Korucu, A. T., & Karakoca, A. (2020). Development and validation of the cloud technologies usage in education scale. *Bartın University Journal of Faculty of Education*, *9*(1), 69-82.

Bartın University Journal of Faculty of Education, 9(1), 69-82

buefad.bartin.edu.tr

Development and Validation of the Cloud Technologies Usage in Education Scale

Agâh Tugrul Korucu *[a], Aydin Karakoca[b]

Article Info

DOI: 10.14686/buefad.623459

Article History:
Received: 23.09.2019
Accepted: 19.11.2019
Published: 01.02.2020

Keywords:
Cloud Technologies,
Scale Development,
Technology Usage,
Motivation,
Interaction.

Article Type:
Research article

Abstract

In this research, it is aimed to develop a scale for the use of cloud technologies in education. The sample group of the study consists of 415 preservice teachers who are studying at universities in Konya. For the validity and reliability analyses of the scale, the sample group consisting of 415 units was randomly allocated (n_1 =208 and n_2=207) sub-samples, the first sample was used for explanatory factor analysis and the second sample was used for confirmatory factor analysis. As a result of the explanatory factor analysis of the data obtained from the first group, 6-item scale consists of motivation and interaction sub-dimensions. Interaction dimension of total variability alone explains 35.89% and motivation dimension explains 33.56%. Factor loads for the sub-dimensions ranged between 0.74 and 0.83. The internal consistency coefficient was 0.83 for Cronbach alpha, 0.77 for motivation subscale and 0.79 for interaction subscale. For the second sample, it was found that the model formed by the two-factor structure of the scale was appropriate according to the fit indices obtained from the confirmatory factor analysis results. As a result, Cloud Technologies Usage scale was found to be a valid and reliable measurement tool.

Eğitimde Bulut Teknolojileri Kullanımı Ölçeğinin Geliştirilmesi ve Geçerliliği

Makale Bilgisi

DOI: 10.14686/buefad.623459

Makale Geçmişi:
Geliş: 23.09.2019
Kabul: 19.11.2019
Yayın: 01.02.2020

Anahtar Kelimeler:
Bulut teknolojileri,
Ölçek geliştirme,
Teknoloji kullanımı,
Motivasyon,
Etkileşim

Makale Türü:
Araştırma makalesi

Öz

Bu araştırmada, bulut teknolojilerinin eğitimde kullanımı için bir ölçek geliştirilmesi amaçlanmıştır. Araştırmanın örneklem grubunu Konya üniversitelerinde okuyan 415 öğretmen adayı oluşturmaktadır. Ölçeğin geçerlik ve güvenirlik analizleri için, 415 birimden oluşan örneklem grubu rastgele iki gruba ayrılmıştır (n_1=208 ve n_2=207). ilk örneklem grubu açıklayıcı, ikinci örnek grubu da doğrulayıcı faktör analizi için kullanılmıştır. Açıklayıcı faktör analizi sonucunda 6 maddelik ölçeğin iki alt boyutlu (motivasyon ve etkileşim) yapıda olduğu bulunmuştur. Alt boyutlardan etkileşim alt boyutu toplam değişkenliğin %35.89'unu, motivasyon alt boyutu ise %33.56'sını açıklamaktadır. Alt boyutlar için faktör yükleri 0.74 ile 0.83 arasında değişmektedir. İç tutarlılık katsayısı Cronbach alpha ölçeğin tamamı için 0.83, motivasyon alt boyutu için 0.77 ve etkileşim alt boyutu için 0.79 bulunmuştur. İkinci örneklem verileri kullanılarak doğrulayıcı faktör analizi sonuçlarından elde edilen uyum göstergelerine göre iki faktörlü modelin uygun olduğu bulunmuştur. Sonuç olarak, Bulut Teknolojileri Kullanımı ölçeğinin geçerli ve güvenilir bir ölçüm aracı olduğu gösterilmiştir.

***Corresponding Author:** agah.korucu@gmail.com
[a] Assoc. Prof.. Dr., Necmettin Erbakan University, Konya/Turkey, https://orcid.org/0000-0002-8334-1526
[b] Assist. Prof. Dr., Necmettin Erbakan University, Konya/Turkey, https://orcid.org/0000-0001-6503-3872

Introduction

In the present century, the development and spread of information and communication technologies have been effective in all areas of life and caused changes occurring globally and on a large scale. These technologies, which were previously physically large, but could process less information, have become small enough to be carried in the pocket today, but have the power to carry out many operations at the same time, and become functional and convenient. Nowadays, thanks to these technologies, the demand for accessing information in an easy and rapid way has increased in case of need, on the move, in short anytime anywhere from different platforms and different operating systems. In today's world where information and technology have a great impact, all users, individually or institutionally, are looking for ways to access, transfer, share and process data independently of time and space, quickly and easily (Sarıtaş, & Üner, 2013; Sırakaya, & Sırakaya, 2013). In this process of change and in meeting the demands, the concept of internet has played an important role, and with the concept of internet, global competition among countries has gained rapid momentum. In order to keep pace with this rapid change and global competition, countries must accept the active and effective use of these technologies in every stage and every area of our lives such as political, social, economic, health, must be open to innovations and interactions in the digitalizing world, and must plan to make maximum use of all the opportunities of internet. Since the competitiveness of a country depends on its innovation and knowledge (Öztopcu, 2018).

Education plays an important role in the change and development of societies. The education sector plays a vital role in the development of any country in terms of building an information-based society (Nayar, & Kumar, 2018). The main purpose of education is to educate individuals by considering the needs of the society and to give information to individuals, as well as to gain the ability to produce, understand, interpret and use it in all individual and social activities. In this sense, education should have a content that will determine the social, political and economic development levels besides its main objectives (Aydın, 2003; Öztopcu, 2018). In today's world, when the needs of the society are taken into consideration, it is necessary to educate individuals who can adapt to the information society, who can use information technologies and internet actively and effectively, and to increase the use of technology in education for these individuals. In other words, education services should shift from traditional to online form while keeping up with the evolution of technology (Pardeshi, 2014). In the process of transitioning to this online environment, valuable personal or public information and data such as photos, documents, music or any other file previously stored in more traditional ways (printing, local or external hard drives, DVD, Flash memory), have been conveyed and stored in electronic and internet environments with the digitalizing world (Ion et al., 2011; Okutucu, 2012). Social networking software and "Web 2.0" environments support constructivist learning environments with multiple features such as creating collaborative opportunities, enhancing interaction and providing multimedia elements to meet all these relocation, maintenance and storage and other 21st century demands (Beldarrain, 2006; Hamutoğlu, 2018; O'Reilly, 2005; Schneckenberg, 2014) and demands in educational system are tried to be met with "cloud technologies" which enable Web 2.0 technologies to be completed, offer common workspaces, and which are adopted as a class in time. "Web 2.0 technologies" and "cloud technologies" which are expressed as two main trends of the development of internet, continue to develop rapidly day by day (Marinos, & Briscoe 2009; Bower, Hedberg, & Kuswara, 2009; Johnson et al., 2010).

Cloud technologies are used not only in the field of education but also over a wide range of applications in public fields such as industry, marketing, telecommunication, tourism, healthcare, insurance, transportation, banking, shopping, hospital and library as well as in personal services, even cloud technologies are considered as the fifth facility following water, electricity, gas and telephone services (Monroy et al., 2013). In addition to the usage of cloud technologies in all these areas, cloud technologies offer; free web mail services (such as Gmail, Hotmail and Yahoo), many content services such as videos, movies, series (YouTube, Netflix etc.), music services (Spotify), as well as text, photos, video social media sites (Facebook, Instagram, Twitter, Pinterest, etc.), blogs and wikis that serve to share a wide range of content such as sharing and collecting these shared content in an area. Considering the fact that there are students in the consumers of these cloud-based technologies, that today's students do not recognize a world without internet (Pardeshi, 2014) and that cloud technologies bring flexible and economic access everywhere, the usage of cloud technologies by educational institutions in managing their resources effectively is considered as a good solution.

When the cloud concept is examined, it is seen that it is used as a metaphor, this metaphor is used to define the location of data and applications in some sources, while the cloud concept is used as an image covering the internet, computer networks, user devices, data centers, Web services, infrastructure and services (Sultan, 2010; Rayport, & Heyword, 2009; Kim, 2009; Sevli, 2011; Molen, 2010; Stevenson & Hedberg, 2011; Tadwalkar, 2013). Although there is no valid definition of cloud technologies, the National Institute of Standards and Technology (NIST) defines them as "a model that can easily and quickly be published and provide network access with minimum management effort or service provider with respect to requests for a shareable and configurable computing resource (e.g. networks, servers, storage, applications and services)". Similarly to this definition, Foster et al. (2008), have identified cloud computing as a virtualized, dynamically scalable, managed computing power, a large-scale distributed computing paradigm driven by the economies of scale, communicated over internet to the demands of external customers (Foster et al., 2008). If a new definition is to be made in line with these definitions and other definitions; cloud technologies is an internet-based platform where the content is stored in different physical environments by service providers' servers and where the content is offered to the users according to the demands of the users, which covers many virtualized services and infrastructure platforms including computers, networks, storage, development platforms and applications, and which offers online access through any device such as computers, laptops, smartphones or tablets. To summarize, it is an internet-based distributed computer paradigm that covers many services within cloud technologies and allows users to access these services only through an internet network.

The advantages of cloud technologies in many areas play an important role. As a matter of fact, the advantages of cloud environments have been effective in increasing its usage and its preference in education. Shin (2015) attributes cloud technologies to gain popularity in the educational sector, potentially offering unprecedented levels of efficiency, flexibility, and value. On the other hand, Nayar and Kumar (2018) state that for educational sector, cloud technologies are revolutionary in achieving competitive demands with lower cost, higher agility and less risk. When the literature is reviewed, it is seen that there are many advantages of cloud technologies. The first of these advantages is that users can archive and back up any type of document without the burden of local data storage, and can access, use, and make changes from any device, anytime and anywhere, even when they leave the training environment (Burda, & Teuteberg, 2016; Shin, 2015; Sarıtaş, & Üner, 2013). This allows avoidance of data loss in the event of a malfunction, and makes it easy to copy and transfer data to a new device (Elamir et al., 2013; Sarıtaş, & Üner, 2013). Features of cloud technologies such as their working in independent platforms, offering of high access opportunities with virtual computers which work more rapidly than physical servers, usage of flexible structure which doesn't require memory and disk changes and their dynamic structure will greatly reduce expensive investment costs in infrastructure, installation in hardware and software, update and renewal transactions and will enable focusing on the main purposes of education by saving time and labour force (Al-Zoube, 2009; Wei, 2014; Sarıtaş, & Üner, 2013; Tosun, & Özdoğan, 2013; Mell, & Grance, 2011). In addition to these features, the following can be listed as other advantages that cloud technologies offer; providing advanced performance, instant updates, automatic maintenance and repair, enabling compatibility between different platforms such as different operating systems, different file formats, enabling collaborative group work and collaboration with remote access, enabling high-level data security in the possibility of viruses etc., having as much or unlimited data storage capacity as needed, not requiring to carry goods, offering backup systems, placing importance to privacy, possessing dynamic infrastructure and multi-dimensional features such as mobility, efficiency, accessibility, flexibility, scalability and continuity (Arpaci, 2016; Kalafat, 2015; Miller, 1989; Sırakaya, & Sırakaya, 2013; Okutucu, 2012; Pardeshi, 2014; Prince, 2011). While all these advantageous features of cloud technologies allow students to be exposed to learning environments for a longer period of time, provide a rich interactive learning environment, provide students with access to the most up-to-date internet facilities and keep them up-to-date, the following advantages are also recorded as a result of performed researches; provision of collaborative learning experiences, support to active learning and individual learning processes, support to oriented teaching and learning theories and their effect to the development of numerous skills such as communication, lateral thinking and problem solving (Bouyer, & Arasteh, 2014; Gonzalez-Martínez et al., 2015; Schneckenberg, 2014; Shin, 2015; Sultan, 2010; Thorsteinsson et al., 2010; Wu, & Huang, 2011).

When considered the advantages of cloud technologies in education, digitalizing world and the investments made by important companies such as Microsoft, IBM, Google and Amazon (Nayar, & Kumar, 2018), it can be said that the importance of cloud technologies will increase day by day. The fact that universities play an important role in global competition and in the development of information societies by covering a wide audience and being a leader in technology development and adoption worldwide (Sabi et al., 2016), day-by-day increasing importance given to information and reasons such as the need to support learning environments with these new technologies by eliminating time and space limitations increase the importance of researching the use of cloud technologies in education. In line with this importance, this study aims to develop a validity and reliability scale to measure the use of cloud technology in university students.

Method

Measurement Development

From the 21-item pool based on the studies (e.g. Al-Zoube M. 2009; Bouyer, & Arasteh, 2014; Pardeshi, 2014; Prince, 2011; Sultan, 2010; Wei, 2014; Wu, 2011) 5 faculty members experts in the subject were evaluated each item as "necessary", "unnecessary" and "may be". As result of the evaluations of the experts, The Cloud Technologies Usage in Education Scale (CTES) consisting six items was created. All items in CTES were measured on 5-point likert type graded between "1=Strongly disagree" and "5=Strongly agree".

Sampling Group

Population of this study is composed of preservice teachers who are studying at universities in Konya in the spring term of 2018-2019. The sampling group was randomly selected from the population, 500 questionnaires were applied to preservice teachers and 415 validated units (83%) of sample were obtained after missing items included questionnaires excluded. When the demographic characteristics of the participants were examined (see Table 1), it was seen that 42% were women, 93% were use internet at least three hours per week and 98% were found themselves sufficient to use mobile devices. The frequency distribution of the demographic questions of the sampling group is given in Table 1.

Data Collection

After CTES questionnaire form designed for online survey format and survey link sent to e-mail adresses of 500 preservice teachers. It was stated on the CTES online survey form that the participants were free to participate in the survey on a voluntary basis.

Data Analysis

Questionnaires without missing observations returned from participants are coded into IBM SPSS Statistics v21 programme for further analysis. Totaly 415 (83%) questionnaries were considered for analysis. This sample was divided into two sub-groups randomly. First group (n_1=208) used for exploratory factor analysis (EFA) and second group (n_2=207) used for confirmatory factor analysis (CFA). Principal component analysis (PCA) method for factor extraction by varimax factor rotation were selected for applying EFA with SPSS. Factor loadings for one factor was at least 0.60 and no cross loading above 0.30 were kept in the model. Reliability analysis for whole scale and subfactors are examined. Tukey's test of additivity was performed for whole scale and sub factors. Lisrel 8.71 was used for perform the CFA, using the second sub-group of the cases, to confirm the PCA factor model. The goodness of fit indexes, including chi-square, (χ^2/degree of freedom $\leq$ 2), root mean square error of approximation (RMSEA<0.8), root mean square residual (RMR), standardized root mean square residual (SRMR<0.08), goodness of fit index (GFI≥0.95), adjusted goodness of fit index (AGFI≥0.95), normed fit index (NFI≥0.95), non-normed fit index (NNFI ≥0.90) and incremental fit index (IFI≥0.95) were used to evaluate the validity of the model (Schreiber et al., 2006). Item analysis, reliability analysis, correlation analysis and descriptive analysis was also performed.

Table 1. Frequency distribution of demographic items.

	EFA	CFA	Total
Gender			
Female	105	68	173
Male	103	139	242
Grade			
1	48	52	100
2	59	42	101
3	61	61	102
4	40	52	92
Internet usage time per week			
0-3 hours	15	16	31
3-6 hours	30	42	72
6-9 hours	56	58	114
9 hours and above	107	91	198
To what extent do you find yourself competent in mobile device use?			
Very Sufficient	40	35	75
Moderate	52	56	108
Enough	112	111	223
Insufficient	4	5	9
How long have you used your mobile device?			
0-2 years	20	12	32
2-4 years	45	27	72
4 years and above	143	168	311

Findings

Item Analysis

Item analysis was performed to keep the relevant items on the scale and to determine the items that disrupt integrity of the six-item CTES. Internal consistency coefficient Cronbach alfa of the CTES found 0.83. There was no item that can cause an increase in this coefficient if removed from the scale. Inter-item correlations are found between 0.33-0.59 and item-total correlations found between 0.47-0.68 (see Table 4). Since all inter-item and item-total correlations were above 0.30, six items were kept on the scale. When the variance amounts (common variance) that each item shares with other variables are examined, factor loadings vary between 0.63 and 0.77 and since all values are above 0.5, all items are included in the analysis (see Table 2).

Exploratory Factor Analysis (EFA)

The first sample group data (n_1 = 208) of the scale built at the end of the assessments conducted by experts was used for EFA. Kaiser-Mayer-Olkin (KMO) test was used to determine whether the sample size of the data was sufficient for EFA and Barttlet's test was performed to determine the suitability of the data for EFA. From the first sample data, KMO was 0.789, and Barttlett's test of sphericity was $X^2=433$ with significance level p=0.00<0.01. These results indicated that the sample size was sufficient, data were consisting of correlated items and appropriate for the EFA. Principal component analysis was chosen as a factor extraction method in order to determine the factors that explained the highest variability. By using the Varimax method, the rotated factors can be interpreted more easily. As a result of PCA, it was found that the data had a 2-factor structure based on the number of eigenvalues greater than 1.The two-factor model consisting of 6 items that explained 69.45% of total variance. For EFA, it was found sufficient to have a total explanation rate of 40-60% variance in social sciences, but a high explanation rate of 69.45% was achieved in this study. Of the two-factor structure, the first factor explained 35.89% of the total variability and the second factor explained 33.57%. The factor loadings of items ranged from 0.74 to 0.82 in the motivation subdimension, from 0.78 to 0.83 in the interaction subdimension.

Table 2. PCA results for CTES.

Item	Motivation	Interaction
M1	0.74	
M2	0.80	
M3	0.82	
I1		0.83
I2		0.83
I3		0.78
Eigenvalue	2.15	2.01
Explained variance	35.89%	33.57%
Total explained variance	69.46%	

Confirmatory Factor Analysis (CFA)

The data obtained from the second sample group consisting of n_2=207 units were used to determine the suitability of the two-factor structure of the scale. CFA using maximum likelihood estimate was conducted with Lisrel 8.71 to evaluate correlated two factor structure of the CTES (Jöreskog, & Sörbom, 1993). The path diagram and standardized estimates of the model are given in Figure 1.

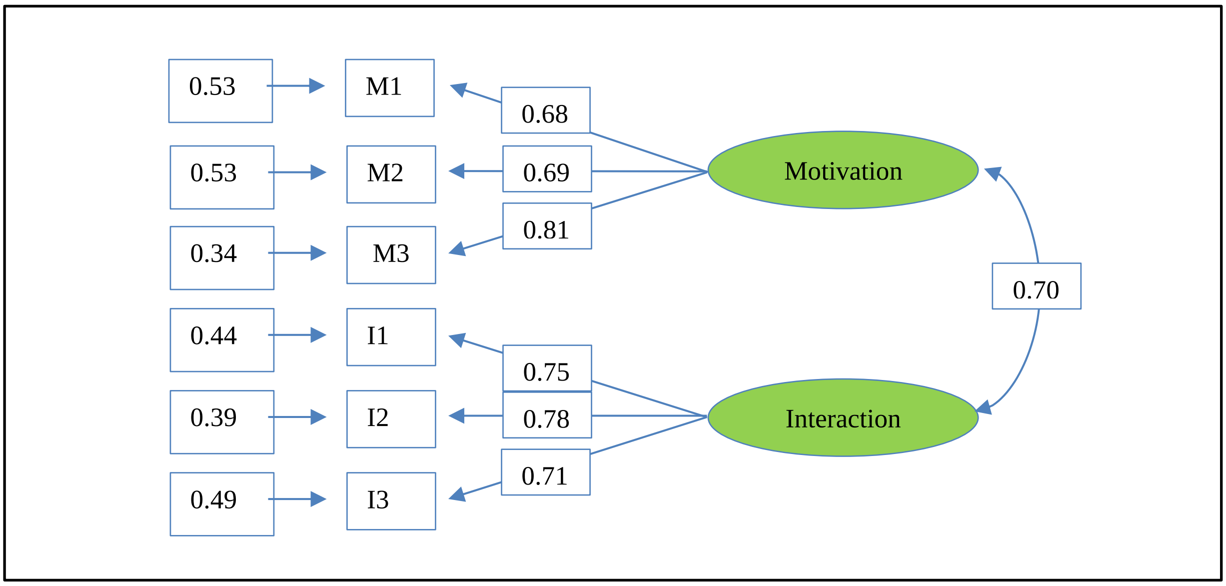

Figure 1. CFA model and estimates for CTES.

The standardized loadings represent the correlation between each observed variable and the corresponding factor. According to standardized loadings of correlated two-factor model given in Figure 1, correlations between motivation and M1, M2 and M3 are found .68, .69 and .81 respectively. Correlations between Interaction and I1, I2 and I2 are 0.75, 0.78 and 0.71 respectively. All the correlations given between factors and items are found statistically significiant. Correlations between factors and Items were all high enough above near 0.70. Correlation coefficient between motivation and interaction were 0.70 and found statisticially significiant. As a result of Figure 1 dimensions underlie the motivation and interaction values of CTES are found correlated.

Frequently used goodness of fit indices for confirmatory model was given in Table 3. Acceptable values of good fit and perfect fit of the statistics are also given (Schreiber et al., 2006). The CFA results for two-factor model were, $\chi^2 = 7.24$, df=8, p=0.51>0.05, χ^2/df =0.93, RMSEA=0, SRMR=0.02, GFI=0.99, AGFI=0.97, NFI=0.99, NNFI=1 and IFI=1 and all results indicated the perfect fit. According to all goodness of fit statistics given in Table 3 showed that the model was appropriate and the two-factor structure as a model based on EFA was confirmed.

Table 3. Goodness of fit statistics for CTES and reference values.

Fit statistics	Good Fit	Perfect Fit	CTES	Evaluation
Chi-square(χ^2/df)	≤ 3	≤ 2	0.93	Perfect Fit
Root mean square error of approximation(RMSEA)	<0.08	<0.05	0	Perfect Fit
Standardized root mean square residual (SRMR)	<0.05	<0.08	0.02	Perfect Fit
Goodness of fit index (GFI)	≥0.90	≥0.95	0.99	Perfect Fit
Adjusted goodnes of fit index (AGFI)	≥0.90	≥0.95	0.97	Perfect Fit
Normed fit index (NFI)	≥0.90	≥0.95	0.99	Perfect Fit
Non-normed fit index (NNFI)	≥0.90	≥0.95	1	Perfect Fit
Incremental fit index (IFI)	≥0.90	≥0.95	1	Perfect Fit

Reliability Analysis

The reliability analysis of the scale was performed with the Cronbach alpha coefficient, which evaluates the internal consistency of the scale items. The Cronbach alpha value indicates whether items form a whole to explain the similar structure. The larger the Cronbach's alpha value, the more consistent the items are in determining the same property. Cronbach's alpha values of 0.70 and above are acceptable (Bland, & Altman, 1997).

Descriptive statistics related to the whole scale and its sub-dimensions are given in Table 4. The cronbach's alpha value for the whole scale was calculated as 0.83. The Cronbach's alpha coefficient for the motivation subscale was 0.77 and the Cronbach's alpha coefficient for the interaction subscale was 0.79. Thus, the 6-item scale was found to have a high reliability.

Tukey's additivity test was used to determine whether item scores for the whole scale and its subdimension items were summable. It was found that there was no multiplicative interaction among the items on the scale, where all items in each sub-dimensions of the six-item scale scores can were summable. All p values for Tukey's test found significiant (p=0.09, p=0.21 and p=0.10 > 0.05).

Table 4. Reliability and descriptive statistics of CTES.

		$\bar{x}$	s.e.	Item-total correlation	Tukey's Additivity Test	
					F	P
Motivation ($\alpha = 0.77$)						
	M1	3.73	0.06	0.59		
	M2	3.86	0.06	0.47	2.89	0.09
	M3	3.75	0.06	0.61		
Interaction($\alpha = 0.79$)						
	I1	3.58	0.07	0.68	1.59	
	I2	3.48	0.07	0.61		0.21
	I3	3.40	0.07	0.52		
Overall($\alpha = 0.83$)		3.63	.031		2.76	0.10

Correlation Analysis

The correlations analysis results showed that there is a significiant correlation among motivation, interaction sub-dimensions and total scale scores of CTES. Pearson correlation coefficients for motivation and interaction score was 0.56 (p=0.00), motivation-total was 0.87 (p=0.00) and interaction- total was 0.89 (p=0.00). Correlation analysis showed that there was a moderate positive linear relationship between motivation and interaction scores.

Discussion

In the information and communication technologies era, the increase in the rate of information production increases the importance of access to and sharing of information. An important feature of the developments in science and technology is their easy access to information. As in many areas, it is very important to reach and share information in education. In this study, a valid, easily applicable and reliable scale has been developed that can handle the use of cloud technologies with all respects, which are popular in sharing information, in the field of education.

The data obtained from the scale consisting of 6 items applied to preservice teachers studying at Konya universities analyzed with PCA and the scale consisted of two sub-dimensions which were motivation and interaction. The scale consists of 5-point likert-type items.

Firstly, item analysis was conducted to determine whether there are any items that disrupt the integrity of the six-item scale. As a result of item analysis, it was seen that the factor loadings of the six-item scale ranged between 0.63 and 0.77, and that the Cronbach internal consistency coefficient of the scale was found to be α=0.83. In addition, correlations between items were found to be between 0.33-0.59 and item-total correlations were between 0.47-0.68. All findings indicate that all items of the scale can be included in the analysis. Because factor loadings of 0.50 or above and reliability coefficient α = 0.70 or higher are taken as proof that the scale is reliable (Büyüköztürk, 2011; Gorsuch, 1983).

Then, in order to determine whether the data were suitable for factor analysis, explanatory factor analysis was performed with the data obtained from the first sample group (n_1 = 208). Kaiser-Meyer-Olkin (KMO) test and Bartlett's test were used in these analyzes. KMO value was found to be 0.79 and Bartlett's test value was $\chi^2 = 43$; p=0.00<0.01. According to these values, it can be said that the data are suitable for factor analysis. KMO values, between 0.60-0.69 are moderate, between 0.70-0.79 are good, 0.80-0.88 are very good, and between 0.90-1 are indicates perfect fit for factor analysis (Akgül, 2005; Büyüköztürk, 2002; Büyüköztürk, 2011; Field, 2000; Russell, 2002; Tavşancıl, 2014; Yaşlıoğlu, 2017). Similarly, Hamutoğlu (2017) found the KMO value to be 0.89 in his study of adapting the Technology Acceptance Model scale to Turkish language on the basis of cloud information technologies and reported that the suitability of the study to factor analysis was very good. In Bartlett's test, p = 0.00 indicates that the correlation matrix is not equal to the identy matrix, that the data set is composed of related variables and that the data set is suitable for factor analysis (Büyüköztürk, 2005; Tabachnick, & Fidell, 2007; Karasar, 2004). Hamutoğlu (2017) determined the Barlett's test results (χ^2 = 9575.38, p= .00) in the scale adaptation study and found that the scale data were suitable for factor analysis. In this sense, the test results in both studies were similar in terms of suitability for factor analysis.

Factor loadings and eigenvalues of the items are another feature that is examined in factor analysis. These values are taken as an important basic criterion in determining the validity of the scale and its separation into factors. (Gorsuch, 1983; O'Rourke et al., 2013). As a result of the PCA and Varimax rotation method, it was seen that the factor loadings of the items in the scale varied between 0.74 and 0.83. As a general opinion in the literature, it is accepted that item factor loadings are at least 0.30 levels (Büyüköztürk, 2011). However, some sources suggest that these values should be at least 0.32 or at least 0.40-0.45 (Seçer, 2013; Tabachnick, & Fidell, 2013). According to both, the factor loadings of the items of this scale can be considered quite well. Because Büyüköztürk (2011) stated that the factor loadings that above 0.50 were quite well. In addition, high factor loadings are seen as an indicator that the variable may be under this factor (Büyüköztürk, 2011). In this sense, when the eigenvalues of the factors in the scale are examined, it is possible to say that the items in the scale are grouped under two factors. When the eigenvalues for the factors are examined, it is seen that the first factor called motivation has 2.15 and the second factor called interaction has 2.01 eigenvalues. In factor analysis, factors with an eigenvalue greater than or equal to 1 are considered significant (Büyüköztürk, 2002; Elderoğlu, 2017). In this sense, both factors on the use of cloud technologies scale are significant. When the variance values explained by these factors in the scale were examined, it was seen that the first factor explained 35.89% of the total variance and the second factor explained 33.57% of the total variance. It was also observed that these factors explained 69.46% of the total variance. This shows that the scale's ability to measure is so high. (Büyüköztürk, 2002). Because the higher the variance described, the better the scale measures. When the total variance is higher than 40% according to some sources and more than 50% according to some sources, when considered as an adequate criterion for the use of the scale (Elderoglu, 2017; Kline, 1994; Büyüköztürk, 2011; O'Rourke et al., 2013) it is possible to say that the CTES meets these criteria.

The scale was applied to the sample group with the two-factor structure obtained by PCA model was analyzed with CFA. The CFA results were evaluated with different fit indices. According to these results $\chi^2 = 7.24$, df=8 with p=0.51>0.05. Failure to reject the null hypothesis indicates the model fit is good (Jöreskog, 1969). χ^2/df statistics was 0.93. It can be said that chi-square / sd value is less than or equal to 2 is acceptable fit for educational sciences and it gives meaningless results for fitting observed data to model (Schreiber et al., 2006; Barrett, 2007; Çelik, & Yılmaz, 2016; Ventura, 2011). When the other goodness of fit values are analyzed, it is seen that RMSEA = 0, SRMR = 0.02, GFI = 0.99, AGFI = 0.97, NFI = 0.99, NNFI = 1 and IFI = 1. RMSEA is less than 0.05, SRMR is less than 0.08, GFI is greater than 0.90 and also AGFI, NFI, NNFI and IFI values greater than 0.90 indicate that all values have excellent goodness of fit. (Dursun, & Aydın, 2011; Rigdon, 1996; Kline, 2005; Shevlin, & Miles, 1998).

In the analyzes conducted for the reliability of the scale, the Cronbach's alpha coefficient for the motivation factor was 0.77 and the Cronbach's alpha coefficient for the interaction factor was 0.79, while the Cronbach's alpha coefficient for the overall scale was 0.83. A psychological test of 0.70 or higher Cronbach alfa appears to be sufficient, and a value above 0.80 is considered to be good. (Alpar, 1998; Büyüköztürk, 2005; Gorsuch, 1983; Horn, 1965; Seçer, 2013). In this sense, the reliability value of the scale was found to be 0.83, which proves that the scale can perform good and reliable measurements.

Finally, when the relationships between the sub-dimensions of the scale and the whole were examined, it was found that there were statistically significant relationships among all scores. Pearson correlation coefficients for motivation and interaction score was 0.56 (p=0.00<0.05), motivation-total was 0.87 (p=0.00<0.05) and interaction- total was 0.89 (p=0.00<0.05). Correlation analysis showed that there was a moderate positive linear relationship between motivation and interaction scores. Also motivation and interaction showed positive, strong linear relation with total score.

Thus, CTES has been shown to be a valid and reliable tool with the ability to measure information on the use of cloud technologies in the field of education.

Conclusion

In this study developed a two-factor scale to examine cloud technology usage of preservice teachers studying at Konya universities. Construct validity and reliability of CTES, indicated that the CTES was valid for investigating the cloud technologies usage of preservice teachers in education. This study contributes to the measurement and evaluation of the effects of the usage of cloud technologies in education together with its sub-dimensions in detail.

In addition, it is thought that the factors in this scale measuring motivation and interaction sub-dimensions will affect the success in education. Because in the literature, it is seen that there are many studies that use of Web 2.0 technologies in education are effective in motivation and interaction. Batıbay (2019) stated that these new digital teaching tools have an effect on motivation and achievement, and that these environments increase the motivation score. In addition to these statements, there are statements that each of the Web 2.0 tools has its own characteristics in terms of motivation and communication, and that the use of these tools has beneficial results on motivation, communication and social interaction and improves the education processes (Nandhini, 2016; Norton, & Hathaway, 2008; Özer, & Özer, 2017; Tiryaki, & Erzurum, 2011).

As the sample group of this study consisted of only preservice teachers in Konya, we should state that the results obtained are only valid for prospective teachers throughout Konya, and we need to be careful because of the limitation of the study in order to make generalizations for the whole country.

- In the future, more general results can be obtained by working with a more comprehensive sample across the country.
- In addition, we recommend such studies as the comparison of the results obtained by applying this scale for different provinces and at different educational levels in schools or in different sectors will contribute to the development of the overall of CTES.

- In this study, the structural validity and reliability of the scale was examined at a specific time point. In future studies, different reliability methods and different validity tests such as test-retest reliability methods can be used.

Appendix

Appendix 1. Cloud Technologies Usage in Education Scale (CTES)

Below are statements to determine the different impacts of cloud technologies usage on education. Participants were asked to indicate the agreement level of the expressions that related to the use of cloud technologies. All items are measured on 5-point likert scale (1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree and 5=Strongly agree".

Motivation
1 Using cloud services increases my professional knowledge
2 I find it useful to use cloud systems in education
3 I intend to use cloud services in my future career
Interaction
1 Using cloud services contributes to collaborative learning of students
2 Using cloud services allows discussion about the course
3 Using cloud services increases interaction with my teacher

Please contact us for the scale: agah.korucu@gmail.com

Ekler

EK 1: Eğitimde Bulut Teknolojileri Kullanımı Ölçeği (BUTEK)

Aşağıda, bulut teknolojileri kullanımının eğitim üzerindeki farklı etkilerini belirleyen ifadeler yer almaktadır. Katılımcılardan bulut teknolojilerinin kullanımıyla ilgili ifadelere katılma düzeylerini belirtmeleri istenmektedir. Tüm maddeler 5 puanlı likert ölçeğinde ölçülmektedir (1=Kesinlikle katılmıyorum, 2=Katılmıyorum, 3=Kararsızım, 4=Katılıyorum ve 5=Kesinlikle katılıyorum).

Motivasyon
1 Bulut hizmetlerini kullanmak mesleki alanımla ilgili bilgimi artırıyor
2 Bulut hizmetlerini eğitim-öğretimde kullanmayı faydalı buluyorum
3 Gelecekteki kariyerimde bulut hizmetlerini kullanmayı düşünüyorum
Etkileşim
1 Bulut hizmetlerini kullanmak öğrencilerin işbirlikçi öğrenmelerine katkı sağlar
2 Bulut hizmetlerini kullanmak dersle ilgili tartışma yapmayı kolaylaştırır
3 Bulut hizmetlerini kullanmak öğretmenimle etkileşimimi artırır

Ölçek için lütfen iletişime geçiniz: agah.korucu@gmail.com

References

Akgül, A. (2005). *Tıbbi Araştırmalarda İstatistiksel Analiz Teknikleri. Spss Uygulamaları [Statistical Analysis Techniques in Medical Research. Spss Applications].* Ankara. ISBN: 975-96359-2-5.

Alpar, R. (1998). *İstatistik ve Spor Bilimleri [Statistics and Sport Sciences].* Ankara: Bağırgan Publishing.

Al-Zoube, M. (2009). E-Learning on the Cloud. Int. Arab J. e-Technol., 1(2), 58-64.

Arpaci, I. (2016). Understanding and predicting students' intention to use mobile cloud storage services. *Computers in Human Behavior, 58, 150-157.*

Aydın, B. (2003). Bilgi toplumu oluşumunda bireylerin yetiştirilmesi ve matematik öğretimi [Education of individuals in the formation of information society and mathematics teaching]. *Pamukkale University Faculty of Education Journal,14(*14), 183-190.

Barrett, P. (2007). Structural equation modelling: Adjudging model fit. *Personality And Individual Differences, 42(*5), 815-824.

Batibay, E. F. (2019). *Web 2.0 Uygulamalarının Türkçe Dersinde Motivasyona ve Başarıya Etkisi: Kahoot Örneği [The Effect of Web 2.0 Applications on Motivation and Success in Turkish Course: Kahoot Case].* Master's thesis, Hacettepe Universty, Institute of Educational Sciences, Ankara, Turkey.

Beldarrain, Y. (2006). Distance education trends: Integrating new technologies to foster student interaction and collaboration. *Distance education, 27(2), 139-153.*

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. Bmj, *314(*7080), 572.

Bouyer, A., & Arasteh, B. (2014). The necessity of using cloud computing in educational system. *Procedia-Social and Behavioral Sciences, 143, 581-585.*

Bower, M., Hedberg, J., & Kuswara, A. (2009). "Conceptualising Web 2.0 Enabled Learning Designs. Same Places, Different Spaces." Proceedings Ascilite 2009, Auckland. Accessed June 24, 2019. http://www.ascilite.org.au/conferences/auckland09/procs/bower.pdf.

Burda, D., & Teuteberg, F. (2016). Exploring consumer preferences in cloud archiving–a student's perspective. *Behaviour & Information Technology*, *35*(2), 89-105.

Büyüköztürk, Ş. (2002). Faktör Analizi Temel Kavramlar ve Ölçek Geliştirmede Kullanımı [Factor Analysis Basic Concepts and Use in Scale Development]. *Educational Management in Theory and Practice, 32(*470-48).

Büyüköztürk, Ş. (2005). *Veri Analizi El Kitabı (5. Basım) [Data Analysis Handbook (5th Edition).* Ankara: PegemA Publishing.

Büyüköztürk, Ş. (2011). *Sosyal bilimler için veri analizi el kitabı[Handbook of data analysis for social sciences]*. Ankara: Pegem Academy.

Çelik, H. E., & Yılmaz, V. (2016). *LISREL 9.1 ile yapısal eşitlik modellemesi: Temel kavramlar-uygulamalar-programlama [Structural equation modeling with LISREL 9.1: Basic concepts-applications-programming].* Ankara:Anı Publishing.

Dursun, Ö. Ö., & Aydın, C. H. (2011). İletişimci Biçimleri Ölçeğinin Türkçeye Çevirisi, Uyarlanması, Geçerlik Ve Güvenirliğinin Sağlanması [Translation, Adaptation, Validity and Reliability of Communicator Forms Scale into Turkish]. *Eskişehir Osmangazi University Journal of Economic and Administrative Sciences,6(*2), 263 286.

Elamir, A. M., Jailani, N., & Bakar, M. A. (2013). Framework and architecture for programming education environment as a cloud computing service. *Procedia Technology, 11*, 1299-1308.

Field, A. (2000). Discovering Statistics Using SPSS For Windows, New Delhi: Sage publication.

Foster, I., Yong, Z., Raicu, I., & Lu, S. (2008). Cloud Computing and Grid Computing 360-Degree Compared. *Grid Computing Environments Workshop, 2008.* 1-10.

González-Martínez, J. A., Bote-Lorenzo, M. L., Gómez-Sánchez, E., & Cano-Parra, R. (2015). Cloud computing and education: A state-of-the-art survey. *Computers & Education, 80, 132-151.*

Gorsuch, R. L. (1983). *Factor analysis*. Hillsdale: Lawrence Erlbaum Associates.

Hamutoğlu, N. B. (2017). Bulut Bilişim Teknolojileri Kabul Modeli 3: Ölçek Uyarlama Çalışması [Cloud Computing Acceptance Model 3: Scale Adaptation Study]. *Sakarya University Journal of Education, 8(*2), 8-25.

Hamutoğlu, N. B. (2018). *İşbirlikli Öğrenme Etkinliklerinde Bulut Bilişim Teknolojilerinin Üniversite Öğrencilerinin Kabul, Paylaşmaya Uygunluk ve Öğrenme Performanslarına Etkisi [The effect of cloud computing technologies in collaborative learning activities on university students' acceptance, eligibility for responsibility-sharing, and learning performance].* Master Thesis, Sakarya University, Institute of Educational Sciences, Sakarya, Turkey.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30(*2), 179-185.

Ion, I., Sachdeva, N., Kumaraguru, P., & Čapkun, S. (2011). Home is safer than the cloud!: privacy concerns for consumer cloud storage. In Proceedings of the Seventh Symposium on Usable Privacy and Security (p. 13). ACM.

Johnson, L., & Smith, R., et al. (2010). The 2010 horizon report: K-12 edition? Austin, TX: The New Media Consortium.

Jöreskog, K. G., & Sörbom D. (1993). LISREL 8: Structural equation modeling with the SIMPLIS command language. Hillsdale, NJ: Lawrence Erlbaum.

Kalafat, Ö. (2015). *Öğrencilerin İşbirlikli Öğrenme Ortamlarında Bulut Teknolojilerini Kullanım Deneyimleri [The students' experiences of using cloud technologies in cooperative learning environments].* Master's Thesis, Ataturk University, Institute of Educational Sciences, Erzurum, Turkey.

Karasar, Ş. (2004). Eğitimde yeni iletişim teknolojileri-internet ve sanal yüksek eğitim [New communication technologies in education-internet and virtual higher education]. *The Turkish Online Journal of Educational Technology*, *3(*4), 117-125.

Kılıç, S. (2013). Örnekleme yöntemleri [Sampling methods]. *Journal of Mood Disorders*, *3(*1), 44-6.

Kim, W. (2009). Cloud computing: Today and tomorrow. *Journal of object technology, 8(1), 65-72.*

Kline, P. (1994). Easy Guide to Factor Analysis. London: Routledge.

Kline, R. B. (2005). *Principles and practice of structural equation modeling*, 2nd ed, New York: Guilford Press.

Marinos, A., & Briscoe, G. (2009). Community cloud computing, in: Cloud Comput. First Int. Conf. CloudCom 2009, in: LNCS, vol.5931, Springer, Berlin, Heidelberg, Beijing, China, pp.472–484.

Mell, P., & Grance, T. (2011). The NIST definition of cloud computing recommendations of the National Institute of Standards and Technology. NIST Spec Publ. 145:7.

Miller, A. K. *(1989). Enhanching Early Chilhood Mainstreaming Through Cooperative Learning: A Brief Literature Revıew. Child Study Journal, 19(*4), 285-291.

Molen, F. V. D. (2010). *Get Ready for Cloud Computing: A Comprehensive Guide to Virtualization and Cloud Computing.* Zaltbommel, The Netherlands: Van Haren Publishing.

Monroy, C. R., Arias, C. A., & Guerrero, Y. N. (2013). The new cloud computingparadigm: the way to IT seen as a utility. *Latin American and Caribbean Journalof Engineering Education, 6(2).*

Nandhini, M. (2016). Web 2.0 tools in education. National Conference on Higher Education in the Knowledge Age: Techno-Pedagogical Perspectives and İnnovations. India.

Nayar, K. B., & Kumar, V. (2018). Cost benefit analysis of cloud computing in education. *International Journal of Business Information Systems, 27(*2), 205-221.

Norton, P., & Hathaway, D. (2008). On its way to K–12 classrooms, Web 2.0 goes to graduate school. *Computers in the Schools, 25(*3-4), 163- 180.

O'Reilly, T. 2005. "What is Web 2.0 – Design Patterns and Business Models for the Next Generation of Software." Accessed June 12, 2019. http://www.oreillynet.com/pub/a/oreilly/tim/ news/2005/09/30/what-is-web-20.html.

Okutucu, B. O. (2012). *Bulut Bilişim ve Teknolojileri [Cloud Computing and Technologies].* Master Thesis, Okan University, Department of Computer Engineering, Istanbul, Turkey.

O'Rourke, N., Psych, R., & Hatcher, L. (2013). *A step-by-step approach to using SAS for factor analysis and structural equation modeling*. Sas Institute.

Özer, Ü., & Özer, E. (2017). Sosyal Bilgiler ile Bilgisayar ve Öğretim Teknolojileri Öğretmeni Adaylarının Eğitimde Web 2.0 Kullanımına Yönelik Görüşleri **[**Social Studies and Computer and Instructional Technologies Teacher Candidates' Views Towards Web 2.0 in Education]**.** *3nd International Congress on Political, Economic and Social Studies (ICPESS).*

Öztopcu, A. (2018). Sürdürülebilir Kalkınma İçin Öğretimde Bilişim Teknolojileri [Information Technology in Instruction for Sustainable Development]. *Journal of Research in Economics, Politics & Finance, 3(1): 86-100.*

Pardeshi, V. H. (2014). Cloud computing for higher education institutes: architecture, strategy and recommendations for effective adaptation. *Procedia Economics and Finance*, *11*, 589-599.Pearson Education.

Prince, J. D. (2011). Introduction to cloud computing. *Journal of Electronic Resources in Medical Libraries*, *8(*4), 449-458.

Rayport, J. F., Heyward, A. (2009). *Envisioning the Cloud: The Next Computing Paradigm*.

Rigdon, E. E. (1996). CFI versus RMSEA: A comparison of two fit indexes for structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, *3(*4), 369-379.

Russell, D. W. (2002). In search of underlying dimensions: The use (and abuse) of factor analysis. *Personality and Social Psychology Bulletin, 28,* 1629–1646.

Sabi, H. M., Uzoka, F. M. E., Langmia, K., & Njeh, F. N. (2016). Conceptualizing a model for adoption of cloud computing in education. *International Journal of Information Management*, *36(*2), 183-191.

Sarıtaş, T., & Üner, N. (2013). Eğitimdeki yenilikçi teknolojiler: Bulut teknolojisi [Innovatıve Technologıes In Educatıon: Cloud Computıng]. *Journal of Research in Education and Teaching, 2(*3), 192-201.

Schneckenberg, D. (2014). Easy, collaborative and engaging–the use of cloud computing in the design of management classrooms. *Educational Research*, *56(*4), 412-435.

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. The Journal of educational research, *99(*6), 323-338.

Seçer, İ. (2013). *Spss ve Lisrel ile pratik veri analizi [Practical data analysis with SPSS and Lisrel]* Ankara: Anı Publishing.

Sevli, O. (2011). *Bulut bilişim ve eğitim alanında örnek bir uygulama [Cloud computing and a sample application in the field of education*]. Master's thesis, Süleyman Demirel University, Institute of Science and Technology Isparta, Turkey.

Shevlin, M., & Miles, J. N. (1998). Effects of sample size, model specification and factor loadings on the GFI in confirmatory factor analysis. *Personality and Individual Differences*, *25(*1).

Shin, D. H. (2015). User value design for cloud courseware system. *Behaviour & Information Technology*, *34(*5), 506-519.

Sırakaya, M., & Sırakaya, D. A. (2013). Eğitim Uygulamaları İçin Yeni Fırsat: Bulut Bilişim [New Opportunıty For Educatıonal Applıcatıons: Cloud Computıng]. *Internatıonal Symposıum On Changes And New Trends In Educatıon.*

Stevenson, M., & Hedberg, J. G. (2011). Head in the clouds: a review of current and future potential for cloud-enabled pedagogies. *Educational Media International*, *48(*4), 321-333.

Sultan, N. (2010*).* Cloud computing for education: A new dawn*?. International Journal of Information Management. 30(*2), 109–116.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics.* Boston: Pearson.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (5th ed.)*. Boston:

Tadwalkar, S. (2013). Cloud Computing–Still a Long Way to Go. Accessed: June 21, 2019. www.mahindrasatyam.com/corporate/.../Cloud_Computing.pdf.

Tavşancıl, E. (2014). *Tutumların Ölçülmesi ve SPSS ile Veri Analizi [Measurement of Attitudes and Data Analysis with SPSS].* Ankara: Nobel Publishing.

Thorsteinsson G., Page T., & Niculescu A. (2010). Using virtual reality for developing design communication. *Studies in Informatics and Control, 19 (2), 93-106.*

Tiryakioğlu, F. & Erzurum, F. (2011). Bir eğitim aracı olarak ağların kullanımı [Use of networks as an educational tool]. 2nd International Conference on New Trends in Education and Their Implications. Antalya.

Tosun, N. Özdoğan, A. (2013). Bulut Bilişim Teknolojisinin Dünü, Bugünü ve Geleceğine Bakış [A View of the Past, Present and Future of Cloud Computing Technology]. *1st International Instructional Technologies and Teacher Education Symposium*, Karadeniz Teknik Üniversitesi, Trabzon.

Ventura, K. (2011). AMOS (Analysis of Moment Structures) ve Yapısal Eşitlik Modeli. *http://web.deu.edu.tr/upk15/docs/seminerSunumlari/AMOS%20(ANALYSIS%20OF%20MOMENT%20STRUCTURES)%20VE%20YAPISAL%20ESITLIK%20MODELIYRD.%20DOC.%20DR.%20KETI%20VENTURA.pdf. 21.08.2019 tarihinde erişilmiştir.*

Wei, C. M. (2014). Research on the network education platform of universities based on cloud computing. In *Advanced Materials Research* (Vol. 926, pp. 4594-4597). Trans Tech Publications.

Wu, C. F., & Huang, L. P. (2011). Developing the environment of information technology education using cloud computing infrastructure. *American Journal of Applied Sciences, 8(9), 864-871.*

Yaşlıoğlu, M. M. (2017). Sosyal bilimlerde faktör analizi ve geçerlilik: Keşfedici ve doğrulayıcı faktör analizlerinin kullanılması [Factor analysis and validity in social sciences: Using exploratory and confirmatory factor analyzes]. *Istanbul Business Research*, *46*, 74-85.