

## **Turkish Adaptation of Digital Literacy Scale and Investigating Pre-service Science Teachers' Digital Literacy\***

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### **Abstract**

The shortest description of digital literacy is the one made by Eshet-Alkalai (2004) as; “survival skill in the digital era”. According to Ng (2012) the indicator of an individual’s being digital literate is her/his adaptation to the new or emerging technologies. Therefore, it is important for the 21st century humanity to develop digital literacy skills. Today, countries are aware of the fact that the quality of education has a big role in shaping their future so they review their education policies accordingly. In this regard, they pace for the sake of benefiting from technology in education. In Turkey, the main aim of the FATİH Project (Movement of Enhancing Opportunities and Improving Technology), carried out by Turkish Ministry of National Education since 2010, is to increase technological opportunities in schools and effectively integrate technology into educational environments. A plethora of research have emphasized that the project increases the technological opportunities however there are deficiencies in its usage in educational environments effectively. The most important stakeholders that influence the success of the project are teachers and the students. Determining the digital literacy skills of teachers, pre-service teachers and students is important in terms of developing the required teacher education programs. Therefore, one of the aims of this research was to adapt the digital literacy scale developed by Ng (2012) into Turkish and the other was to investigate pre-service science teachers’ digital literacy. 979 junior and senior pre-service science teachers from 13 state universities participated in the research. Factor loadings of the scale items varied between 0.46 and 0.74 in according to the exploratory factor analysis result. In the scale; 10 items fall into one factor and explain 40% of the total variability. Cronbach Alpha reliability score is 0.86. The adapted version of the digital literacy scale is determined as valid and reliable. According to the findings related to the second aim of the study, the digital literacy skills of pre-service science teachers seem generally qualified.

**Keywords:** scale adaptation, digital literacy, pre-service teachers

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## Dijital Okuryazarlık Ölçeğinin Türkçeye Uyarlanması ve Fen Bilgisi Öğretmen Adaylarının Dijital Okuryazarlık Durumları

### Öz

Dijital okuryazarlık için yapılmış en kısa tanım “dijital çağda hayatta kalma becerisi” şeklindedir (Eshet-Alkalai, 2004). Ng (2012)’ye göre bir bireyin dijital okuryazar olmasının göstergesi; yeni veya gelişmekte olan teknolojilere adaptasyonudur. Bu nedenlerle dijital çağda öğrenen ve öğreten bireylerde bu becerileri geliştirmek 21. yüzyılda oldukça önemlidir. Günümüzde ülkeler geleceğin şekillenmesinde kaliteli eğitimin büyük rol oynayacağını farkındadırlar ve buna göre eğitim politikalarını gözden geçirmektedirler. Bu nedenle eğitimde teknolojiden daha fazla yararlanma adına adımlar atılmaktadır. Türkiye’de Milli Eğitim Bakanlığı tarafından 2010 yılından itibaren yürütülen FATİH (Fırsatları Artırma ve Teknolojiyi İyileştirme Hareketi) projesinin temel amacı okullarda teknolojik fırsatları artırmak ve etkili olarak teknolojiyi eğitim ortamlarına entegre etmeyi sağlamaktır. Projenin teknolojik fırsatları artırdığı gerçeğinin yanı sıra eğitim ortamlarında etkili kullanımına ilişkin eksikliklerine vurgu yapan araştırmalar da yer almaktadır. Projenin başarısını etkileyen en önemli paydaşlar şüphesiz ki öğretmen, öğretmen adayları ve öğrencilerdir. Öğretmen, öğretmen adayları ve öğrencilerin dijital okuryazarlık durumlarının belirlenmesi, gerekli öğretmen eğitim programlarının şekillendirilmesi ve öğretmenlerin öğrencilerine teknolojik liderlik yapabilmeleri açısından önemlidir. Bu nedenle bu çalışmanın iki amacından ilki Ng (2012) tarafından geliştirilmiş olan dijital okuryazarlık ölçeğinin Türkçeye uyarlanması ve diğer amaç ise fen bilgisi öğretmen adaylarının dijital okuryazarlık yeterliklerinin araştırılması olmuştur. Araştırmaya 13 devlet üniversitesinden 3. ve 4. sınıfta okuyan 979 fen bilgisi öğretmen adayı katılmıştır. Açımlayıcı faktör analizi sonucunda ölçek maddelerinin faktör yükleri 0.46 ile 0.74 arasında değişkenlik göstermiştir. Ölçekte; tek faktörde 10 madde yer almakta ve toplam değişkenliğin %40’ını açıklamaktadır. Ölçeğin güvenilirliğine ilişkin Cronbach Alpha değeri 0.86 olarak bulunmuştur. Yapılan dijital okuryazarlık ölçeği uyarlama çalışmasının geçerli ve güvenilir olduğu belirlenmiştir. Bununla birlikte araştırmanın bulguları fen bilgisi öğretmen adaylarının dijital okuryazarlık becerilerinin genel olarak iyi olduğunu göstermektedir.

**Anahtar Sözcükler:** ölçek uyarlama, dijital okuryazarlık, öğretmen adayları

## Introduction

Digital literacy, which has become a prevalent issue in the education literature in the last decade (Knobel, 2011; Li & Ranieri, 2010; Ng, 2012; Thompson, 2013) have been listed among 21<sup>st</sup> century skills (Voogt, Erstad, Dede & Mishra, 2013; Vavik & Salomon, 2015). Consequently, it seems to be important for a country to have digitally literate teachers and students as well. Gilster (1997) was the first researcher who revealed the concept of digital literacy. There is a complication in usage of the “digital literacy” concept in the literature. Digital literacy was limited with technical aspects or cognitive and socio-emotional aspects in the literature (Eshet-Alkalai, 2004). According to Aviram and Eshet-Alkalai (2006) “Digital literacy is usually conceived of as a combination of technical-procedural, cognitive and emotional-social skills.” The shortest definition of digital literacy was presented by Eshet-Alkalai (2004) as survival skill in the digital era. Eshet-Alkalai (2005) also presented a framework for digital literacy including photo-visual, reproduction, information, branching, and socio-emotional literacies.

Ng (2012) revealed a digital literacy framework considering all the existing definitions. According to this framework, digital literacy has three dimensions; technical (possessing the technical and operational skills to use ICT for learning and in everyday activities), cognitive (ability to think critically in the search, evaluate and create cycle of handling digital information) and socio-emotional (being able to use the internet responsibly for communicating, socializing and learning). According to Ng (2012), in order to determine whether an individual is a digitally literate, adaption of the individual to new or emerging technologies can be assumed as an indicator. That is to say, we expect in-service and pre-service teachers as well as students to adapt easily to new technologies. In addition, government policy makers should provide opportunities for these stakeholders both for improving citizens’ digital literacy skills and integration of technology into education. In Turkey, Ministry of Education has been conducting FATİH (Movement of Enhancing Opportunities and Improving Technology) project since 2010 in order to increase technological opportunities for state schools and to integrate technology into educational settings effectively. Besides the increasing number of technological tools in schools, in-service training programs have been being utilized for this purpose. This project has a huge budget. However, there are many research findings, which criticize the effectiveness of the project (Ekici & Yılmaz, 2013; Banoğlu, Madenoğlu, Uysal & Dede, 2014; Keleş & Turan, 2015) in terms of efficacy especially when we consider second order barriers of technology integration. These barriers include knowledge, attitudes, and skills of teachers (Ertmer, 1999). In addition, PISA 2015 results showed that Turkish students were ranked as 52<sup>nd</sup> among 70 countries in terms of science literacy (OECD, 2016). Considering the above mentioned points, it can be said that policy makers should take some precautions in order to cope with this problem. One of the points to be focused on seems to be digital literacy skills of teachers and students. Because, technology can be utilized effectively for better education with digitally literate teachers and students who can easily adapt to and use technology in teaching-learning processes. Knobel (2011) pointed out the need for an

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innovation in teacher education programs so that teachers of the future will have digital literacy skills and will help their students as technology leaders. 21<sup>st</sup> century teachers should be digitally literate in order to be beneficial for their students (Withrow, 2004). In this context, assessing digital literacy arise as one of the issues to be performed.

A digital literacy scale, having 47 items, validated with a sample of teenagers by Rodríguez-de-Dios, Igartua & González-Vázquez (2016). It was designed as a 5-point Likert type self-report questionnaire. Hargittai (2005) studied on web-oriented digital literacy. Hargittai (2005) utilized both observations and survey questions together to investigate participants' digital literacy. This study suggested observing performance instead of assessing self-perceived digital literacy skills. Items used in this study were related to the familiarity of some technology related features such as MP3, PDF, advance search etc. Participants were asked how familiar they were with each of these features in each item. Gui and Argentin (2011) summarized main challenges of a large-scale survey tending to assess digital literacy skills. They conducted a test including three dimensions of digital literacy on 980 high school students. Items of the test consisted of knowledge questions, situation-based questions and online tasks for students to be completed. They used a Rasch-type model for scoring. The digital literacy scale developed by KİYİCİ (2008) can be given as an example for a digital literacy scale towards Turkish students. The scale has 100 items and is used by many other researchers. There are 6 sub-dimensions of this scale.

Considering the above-mentioned examples, it can be said that assessing digital literacy is not an easy task and that there is not a definite way for this purpose mentioned in the literature. For this reason, this study considered the feasibility of implementation regarding this assessment. Fraenkel and Wallen (1996) point out feasibility of implementation as one of the key features including validity, reliability and some other factors to be considered for an ideal assessment instrument. Number of items and practicality of implementation are directly related to feasibility. Many of the current digital literacy assessment tools need a long time and effort to be implemented. For this reason, there is a need for a valid, reliable and feasible digital literacy assessment scale for Turkish teachers or pre-service teachers. In this study, participants were intently selected from pre-service science teachers from 13 state universities in Turkey because of the above-mentioned PISA results and the importance of science teaching on students' science literacy. In this context, this study aimed to adapt the digital literacy skills scale (originally developed by Ng [2012]) into Turkish and investigate the qualifications of Turkish pre-service science teachers in terms of their digital literacy skills. The reasons for selecting this scale can be summarized as follows; it is difficult to find a digital literacy scale in Turkish, the scale is easy to be implemented (feasible), number of items are not crowded and the scale is well accepted in the related literature.

In conclusion, the purposes of this study is twofold:

- 1) to adapt the digital literacy skills scale developed by Ng (2012) and
- 2) to investigate the qualifications of Turkish pre-service science teachers in terms of their digital literacy skills.

## **Method**

### **The Procedure**

Adaptation of digital literacy skills scale (originally developed by Ng [2012]) was realized within four steps. Firstly, two of the researchers translated the original ten items into Turkish independently. Then, translated versions were compared in terms of covering the original meanings. Secondly, a third researcher conducted a back translation on that translated version. Also, a Turkish language specialist examined the meaning of items in this step. Three researchers as well as the Turkish language specialist decided to implement this finalized version. At the third step, the scale was presented to Ahi Evran University Ethical Committee for approval of implementation. Following the approval, a demographic part was added to the scale to collect data about participants' age, gender and years (see Appendix). Then, all the items were presented to the research sample by a 5-point Likert mode (from 1=strongly disagree to 5=strongly agree). At the last step, data was entered into the SPSS and an exploratory factor analysis (EFA) was conducted for validation of the scale results.

### **The Participants**

979 pre-service science teachers from 13 state universities participated. They were particularly selected among junior (530 participants) and senior (431) pre-service science teachers, because the technology enhancement courses were already taken at those levels. 18 participants did not mark their grade level. Convenience sampling was applied to reach the maximum number of sampling. Of the all participants, 764 were female. Their ages were observed between 18 and 37 with a mean of 21.7.

### **Data Analysis**

An exploratory factor analysis (n=979) was performed on the data to collect construct-related evidence for validity of the scores (Fraenkel & Wallen, 1996). Kaiser-Meyer-Olkin (KMO) measure of sampling and the Bartlett's test of sphericity were firstly examined to determine the appropriateness of sample for EFA (Costello & Osborne, 2005). Then, a maximum likelihood analysis together with a varimax rotation was executed. Taking the decisions regarding the retention of items several methods (eigenvalue > 1, communality value > 0.5, scree plots and maximizing the explained variance) were utilized. Finally, following the EFA, Cronbach's alpha scores were examined for reliability purposes.

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### Findings

As mentioned previously, we firstly examined KMO and Bartlett's test of sphericity values for appropriateness of sampling. KMO measure of sampling index was calculated as 0.90 by SPSS. Also, Bartlett's test of sphericity was significant at  $p < 0.0001$  level together with a chi-square value of 3383 ( $n=979$ ). The maximum likelihood analysis together with varimax rotation produced the factor loadings presented in Table 1.

Table 1

*Factor Loadings Calculated with Maximum Likelihood Analysis*

Item Number	Item	Factor Loading
1	I know how to solve my own technical problems.	0.71
2	I can learn new technologies easily.	0.74
3	I keep up with important new technologies.	0.71
4	I know about a lot of different technologies.	0.70
5	I have the technical skills I need to use ICT for learning and to create artefacts (e.g. presentations, digital stories, wikis, blogs) that demonstrate my understanding of what I have learnt.	0.68
6	I have good ICT skills.	0.49
7	I am confident with my search and evaluate skills in regards to obtaining information from the Web.	0.63
8	I am familiar with issues related to web-based activities e.g. cyber safety, search issues, plagiarism.	0.52
9	ICT enables me to collaborate better with my peers on project work and other learning activities.	0.60
10	I frequently obtain help with my university work from my friends over the Internet e.g. through Skype, Facebook, Blogs.	0.46

The analysis produced a one-factor solution called as digital literacy skills. As can be seen in Table 1 all the factor loadings were observed at values between 0.46 and 0.74. Since all the items had factor loadings higher than 0.40, all the items were retained (Stevens, 1996). This one factor solution explained 40 % of the variance. Finally, Cronbach's alpha was found as 0.86 corresponding to high reliability.

### Descriptive Statistics

Following validation of the scale results, we examined the descriptive scores including each item's mean (M), standard deviation (SD), minimum and maximum score. Descriptive statistics were investigated for responding to second purpose of the study. Item statistics were presented within Table 2.

Table 2.

*Descriptive Statistics*

Item Number	M	SD	Minimum	Maximum
1	3.70	0.89	1	5
2	3.98	0.86	1	5
3	3.74	0.93	1	5
4	3.44	0.98	1	5
5	3.72	1.00	1	5
6	3.17	1.05	1	5
7	3.83	0.93	1	5
8	3.30	1.08	1	5
9	3.87	0.88	1	5
10	3.79	1.08	1	5

As can be seen in Table 2, all the items' mean scores were observed above mid-point which was 3 (because the minimum score was 1 whereas the maximum was 5 for each item). Considering this result, it can be mentioned that Turkish pre-service science teachers' digital literacy skills seemed qualified. Maximum mean scores were observed for items 2 and 9 whereas minimum mean scores were observed for items 6 and 8. Accordingly, participants' digital literacy skills related to learning new technologies and collaborating with others via ICT is more qualified than their skills related to ICT and issues of web-based activities. When it comes to standard deviations, minimum scores were observed for items 1, 2 and 9 whereas the highest scores for standard deviations were observed for items 8 and 10. This means that participants' scores on items 1, 2 and 9 are closer than their scores on items 8 and 10. In other words, participants' digital literacy scores related to solving technical problems, learning new technologies and collaborating by ICT is closer than their scores related to issues of web-based activities and utilization of internet connection for their own university work.

**Conclusion and Discussion**

In conclusion, the adapted version of the digital literacy scale can be used as a valid and reliable scale for Turkish pre-service science teachers. This is mainly important because this scale seems to fill in the gap regarding the need for a valid, reliable and feasible instrument to be used for assessing digital literacy, to some extent. The existing digital literacy assessment tools generally requires a long time and effort to be implemented. Fraenkel and Wallen (1996) point out feasibility of implementation as one of the key features including validity, reliability and some other factors to be considered for an ideal assessment instrument. In this regard, feasibility of this validated scale seems to come into prominence. Analysis in this study were conducted on data gathered from Turkish pre-service science teachers. For this reason, future research can adapt the scale for (pre-service) teachers from other disciplines. By this way it will be possible for researchers, studying on (pre-

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service) teachers' digital literacies, to find and conduct Turkish version of the scale easily.

This study also investigated the qualifications of Turkish pre-service science teachers in terms of their digital literacy skills. According to the results, pre-service science teachers' digital literacy skills were found to be generally qualified. In Turkey there are many research focusing on attitudes, self-efficacies, competencies of (pre-service) science teachers in ICT context (Çelik & Karamustafaoğlu, 2016; Çetin & Güngör, 2014; Şad & Nalçacı, 2015; Kara, Aydın, Bahar & Yılmaz, 2014). However, it is difficult to find research focusing on digital literacy of Turkish (pre-service) science teachers. For this reason, discussion related to comparison of the findings of this study with previous ones in this manner could not be provided. Digital literacy assessment methods and tools seem to remain on the agenda of researchers in the upcoming years.

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**Appendix1.** The Turkish adapted version of the digital literacy scale

<b>Bölümde kaçınıcı yılınız?:</b> <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 4'ten fazla <b>Cinsiyetiniz:</b> <input type="checkbox"/> Erkek <input type="checkbox"/> Kız					
<b>Yaşınız:</b> .....					
<b>DİJİTAL OKURYAZARLIK ÖLÇEĞİ</b>	<b>Kesinlikle katılmıyorum</b>	<b>Katılmıyorum</b>	<b>Kararsızım</b>	<b>Katılıyorum</b>	<b>Kesinlikle katılıyorum</b>
1. Kullandığım teknolojilerle ilgili karşılaştığım teknik problemleri nasıl çözeceğimi bilirim.					
2. Yeni teknolojileri kolayca öğrenebilirim.					
3. Önemli yeni teknolojileri takip ederim.					
4. Birçok farklı teknoloji hakkında bilgi sahibiyim.					
5. Bilgi ve iletişim teknolojilerini öğrenme amaçlı kullanma konusunda ve öğrendiklerimi sergileyebileceğim dijital öğretim materyallerini (Örneğin: Sunumlar, dijital hikayeler, wikiler, bloglar) geliştirmek için gereken teknik becerilere sahibim.					
6. Bilgi ve iletişim teknolojileri konusunda sahip olduğum beceriler yeterlidir.					
7. İnternette bilgi edinmek için yaptığım arama ve değerlendirmelerde kendime güvenirim.					
8. Siber güvenlik, webde arama ve internette sahtecilik vb. internet etkinlikleri ile ilgili konulara aşinayım.					
9. Bilgi ve iletişim teknolojileri, bir projede çalışma ve diğer öğrenme etkinlikleri konusunda akranlarımla daha iyi işbirliği yapmamı sağlar.					
10. Üniversitedeki çalışmalarımda, arkadaşlarımla internet üzerinden (ör. Skype, Facebook, Bloglar aracılığıyla) sıklıkla yardımlaşırım.					

**Appendix 2.** The original version of the digital literacy scale (Ng, 2012)

<b>DIGITAL LITERACY SCALE</b>	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
1. I know how to solve my own technical problems.					
2. I can learn new technologies easily.					
3. I keep up with important new technologies.					
4. I know about a lot of different Technologies.					
5. I have the technical skills I need to use ICT for learning and to create artefacts (e.g. presentations, digital stories, wikis, blogs) that demonstrate my understanding of what I have learnt.					
6. I have good ICT skills.					
7. I am confident with my search and evaluate skills in regards to obtaining information from the Web.					
8. I am familiar with issues related to web-based activities e.g. cyber safety, search issues, plaigarism.					
9. ICT enables me to collaborate better with my peers on project work and other learning activities.					
10. I frequently obtain help with my university work from my friends over the Internet e.g. through Skype, Facebook, Blogs.					

