009). In this research both CFA1 group (n=473) and CFA2 group (n=394) met this assumption. To assess the factorability of the scale Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used. KMO verified the sampling adequacy for CFA1=.95 and for CFA2= .94. The KMO values are above the suggested cut off .60 by Pallant (2001) and Tabannick & Fidell (2007). Bartlett's test of sphericity value is significant for both CFA1 and CFA2 (CFA1 $\chi^2$ =7335.049, Sd=780, p<.00; CFA2 $\chi^2$ =8356.177, Sd=780, p<.00) as well. There are no missing data in the two datasets.

*2. Linearity and normality.* To identify the linearity and normality normal p-p plot of standardized residual and histogram charts were reviewed.

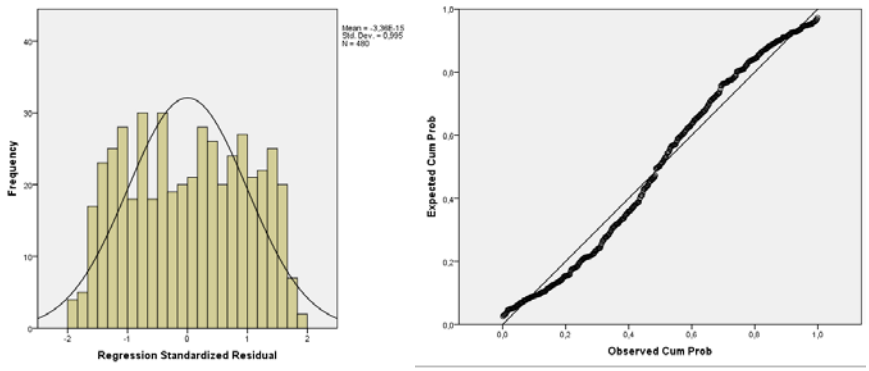


*Figure 1.* Normal P-P plot of regression standardized residual and histogram for CFA1

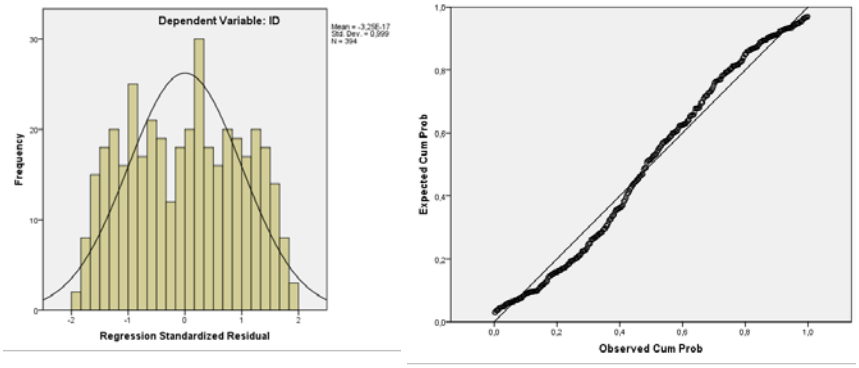


*Figure 2.* Normal P-P plot of regression standardized residual and histogram for CFA2

According to the figures, the datasets of CFA1 and CFA2 look appropriate for both linearity and normality. In addition to the identify the normality assumption, the relative multivariate kurtosis value reviewed and the values were 1.264 for CFA1 and 1.206 for CFA2 datasets. Kline (1998) stated that the multivariate normality kurtosis values of < 2 showed normality (as cited in: Askar & Mazman, 2013).

*3. Multicollinearity.* When there are moderate to high intercorrelations among the independent variables, the problem is referred to as multicollinearity (Pedhazur & Schmelkin, 1991; Stevens, 2009). Some diagnostics of multicollinearity are tolerance and variance inflation factor (VIF). Values below 0.1 indicate serious problems in tolerance statistic and VIF values should be below a value of 10 (Akbulut, 2010; Field, 2007). In the both datasets these values were appropriate (CFA1: minimum tolerance=.38, maximum VIF=1.79; CFA2: minimum tolerance=.28, maximum VIF=3.60).

*4. Detecting univariate and multivariate outliers.* To identify univariate outliers critical t values (-1.96;+1.96) at .05 significance were investigated and there were not

any outliers for the two CFA datasets. However, when the Mahalanobis distance values were analysed for the CFA1 seven observations of 480 and for CFA2 14 of 408 were identified exceeding the critical value of five independent variables of 20.52 in the multivariate outliers (Tabachnick & Fidell (2007).

As a result of meeting the assumption of CFA, the two datasets met the criterions of implementing CFAs. Consequently 473 observations of CFA1 and 394 observations of CFA2 were analysed for construct validity of the ETSSE scale.

*Implementation of the Confirmatory Factor Analyses*

*The CFA1 group.* As a result of the analysis, fit indices values for CFA1 group, first order CFA were found as [$\chi^2$ (729, n = 473) = 1781.64, p < .000, RMSEA=.055, S-RMR=.049, NFI = .95, NNFI=.97, CFI=.97, IFI=.97]. A second order confirmatory factor model was formulated to show if the five first order factors were indicator of the theoretically proposed higher order factor ETSSE. As a result of analysis fit indices values were found as [$\chi^2$ (734, n = 473) = 1857.23, p < .000, RMSEA=.057, S-RMR=.053, NFI = .95, NNFI=.97, CFI=.97, IFI=.97]. According to the cut-off values which were indicated in the Table 2, both the first order and second order CFAs yielded acceptable or good fit for the proposed model. All these values for the proposed models of CFA1 group indicated that the models are appropriate and confirmed.

**Table 3.**

*The Standard Fit Criteria and Fit Values of CFA1 for the Proposed Model*

| Values | Good Fit Values | Acceptable Fit Values | 1st order CFA | 2nd order CFA |
|---|---|---|---|---|
| $X^2/Sd$ | .00 < $X^2$/df < 3 | 3.01 < $X^2$/df < 5.00 | 2.44 | 2.53 |
| RMSEA | .00 <RMSEA< .05 | .05 <RMSEA< .08 | .055 | .057 |
| SRMR | .00 <SRMR< .05 | .05 <SRMR< .10 | .049 | .053 |
| NFI | .95 <NFI< 1.00 | .90 <NFI< .95 | .95 | .95 |
| NNFI | .97 <NNFI< 1.00 | .95 <NNFI< .97 | .97 | .97 |
| CFI | .97 <CFI< 1.00 | .95 <CFI< .97 | .97 | .97 |
| IFI | .95 <IFI< 1.00 | .90 <IFI< .95 | .97 | .97 |

* 1st order CFA for CFA1: $\chi^2$ =1781.64; df=729; for RMSEA %90 confidence interval = (.050, .56)

When the relationships of the sub factors with general structure of the ETSSE model reviewed, the values accordingly found to be as (F1) Facilitating and inspiring student learning and creativity =.79, (F2) Designing and developing digital age learning experiences and assessments =.90 (F3) Modelling digital age work and learning =.96, (F4) Promoting and modelling digital citizenship and responsibility =.85 (F5) Engaging in professional growth and leadership =.90.

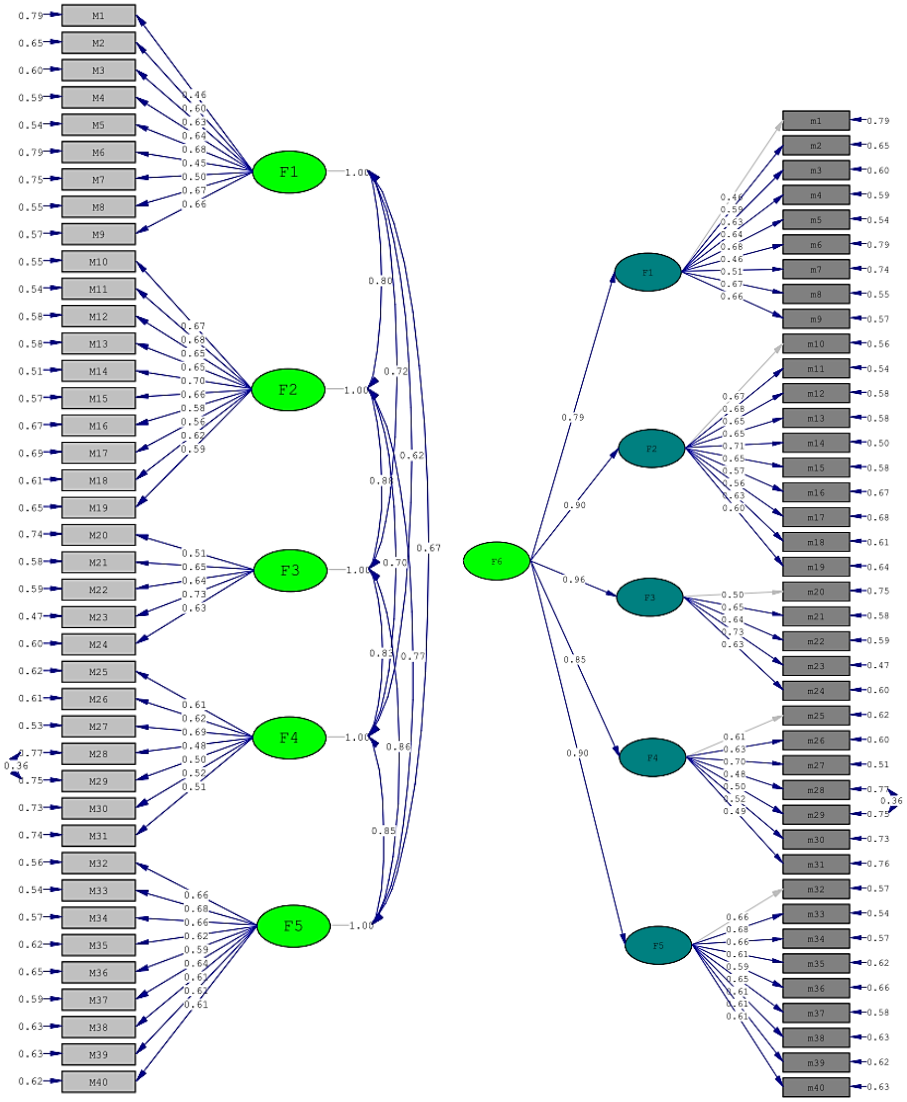


*Figure 3.* The standardized solution screen showing factor loads of first order and second order CFA's for the CFA1 group

The path diagrams of the CFA1's first order and second order models showing standardized solutions screen with the factor loads are depicted in the Figure 3. As a result of the relationship of sub factors with the ETSSE scale, it is inferred that the F3 sub factor was the most related to the ETSSE. When the factor loads of the scale were reviewed, the lowest one found to be as .46 and the highest .73.

The CFA2 group. As a result of the analysis, fit indices values for CFA2 group, first order CFA were found as [$\chi 2$ (727, n =394)= 1886.31, p< .000, RMSEA= .064, S-RMR= .056, NFI= .95, NNFI= .97, CFI= .97, IFI= .97]. A second order confirmatory factor model was formulated to show if the five first order factors were indicator of the theoretically proposed higher order factor ETSSE. As a result of analysis fit indices values were found as [$\chi 2$ (732, n= 394)= 2362.77, p< .000, RMSEA =.069, S-RMR= .059, NFI= .95, NNFI= .97, CFI= .97, IFI=.97].

**Table 4.**

The Standard Fit Criteria and Fit Values of CFA2 for the Proposed Model

| Values | Good Fit Values | Acceptable Fit Values | 1st order CFA | 2nd order CFA |
|---|---|---|---|---|
| X2/Sd | .00 < X2/df < 3 | 3.01 < X2/df < 5.00 | 2.59 | 3.23 |
| RMSEA | .00 <RMSEA< .05 | .05 <RMSEA< .08 | .064 | .069 |
| SRMR | .00 <SRMR< .05 | .05 <SRMR< .10 | .056 | .059 |
| NFI | .95 <NFI< 1.00 | .90 <NFI< .95 | .95 | .95 |
| NNFI | .97 <NNFI< 1.00 | .95 <NNFI< .97 | .97 | .97 |
| CFI | .97 <CFI< 1.00 | .95 <CFI< .97 | .97 | .97 |
| IFI | .95 <IFI< 1.00 | .90 <IFI< .95 | .97 | .97 |

* 1st order CFA for CFA2 : $\chi 2$ =1886.31; df=727; for RMSEA %90 confidence interval = (.062, .69)

According to the cut-off values which were indicated in the Table 3, both the first order and second order CFAs yielded acceptable or good fit for the proposed model. All these values for the proposed models of CFA2 group indicated that the models are appropriate and confirmed.

When the relationships of the sub factors with general structure of the ETSSE model reviewed, the values accordingly found to be as (F1) Facilitating and inspiring student learning and creativity =.72, (F2) Designing and developing digital age learning experiences and assessments =.91 (F3) Modelling digital age work and learning =.97, (F4) Promoting and modelling digital citizenship and responsibility =.84 (F5) Engaging in professional growth and leadership =.85. As a result of the relationship of sub factors with the ETSSE scale, it is inferred that the F3 sub factor was the most related to the ETSSE. The factor loads of the scale ranged from .48 to .75.

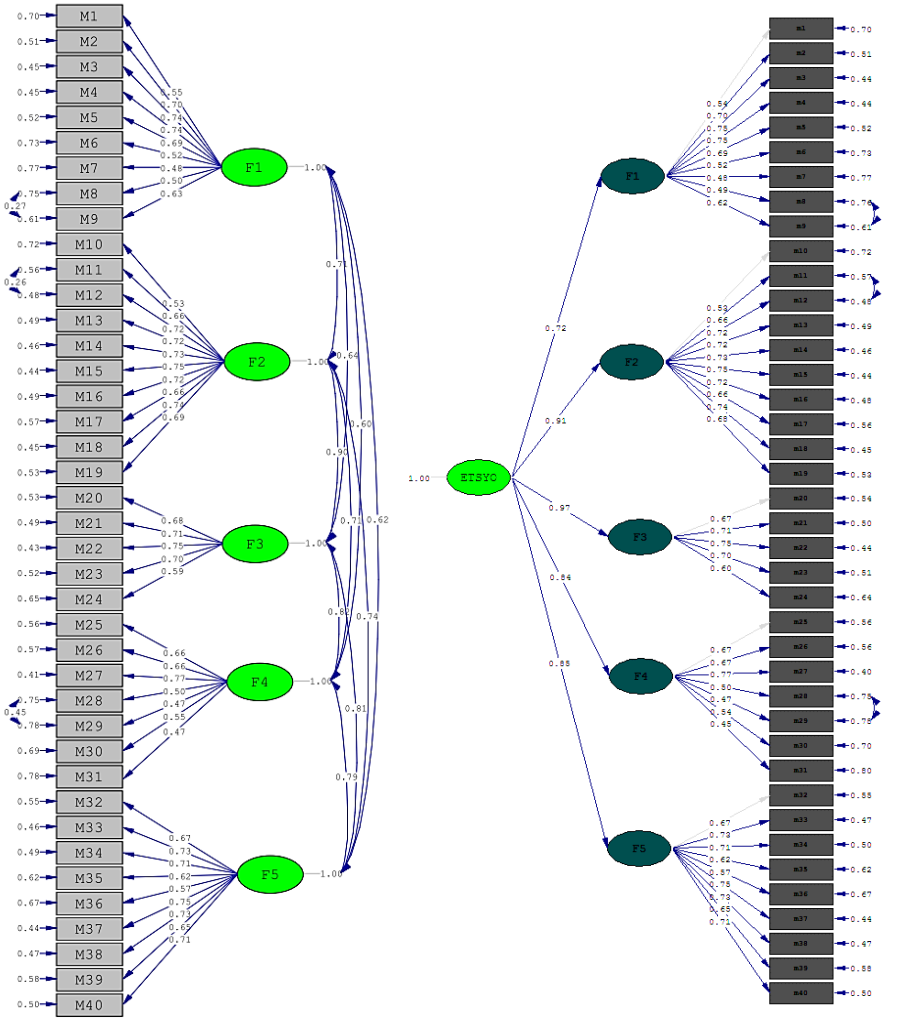


*Figure 4.* The standardized solution screen showing factor loads of first order and second order CFA's for the CFA2 group

*Concurrent validity.* In order to identify the concurrent validity of the ETSSE scale, the Educational Technology Standards Determination Scale (ETSS) based on the 2000 ISTE National Educational Technology Standards for teachers (NETS-T) developed by Coklar and Odabasi (2009) was used. The ETSS has 41 items and six sub factors and carried out with 460 senior level prospective teachers in 2005-2006 fall semesters in Turkey. Çoklar and Odabasi (2009) summarized the ETSS under six sub factors similar to ISTE NETS-T of 2000. The sub factors of ETSS are; 1. Technology operations and concepts 2. Planning and Designing Learning Environments and

Experiences 3. Assessment and evaluation 4. Productivity and professional practice 5. Social, ethical, legal and human issues 6. Planning of teaching according to individual differences and special needs.

The ETSSE and the ETSS scales were carried out on 114 senior level prospective teachers at the same time. The Pearson correlation coefficient calculated between the scores of both scales were found as .83 ($p < .01$). As a result, a high, positive and significant correlation determined between the ETSSE scale and the ETSS scale. Thus, the ETSSE scale can be said to provide concurrent validity.

*Findings Regarding Reliability*

*Item analysis.* The item-total correlation of the ETSSE scale which was corrected for item discrimination has been calculated by Pearson product-moment correlation coefficient.

**Table 5.**
*The Values of Corrected Item Total Correlation (CITC) for the ETSSE Scale*

| Sub dimensions | Item number | CFA 1 | | | CFA 2 | | |
|---|---|---|---|---|---|---|---|
| | | CITC | α | ω | CITC | α | ω |
| (1) Facilitating and inspiring student learning and creativity | m1 | .36 | .83 | .83 | .43 | .85 | .85 |
| | m2 | .45 | | | .53 | | |
| | m3 | .50 | | | .53 | | |
| | m4 | .48 | | | .56 | | |
| | m5 | .58 | | | .55 | | |
| | m6 | .34 | | | .37 | | |
| | m7 | .47 | | | .45 | | |
| | m8 | .56 | | | .42 | | |
| | m9 | .57 | | | .61 | | |
| (2) Designing and developing digital age learning experiences and assessments | m10 | .58 | .87 | .87 | .55 | .90 | .90 |
| | m11 | .58 | | | .60 | | |
| | m12 | .55 | | | .67 | | |
| | m13 | .57 | | | .63 | | |
| | m14 | .63 | | | .63 | | |
| | m15 | .61 | | | .67 | | |
| | m16 | .51 | | | .62 | | |
| | m17 | .54 | | | .62 | | |
| | m18 | .58 | | | .67 | | |
| | m19 | .54 | | | .59 | | |

Table 6 Continued

| Sub dimensions | Item number | CFA 1 | | | CFA 2 | | |
|---|---|---|---|---|---|---|---|
| | | CITC | α | ω | CITC | α | ω |
| (3) Modelling digital age work and learning | m20 | .46 | | | .61 | | |
| | m21 | .59 | | | .62 | | |
| | m22 | .57 | .77 | .77 | .66 | .82 | .82 |
| | m23 | .66 | | | .65 | | |
| | m24 | .57 | | | .56 | | |
| (4) Promoting and modelling digital citizenship and responsibility | m25 | .51 | | | .54 | | |
| | m26 | .52 | | | .50 | | |
| | m27 | .60 | | | .66 | | |
| | m28 | .40 | .78 | .76 | .43 | .80 | .80 |
| | m29 | .40 | | | .40 | | |
| | m30 | .45 | | | .46 | | |
| | m31 | .47 | | | .48 | | |
| (5) Engaging in professional growth and leadership | m32 | .59 | | | .59 | | |
| | m33 | .61 | | | .63 | | |
| | m34 | .59 | | | .62 | | |
| | m35 | .52 | | | .52 | | |
| | m36 | .54 | .85 | .86 | .49 | .89 | .89 |
| | m37 | .59 | | | .64 | | |
| | m38 | .56 | | | .65 | | |
| | m39 | .52 | | | .56 | | |
| | m40 | .56 | | | .64 | | |

According to the Table 4, the corrected item-total correlations (CITC) of CFA1 dataset ranges from .34 to .66; and CFA2 dataset ranges from .37 to .67. Generally, the item total correlation values above .30 and upper are accepted that the items discriminated individuals well (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2008). Both of these values are above .30 showing that all the items correlate with the total score of the scale and are reliable.

*Reliability*

In order to identify the reliability of the scale's internal consistency, both Cronbach Alpha and McDonald (Omega) coefficients were calculated. As it is seen in the Table 4, Cronbach Alpha values for overall scale and sub scales ranged from .77 to .87 and McDonald (Omega) coefficients ranged from .76 to 87 for the CFA1 dataset. Again, when the CFA2 dataset reviewed both Cronbach Alpha and McDonald (Omega) values ranged from .80 to .90. These results indicate that internal consistency of composite and sub-scales of the ETSSE scale and their reliability were adequate.

Another technic of reliability is to identify differences of arithmetic mean of the scores of those having a high and low self-efficacy level measured by each sub-scales and total scale. Differences in the mean scores of the upper 27% and lower 27% groups can be reviewed for the internal criterion discriminant (Atılgan, Seçkes,

Yurdugül & Çırak, 2007). For internal criterion discriminant validity, upper and lower distinct group based t-test was conducted and the results are presented in Table 5.

**Table 7.**

*Internal Criterion Discriminant Validity, Upper 27% and Lower 27% Distinct Groups Based Independent Samples T-Test Scores*

| | | CFA1 | | | | | | CFA2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Factors | Group | n | $\bar{X}$ | Sd | df | t | p | n | $\bar{X}$ | Sd | df | t | p |
| F1 | Lower | 128 | 3.39 | .21 | 254 | 44.04 | .00 | 106 | 3.17 | .30 | 210 | -31.59 | .00 |
| | Upper | 128 | 4.69 | .26 | | | | | 4.46 | .30 | | | |
| F2 | Lower | 128 | 3.21 | .31 | 254 | -41.55 | .00 | 106 | 2.94 | .36 | 210 | -32.47 | .00 |
| | Upper | 128 | 4.58 | .21 | | | | | 4.39 | .29 | | | |
| F3 | Lower | 128 | 3.17 | .34 | 254 | -41.84 | .00 | 106 | 2.98 | .32 | 210 | -37.29 | .00 |
| | Upper | 128 | 4.65 | .33 | | | | | 4.48 | .26 | | | |
| F4 | Lower | 128 | 3.06 | .35 | 254 | -42.48 | .00 | 106 | 2.95 | .34 | 210 | -34.61 | .00 |
| | Upper | 128 | 4.57 | .20 | | | | | 4.43 | .28 | | | |
| F5 | Lower | 128 | 3.28 | .34 | 254 | -40.49 | .00 | 106 | 3.02 | .32 | 210 | -36.33 | .00 |
| | Upper | 128 | 4.68 | .19 | | | | | 4.46 | .25 | | | |
| ETSSE | Lower | 128 | 3.35 | .25 | 254 | -43.85 | .00 | 106 | 3.13 | .27 | 210 | -34.67 | .00 |
| | Upper | 128 | 4.52 | .17 | | | | | 4.32 | .22 | | | |

According to the independent samples t-test results, the self-efficacy scores of 27% upper and lower groups in either CFA1 or CFA2 differentiated significantly at all sub-scales and total scales at .01 level. Thus these results provide adequate evidence for internal criterion discriminant validity.

## Conclusion and Recommendations

When the literature about ISTE standards reviewed, Coklar's (2008) research about the ISTE NETS-T 2000 standards and performance indicators is an important resource. The other researchers, Misirli (2014) studied standards for students, Caglar (2012) studied standards for teachers and Hacifazlioglu, Karadeniz and Dalgic (2010) studied standards for administrators. Besides, Kabakci Yurdakul, Odabasi, Kilicer, Coklar, Birinci and Kurt (2014) determined teacher competencies based on Technopedagogical education in terms of national standards consisting 20 competencies and 120 performance indicators with 24 faculty members. Despite the fact that the previous researches on standards for teachers or other groups are important in Turkey, the more studies which specify educational technology skills similar to ISTE or UNESCO ICT competences will contribute to identify national educational technology standards. Besides, these standards or competences should be developed in accordance with the valid pedagogical and technological

improvements. The ETSSE scale shows a valid point of view on the grounds that based on the contemporary ISTE standards for teachers. The standards are differentiated from the previous ISTE NETS-T in terms of highlighting on creativity and innovation (Orhan, Kurt, Ozan, Som Vural & Turkan, 2015) and these standards have constructivist focus and attaches importance to globalization, cultural awareness and reflect that changing perspective and require teachers to demonstrate leadership (Willis, 2012). Kadijevich and Haapasalo (2008) stated that it seemed more important to examine relevant variables concerning educational technology standards (behaviour, intention, interest, attitude, support, experience, etc.) by using multiple sources of evidence combining qualitative and quantitative aspects. For these reasons this scale is an important data gathering tool to reveal teachers' and prospective teachers' educational technology standards self-efficacy within the context of creativity, collaboration, innovation and globalization which are also considered important competences in 21st century teacher competence frameworks.

There are two different study groups in this research one of which is prospective teachers studying at various departments and different teacher training programs and the latter is ongoing teachers of 34 different branches having teaching experience 1-5 years to above 20 years. Therefore the study indicates that it is carried out on different populations of pre-service and in-service groups.

Due to the ISTE standards and performance indicators framework is constructed by the internationally known many specialists (ISTE, 2000; ISTE, 2014) in the area of educational technology and the standards are included in a theoretically driven model which is updated by new researches about using technology in education, regardless of exploratory factor analysis only CFA procedures were carried out in this research. Segars and Grover (1993) allege that as more was known about the theoretical and measurement properties of scales and their underlying constructs, methods for empirically evaluating these associations should have evolved from the exploratory nature of classical techniques to the more exacting and confirmatory nature of contemporary techniques. Since, this research is testing the ISTE standards in Turkish pre-service teachers and in-service teachers the formulation of the standards is a prerequisite for the application of CFA (Pedhazur & Schmelkin, 1991). However, Worthington and Whittaker (2006) stated that rather than producing a CFA that would ultimately need to be followed by a second CFA, accordingly two CFAs implemented in two different study groups.

Consequently, the factor structure of the ETSSE scale which is based on the ISTE standards for teachers is examined via two different CFAs. The first and second order CFAs of two different datasets showed that the structures containing five factors and 40 items are confirmed by the fit values of two construct validity implementations and are valid in terms of content, construct, concurrence and internal criterion discriminant validity and reliable in terms of corrected item total correlation, Cronbach Alpha, McDonalds Omega. This tool can be also utilized for assessing to what extend teachers or prospective teachers have self-efficacy levels in respect to the five sub-scales or total scale at various educational institutions.

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# Appendix

**Education Technology Standards Self-Efficacy (ETSSE) Scale**

| | | Tamamen Katılıyorum | Katılıyorum | Biraz Katılıyorum | Katılmıyorum | Tamamen Katılmıyorum |
|---|---|---|---|---|---|---|
| 1. | Teknolojiyi, öğrencilerin yaratıcı düşünmelerini geliştirmeleri için kullanabilirim. | | | | | |
| 2. | Gerçek yaşam problemlerini çözmede; dijital araçların nasıl kullanılabileceği konusunda öğrencileri yönlendirebilirim. | | | | | |
| 3. | Öğrencileri, çeşitli dijital öğrenme ortamlarına katılmaları için teşvik edebilirim. | | | | | |
| 4. | Öğrenmeyi kolaylaştırma konusunda, öğrencileri teknolojik araçları kullanmaya teşvik edebilirim. | | | | | |
| 5. | Dijital araçları ve kaynakları kullanarak öğrencilerin gerçek yaşamla ilgili konuları araştırmalarına rehberlik edebilirim. | | | | | |
| 6. | Belirli bir konudaki problemi çözmeleri için öğrencileri internette araştırma yapmaya yönlendirebilirim. | | | | | |
| 7. | Öğretim sürecinde, teknoloji destekli iletişim ortamlarından (blog, forum, sohbet, e-posta vb.) yararlanabilirim. | | | | | |
| 8. | Öğrencilerin birbirleriyle etkileşime girmeleri için çeşitli dijital ortamları kullanmalarını sağlayabilirim. | | | | | |
| 9. | Öğrencilerin, bilgi ve iletişim teknolojisi araçlarını işbirlikli öğrenme için kullanmalarına rehberlik edebilirim. | | | | | |
| 10. | Öğrencilere bireysel gelişimlerini aktif bir biçimde izleyebileceği teknolojiyle zenginleştirilmiş öğrenme ortamları oluşturabilirim. | | | | | |
| 11. | Öğrencilerin kalıcı bir biçimde öğrenmesini sağlamak için konu alanıyla ilgili dijital araç ve kaynakları bütünleştirerek uygun öğrenme etkinlikleri tasarlayabilirim. | | | | | |
| 12. | Öğrencilerin yaratıcı düşünmelerini desteklemek için konu alanıyla ilgili dijital araç ve kaynakları bütünleştirerek uygun öğrenme etkinlikleri tasarlayabilirim. | | | | | |
| 13. | Bilgi ve iletişim teknolojilerini kullanarak farklı deneyimlere sahip öğrenciler için uygun öğrenme ortamları hazırlayabilirim. | | | | | |
| 14. | Öğrencilerin farklı öğrenme ihtiyaçlarını daha etkili desteklemek için teknolojiyle zenginleştirilmiş öğretim stratejilerini uygulayabilirim. | | | | | |
| 15. | Öğrencilerin öğrenme düzeylerini değerlendirmek için teknolojiyi etkili bir şekilde kullanabilirim. | | | | | |
| 16. | Öğrenme-öğretme sürecinin içinde ve sonunda alternatif değerlendirme yöntemlerini kullanırken teknolojiden yararlanabilirim. | | | | | |
| 17. | Teknolojik araçları, öğretim süreci ile ilgili her türlü verileri işlemek ve raporlaştırmak için kullanabilirim. | | | | | |
| 18. | Öğretim süreci için en uygun teknolojiyi/teknolojileri seçebilirim. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 19. | Öğrenme-öğretme sürecinin gerçekleştirileceği ortamı teknoloji kullanımına uygun olarak düzenleyebilirim. | | | | | |
| 20. | Küresel toplumun bir üyesi olarak yenilikçi bir öğretmenin sahip olması gereken tutumları sergileyebilirim. | | | | | |
| 21. | Bilişim teknolojileri ile ilgili yazılım ve donanımları etkili bir biçimde kullanabilirim. | | | | | |
| 22. | Sahip olduğum teknoloji bilgimi yeni teknolojilere, etkili bir biçimde transfer edebilirim. | | | | | |
| 23. | Öğrencilerin ulaştığı bilgi kaynaklarını doğru biçimde kullanmaları için dijital araçların etkili biçimde kullanılmasına rehberlik edebilirim. | | | | | |
| 24. | Daha etkili bir öğretmen olabilmek için yeni teknolojik araçlar konusunda sürekli olarak kendimi geliştirebilirim. | | | | | |
| 25. | Bilgi ve iletişim teknolojileri ile ilgili yasal sorumlulukları bilirim. | | | | | |
| 26. | Bilgi ve iletişim teknolojileri ile ilgili ahlâki sorumlulukları öğrencilere kazandırabilirim. | | | | | |
| 27. | Öğrenme-öğretme sürecinde, öğrencileri güvenilir dijital kaynaklara yönlendirerek doğru bilgiye ulaşmaları için onlara rehberlik edebilirim. | | | | | |
| 28. | Bilişim teknolojilerini kullanırken lisanslı yazılımlar kullanmaya özen gösteririm. | | | | | |
| 29. | Dijital kaynakları kullanırken telif hakkı konusunda hassas davranırım. | | | | | |
| 30. | Sanal sosyal ağları kullanırken öğrencileri düşünerek onlara model olabilecek biçimde davranabilirim. | | | | | |
| 31. | Bilgi çağının iletişim araçlarını kullanarak farklı kültürlerden öğretmenlerle iletişime geçebilirim. | | | | | |
| 32. | Bilgi ve iletişim teknolojilerindeki yenilikleri izlerim. | | | | | |
| 33. | Mesleki gelişimimi desteklemek için bilgi ve iletişim teknolojilerinden yararlanabilirim. | | | | | |
| 34. | Teknoloji kaynaklarını yaşam boyu öğrenen bir birey olmak için kullanabilirim. | | | | | |
| 35. | Öğretmenlik becerilerimi geliştirmek için çevrim içi ortamlarda (forumlar, video konferanslar, sanal sosyal ağlar vs.) öğretmenlerle bilgi alışverişinde bulunabilirim. | | | | | |
| 36. | Ulusal ve uluslararası topluluklara katılarak öğrencilerin öğrenmesine katkı sağlayacak etkili teknoloji uygulamalarını inceleyebilirim. | | | | | |
| 37. | Mesleğimde kendimi geliştirmek için dijital araç ve kaynakları etkili biçimde kullanabilirim. | | | | | |
| 38. | Teknolojinin eğitimde etkili bir biçimde kullanılması için meslektaşlarıma öncülük edebilirim. | | | | | |
| 39. | Mesleki gelişimimi sağlamak için meslektaşlarımla e-posta grupları ya da sanal sosyal gruplar oluşturabilirim. | | | | | |
| 40. | Mesleğim ve konu alanım ile ilgili yapılan araştırmaları inceleyerek bunları, öğrencilerin öğrenmesine katkı sağlaması için kullanabilirim. | | | | | |

**Distribution of the items in terms of the sub factors**

1. Facilitating and inspiring student learning and creativity: *1-9 items*

2. Designing and developing digital age learning experiences and assessments: *10-19 items*

3. Modelling digital age work and learning: *20-24 items*

4. Promoting and modelling digital citizenship and responsibility: *25-31 items*

5. Engaging in professional growth and leadership: *32-40 items*

## Eğitim Teknolojisi Standartlarına Yönelik Öz-Yeterlik Ölçeği (ETSYÖ): Geçerlik Güvenirlik Çalışması

**Atıf:**

Simsek, O., & Yazar, T. (2016). Education technology standards self-efficacy (ETSSE) scale: A validity and reliability study. *Eurasian Journal of Educational Research*, 63, 311-334, http://dx.doi.org/ 10.14689/ejer.2016.63.18

### Özet

*Problem Durumu:* Yakın gelecekte, diğer bazı alanlarda olduğu gibi eğitim alanında da, uluslararası standartlarda eğitim veren kaliteli okul ve üniversiteler; kalitesiz olan ve çağa ayak uyduramayan kurumların yerini alacaktır (Özcan, 2013). 21. yüzyıl becerilerinin ne olması ile ilgili ulusal ve uluslararası düzeyde yapılan çalışmalar öğrencilerde, öğretmenlerde ve yöneticilerde bulunması gereken özellikleri standartlar biçiminde ifade ederken bilgi ve iletişim teknolojilerini etkin biçimde kullanma becerisinin temel beceriler arasında olduğu belirtilmiştir (Voogt ve Roblin, 2010).

ISTE'nin yayımladığı 2008 Uluslararası Eğitim Teknolojisi Standartlarına göre öğretmenler; dijital çağın öğrenme deneyimlerini tasarlayarak öğrencilerin öğrenmelerini kolaylaştıran ve yaratıcı düşünmelerini teşvik eden, dijital çağın çalışma anlayışına öncülük eden, bir dijital vatandaşın sahip olduğu sorumlulukları bilen ve okul içinde ya da dışında mesleki gelişim ve liderlik etkinliklerine katılan, yirmi birinci yüzyıl becerisi sergileyen bireylerdir.

Bu araştırmanın amacı, ISTE tarafından öğretmen ve öğretmen adayları için en son belirlenen (2008) uluslararası eğitim teknolojisi standartlarının beş boyutlu yapısının Doğrulayıcı Faktör Analizi(DFA) ile test etmek ve Eğitim Teknolojisi Standartlarına Yönelik Özyeterlik (ETSYÖ) ölçeğini geliştirmektir.

*Araştırmanın Yöntemi:* Araştırmanın ölçek geliştirme sürecinde seçilen çalışma gruplarını; 2014-2015 öğretim yılının bahar döneminde Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi'nin öğrenim gören öğretmen adayları ve Diyarbakır ili merkez ilçelerinde bulunan ortaokul ve lise öğretmenleri oluşturmaktadır. Veriler öğretmen adayları (DFA1; n=473) ile öğretmenler (DFA2; n=394) olmak üzere iki farklı gruptan toplanmıştır. Araştırmada ölçeğin kapsamını belirlemek için öncelikli olarak ISTE-T (2008) standartları ve performans göstergeleri ve açıklamaları incelendikten sonra bu standartları açıklayan Morphew (2012) ve Cennamo, Ross ve Ertmer'in (2010) çalışmaları da göz önünde tutulmuş ve alan uzmanlarının değerlendirmesi için 62 maddelik bir anket formu oluşturulmuştur. 12 katılımcı uzmanın görüşlerini belirttiği kapsam geçerlik oranları(KGO) hesaplanmıştır. KGO hesaplandıktan sonra 40 maddelik bir pilot ölçek hazırlanmıştır. ETSYÖ ölçeğinin alt boyutları, (1) Öğrencilerin öğrenmelerini kolaylaştırma ve yaratıcılığı teşvik etme (2) Dijital çağa uygun öğrenme ortamları ve değerlendirme etkinlikleri tasarımlama ve geliştirme (3) Dijital çağın çalışma ve öğrenme anlayışına öncülük etme (4) Dijital vatandaşlıkta model olma (5) Mesleki gelişim ve liderlik etkinliklerine katılma şeklindedir.

Araştırmada, Hem DFA1 hem de DFA2 grubu için DFA'nın uygulanmasından önce Tabachnick ve Fidell (2007) tarafından belirtilen sayıltılara göre veri setleri incelenmiştir. Örneklem ve kayıp veri, doğrusallık ve normallik, çoklu bağlantılılık ve aykırı gözlemler ön koşulları incelendikten sonra öğretmen ve öğretmen adayları için iki farklı doğrulayıcı faktör analizi uygulanmıştır.

*Araştırmanın Bulguları:* DFA1 için birinci düzey DFA bulguları [$\chi^2$ (729, N = 473) = 1781.64, p < .000, RMSEA=.055, S-RMR=.049, NFI = .95, NNFI=.97, CFI=.97, IFI=.97] kurulan modelin kabul edilebilir uyum gösterdiğini ortaya koymaktadır. ETSYÖ'nün alt ölçekleri ile tek bir yapıya yönelip yönelmediğinin belirlenmesi için DFA1 grubunun veri seti ile ikinci düzey DFA uygulanmış ve bulgulara göre ETSYÖ'nün genel yapısı da kabul edilebilir uyum göstermiştir [$\chi^2$ (734, N = 473) = 1857.23, p < .000, RMSEA=.057, S-RMR=.053, NFI = .95, NNFI=.97, CFI=.97, IFI=.97].

DFA2 için birinci düzey [$\chi^2$ (727, N = 394) = 1886.31, p < .000, RMSEA=.064, S-RMR=.056, NFI = .95, NNFI=.97, CFI=.97, IFI=.97]; ikinci düzey [$\chi^2$ (732, N = 394) = 2362.77, p < .000, RMSEA=.069, S-RMR=.059, NFI = .95, NNFI=.97, CFI=.97, IFI=.97] şeklindedir ve bu sonuçlar ölçeğin kabul edilebilir olduğunu göstermektedir.

ETSYÖ ölçeğinin uyum geçerliğini ortaya koymak için Çoklar ve Odabaşı (2009) tarafından geliştirilen Uluslararası Eğitim Teknolojileri Birliği'nin öğretmen ve öğretmen adayları için belirlediği Ulusal Eğitim Teknolojisi Standartlarını (2000) temel alan Öğretmenlere Yönelik Eğitim Teknolojisi Standartlarını Belirleme Ölçeği (ETSÖ) kullanılmıştır. ETSYÖ ve ETSÖ 114 kişilik bir gruba uygulanmıştır. Her iki ölçekten alınan puanlar arasında hesaplanan korelasyon katsayısı .83 (p<.01) olarak bulunmuştur. ETSYÖ ölçeği ile ETSÖ arasında yüksek düzeyde, pozitif ve anlamlı bir ilişki olduğu belirlenmiştir.

ETSYÖ Ölçeğinin madde ayırt ediciliği için düzeltilmiş madde-toplam korelasyonu hesaplanmıştır. DFA1 ve DFA2 grupları ile gerçekleştirilen çözümlemelerde madde

toplam korelasyonuna ilişkin değerlerin .34 ile .67 arasında değiştiği görülmüştür. Ölçeğin güvenirliğine ilişkin bulguların incelenmesi için hem Cronbach Alpha hem de McDonald (Omega) katsayısı değerlerine bakılmış ve Cronbach Alpha değerleri tüm ölçek için .95, 1.boyut=.83; 2.boyut=.87; 3.boyut=.77; 4.boyut=.78; 5.boyut=.85 çıkmıştır. McDonald'ın Omega katsayısı incelendiğinde tüm ölçek için .96, 1.boyut=.83; 2.boyut=.87; 3.boyut=.77; 4.boyut=.76; 5.boyut=.86 çıkmıştır. Ayrıca, her bir alt ölçeğin ve birleşik ölçeğin (ETSYÖ) ölçtüğü eğitim teknolojisi standartları öz yeterlik boyutlarındaki %27'lik alt ve %27'lik üst grupların puan ortalamaları arasındaki farkların istatistiksel olarak anlamlı olduğu görülmüştür.

*Araştırmanın Sonuçları ve Önerileri:* Alanyazında ISTE'nin eğitim teknolojisi standartları ya da UNESCO'nun BİT yeterlikleri çerçevesi ile ilgili çalışmaların yeterli olmadığı söylenebilir. Zira, eğitim teknolojisi standartları uluslararası katılımcılar tarafından sürekli geliştirildikleri için güncel çalışmaların yapılmasına gereksinim vardır. Kadijevich ve Haapasalo (2008) da eğitim teknolojisi standartlarının (davranış, isteklilik, ilgi, tutum, destek, deneyim vs.) çeşitli kanıtlara dayalı kaynaklar kullanarak niteliksel ve niceliksel biçimde incelenmesi gerektiğini vurgulamıştır. Bu araştırmada geliştirilen ölçek ISTE'nin 2008 yılında ortaya koyduğu öğretmen standartlarını ve performans göstergelerini dikkate aldığı için daha güncel bir bakış açısı ortaya koymaktadır. ISTE NETS-T (2000) standartlarından farklı olarak 2008 yılındaki standartların yaratıcılık ve yenilikçilik vurgusu yaptığı (Orhan, Kurt, Ozan, Som Vural ve Türkan, 2015), yapılandırmacı yaklaşıma dayalı olduğu ve mesleki yaşamda küreselleşme ve kültürel farkındalığın geliştirilmesine önem verdiği görülmektedir (Willis, 2012). Bu nedenle, öğretmen ve öğretmen adayları için uluslararası eğitim teknolojisi standartları (ISTE-T) bağlamında geliştirilen bu ölçek, 21. yüzyıl öğretmen özelliklerini yaratıcılık, işbirliği ve yenilikçilik bağlamında incelemek için önemli bir veri toplama aracıdır. Bu maddeler ve boyutlar deneysel ve tarama modellerinde kullanılarak eğitimsel araştırmalara katkı sağlayacaktır. Hem öğretmen adayları hem de öğretmenler ile gerçekleştirilen bu çalışmada iki grup için doğrulayıcı faktör analizinin yapılması ve geçerlik – güvenirlik sonuçlarının istatistiksel olarak anlamlı çıkması nedeniyle ETSYÖ ölçeği alt boyutları ve birleşik ölçek olarak kullanılabileceğini göstermektedir.

*Anahtar Sözcükler:* Eğitim teknolojisi standartları, ISTE standartları, ölçek geliştirme, doğrulayıcı faktör analizi