Scale Development

DEVELOPMENT OF ATTITUDES SCALE TOWARDS THE USE OF INFORMATION TECHNOLOGY IN EDUCATION

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ABSTRACT

This study aims at developing an assessment tool to measure teacher prospective teachers' attitudes towards the use of information technology. After reviewing the related studies and literature in this field, a pool of 41 items prepared on a 5-point Likert scale was shaped. The content and construct validity of the Likert-type scale was consulted to an expert. In line with expert opinions, the number of items was reduced to 39 and a draft version of the scale was reshaped. The 39-item draft form of the scale was applied to 335 prospective teachers studying in different branches at Gazi University Gazi Faculty of Education in the fall semester of 2018-2019 Academic Year. In order to determine the validity of the scale, exploratory factor analysis (EFA) was conducted. Regarding the analysis, the scale was determined to consist of a 22-item 4-factor construct. The Cronbach-alpha reliability coefficient for the whole scale was calculated as .92. The Cronbach-alpha values of the 4 dimensions of the scale were calculated as .89 for the first dimension, .86 for the second dimension, .79 for the third dimension, and .76 for the fourth dimension, respectively. For the construct validity of the scale, confirmatory factor analysis was performed and the obtained fit index values; X2=589.07 sd=203, p=.00, RMSEA=.075, SRMR=.060 GFI=.86, AGFI=.83, NFI=.94, NNFI=.96, CFI=.96 and IFI=.96. Regarding these results, the scale was confirmed to consist of 22 items and 4 factors. In light of these findings, the scale can be indicated to measure the attitudes of prospective teachers towards the use of information technology in education in a valid and reliable way.

Keywords: Education, information technology, attitude, scale

INTRODUCTION

Rapid developments in technology in the 21st century affect every field of life as well as the field of education and cause changes and developments. The teacher skills and competencies needed in the information age are also redefined. Today, teachers need to have the competence to use information technologies well and integrate them into education. When the literature was examined, a scale that directly measured attitudes towards the use of information technology in education could not be determined. Therefore, a scale was developed to determine the attitudes of teachers and prospective teachers towards the use of information technology in education.

Technology, among the most prominent concepts in the 21st century, influences and directs human life in many areas in our constantly developing and changing world. Today, it is impossible for technology which comes into every area of life not to enter the field of education and not to affect the developments regarding education. Thus, traditional education can be indicated to be now behind. Many developments demonstrating the integration of education and technology and the utilization of technology in education exist both in our country and in many other societies (Kartal, 2017: 7). Utilizing the technology both as a resource and as a support to education is a fundamental requirement of our age and this applies to all domains and class levels (Jackson, Schouten, Maurer & Simon, 2018: 1537).

The increasing use of technology in every field has made the integration of information technologies into education a necessity. Therefore, it has obligated for educational institutions to provide students with information technology skills for adaptation to the changing world, and to provide the necessary equipment and training for them to access and use the information they reach (Şendurur, 2012: 11). Undoubtedly, a good and desired development of education will be ensured by increasing technology integration at every level of education (Krahenbuhl, 2018: 1975).

Information technology has become an important part of our daily life with significant investments in technology in our country and in almost every country of the world. With the new generation, it has become almost impossible to think and isolate these new technologies separately. We can also benefit from these innovations that can affect our lives so much in the field of education (Ekici, Ekici Taşkın and Kara, 2012: 54-55). The utilization of information technology in education is the ethical practice and work of creating, using and managing appropriate technological processes and resources, and facilitating learning and improving performance" (www.aect.org, 2013 cited in Turgut, 2017: 15). Transferring and using new technologies in the field of education is very important in terms of improving the quality of education and training. The use of contemporary technology in education will enable students to learn more easily and faster, while at the same time ensuring teachers' job satisfaction. The integration of teachers and technology in contemporary education will help to increase the quality of education and training (Yılmaz, 2007: 161). The information technologies can be utilized to draw students' attention, to encourage their learning desires and wishes, as well as highlighting

the important and prominent points of the issues and to better understand and comprehend issues in education and training (Hayal, 2015: 32). Learning to use technology as a resource and support to teaching is a fundamental principle that is incorporated into all of our classes (Jackson, et. al., 2018: 1537). The utilization of information technology in education encourages students to focus on their learning process; therefore, it enables students to improve their cognitive skills by increasing their motivation and self-confidence (Heafner, 2004: 47 cited in Kaya, 2008: 192). Educational technology gives the learning environment flexibility in being dependent on time and space. Developed and enriched learning environments can be offered to people in almost every region of the country, even in the World (Turgut, 2017: 17). The development of teacher education technology competencies has been undertaken and is now being moved to consideration for increasing integration of technology across teacher training (Foulger, et. al., 2017 cited in Krahenbuhl, 2018). Although there are 2 scales (Öksüz, C. & Ak, Ş. 2010; Kol, S. 2012) in the literature on the use of technology, a direct scale on the use of information technology could not be determined.

Reviewing the scales in the literature demonstrates that the previous studies on this subject are inadequate and outdated within the framework of the latest developments in technology. For this reason, the scale developed in this study is regarded to assess teachers' and prospective teachers' attitudes towards using current information technology tools and contribute to other researchers in this regard.

METHOD

The survey model was used in the research. The studies aimed at collecting data to determine the specific characteristics of a group are called survey research (Büyüköztürk, 2012: 14). This research is a scale development study. Scale development process “identify the problem”, “item writing”, “get expert opinion” and “make pre-application” can be explained in four stages (Büyüköztürk, 2012: 125).

Study Group

The participants were determined through the convenient sampling method. In this vein, 335 prospective teachers including 240 (71.6%) females and 95 (28.4%) males who have been studying at various class levels in Gazi University Faculty of Education; English language teaching, Social Sciences Education, History Education, Turkish language teaching, and Primary School Education participated in the study. The number of participants can be regarded to be sufficient for the scale development study (Tabachnick & Fidell, 2015).

The Development of the Scale

In the first stage of the development of the scale, the literature was reviewed and it was attempted to determine whether there was a scale developed previously regarding this issue. In the second stage, new and up-to-date information technology tools that can be utilized in education through the internet were searched and acknowledgment about these tools was obtained. Then, a pool of 41 items was created considering the

affective, cognitive and behavioral characteristics of the attitudes. The item pool was reviewed by 2 experts in the field of Computer Education and Instructional Technology, 1 expert in the field of Educational Sciences and 1 expert in the field of the Turkish language. Required corrections were made for the items that were deemed appropriate to be corrected in the light of experts' feedbacks and 2 items with negative opinions were dismissed from the pool. The draft form of the scale was formed from the 39 items in the pool after the stage of obtaining experts' opinion. Among 39 items, 15 of them are related to cognitive, 10 of them are related to affective and 14 of them are related to behavioral attitudes. Of the 39 items in the pool, 12 contained negative expressions while and 27 contained positive expressions. The items in the scale were rated as "I strongly disagree" (1), "Disagree" (2), "Undecided" (3), "Agree" (4) and "I strongly agree" (5) with a 5-point Likert type rating. The draft scale was applied on a voluntary basis with the permission of the lecturers who give lectures to participants.

Data Analysis

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted to test the validity and reliability of the scale from the data obtained from the draft form of the Attitudes Scale towards the Use of Information Technology in Education. SPSS 22.0 package program was utilized for EFA and in this analysis, which factors were related to the items in the scale were revealed. At this stage, Kaiser Meyer Olkin test (KMO) and Bartlett test of Sphericity techniques were utilized to determine whether the data were appropriate to the principal component analysis.

Lisrel 8.7 package program was utilized for CFA and the appropriateness of the model revealed in AFA was checked. To assess this compliance, chi-square (Der2), Degrees of Freedom (SD), Adjusted Goodness of Fit Index (AGFI), Goodness of Fit Index (GFI), 360 Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Incremental Fit Index (IFI), Comparative Fit Index (CFI) and Root-Mean-Square Error of Approximation (RMSEA) values were analyzed. For the internal consistency of the scale, Cronbach-Alpha values of the whole attitude scale and the factors forming it were calculated.

FINDINGS

This section presents the findings regarding the reliability and validity of "The Attitudes Scale towards the Use of Information Technology in Education".

The Findings regarding the Validity of the Scale

Before starting factor analysis, Kaiser Meyer Olkin coefficient was calculated and Bartlett's test of Sphericity was implemented to determine the appropriateness of the data. KMO value was calculated as .93. Bartlett's test of Sphericity results demonstrated X^2=7477.066; sd=703 p=0.00. In the light of these values, factor analysis was concluded to be implemented on a scale of 39 items.

As a result of the first implementation of EFA, the scale was generated under 5 factors. The total variance of these 5 factors is 57.845%. Here, some items were observed to very little load to some factors, some items load more than one factor, and some load values were low and EFA was repeated by removing these items from the scale. It was seen that the remaining 22 items were generated under 4 factors. The eigenvalues of these factors are presented in Figure 1.

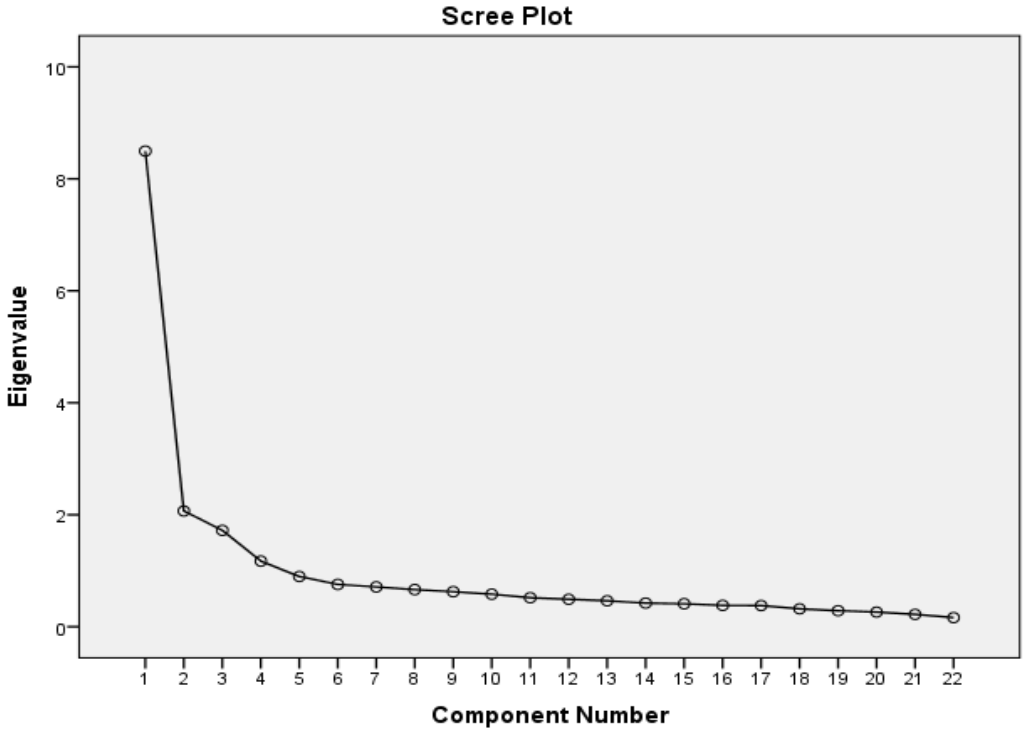

Figure 1: Eigenvalues of Factors

In these analyzes, promax, one of the oblique rotation techniques, was utilized and .40 was taken as the lower cut-off point of the factor loads. items with a factor load below this value were not processed. Table 1 presents the EFA values of the remaining 22 items.

Table 1: EFA Values of Factors of the Items in "Attitudes Scale owards the Use of Information Technology in Education"

		F1	F2	F3	F4
		EFA	EFA	EFA	EFA
I 2	I consider using information technology tools in the lessons.	.947			
I 1	It is necessary to use virtual reality applications in education.	.894			
I 3	I encourage my students to use educational technology.	.843			
I 6	I believe that designing materials utilizing the information technology will increase the interest in the course.	.733			
I 8	I try to learn the information technology tools that will help me in my professional life.	.727			
I 13	I think animations contribute to the transfer of the course contents in a more instructive way.	.557			
I 11	I would like to attend interactive lectures.	.544			
I 34	I follow the innovations in the field of information technology.		.913		
I 33	I follow web sites with course content used in information technology.		.905		
I 38	I utilize the contents of EIN (Education Information Network) in the lessons.		.674		
I 32	I utilize presentation programs.		.658		
I 35	I use my knowledge of information technology to create course content.		.641		
I 28	I prepare a concept map on the computer.		.576		
I 37	I try to improve myself in information technology		.540		
I 22	I do not like the content of the course through animation.			.866	
I 18	I feel uncomfortable with the use of content shaped with information technology in the courses.			.721	
I 24	I don't like teaching with the help of information technology.			.711	
I 19	I'm not interested in information technology.			.622	
I 9	I do not believe that information technology will contribute to my profession.			.584	
I 17	I enjoy preparing content with a software of the information technology.				.817
I 15	It makes me unhappy to make posters with programs of information technology.				.743
I 14	I enjoy preparing course content in a digital environment.				.736

Factors	Eigenvalues	Variance percentage	Described Total Variance
F1	8.497	38.623	61.175
F2	2.067	9.395	
F3	1.722	7.827	
F4	1.173	5.331	

EFA Exploratory Factor Analysis
F1 Load Values of the First Factor
F2 Load Factors of the Second Factor
F3 Load Factors of the Third Factor
F4 Load Factors of the Fourth Factor

Table 1 indicates that the factor load values of the EFA are listed from high to low for each factor. Table 1 also represents that the 22-item scale developed is composed of 4 factors, the first factor includes 7, the second factor includes 7, the 3rd factor includes 5, and the 4th factor includes 3 items. By examining the items of the factors, the first factor was called “Attitudes toward information technology usage”, the second factor was called “Attitudes toward keeping up the information technology”, the third factor was called “Attitudes towards the interest in information technology”, and the fourth factor was called “Attitudes towards creating content with information technology”.

EFA results presents that the load values of the first factor vary between .947 and .544, load values of the second factor vary between .913 and .540, load values of the third factor vary between .866 and .584, and load values of the fourth factor vary between .817 and .736. Of the total variance, which was 61.175%, 38.623% refers to the first factor, 9.395% refers to the second factor, 7.827% refers to the third factor, and 5.331% refers to the fourth factor. As for the eigenvalues of the factors, 8.497 was for the first factor, 2.067 for the second factor, 1.722 for the third factor, and 1.173 for the fourth factor.

The results obtained from EFA were confirmed by confirmatory factor analysis (CFA). CFA path diagram and factor loads of the scale are presented in Figure 2.

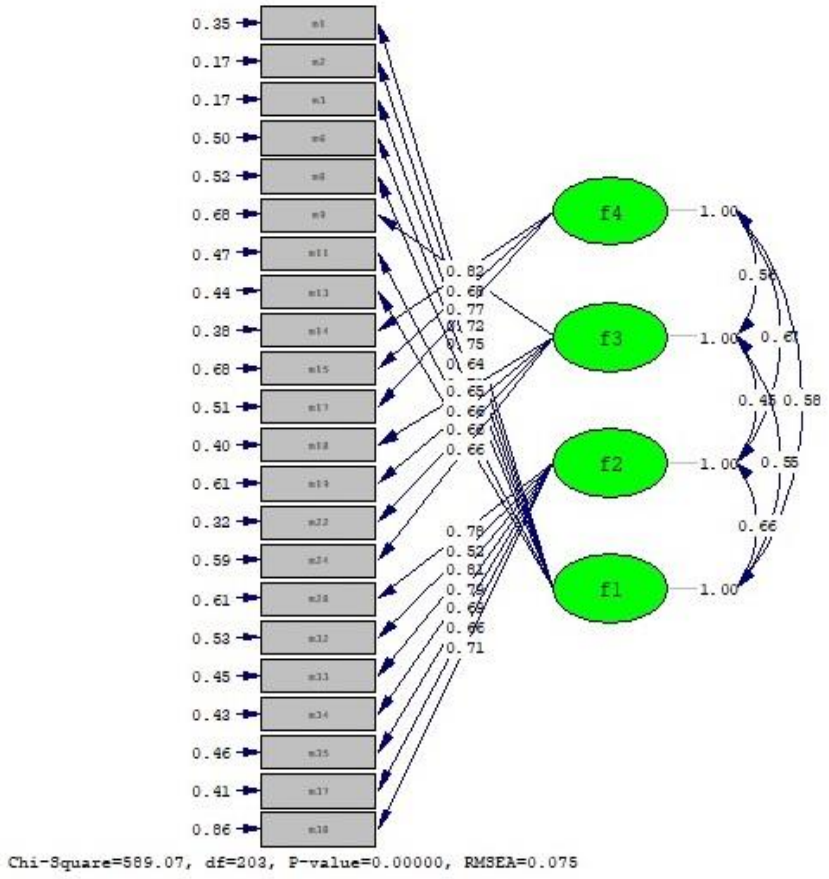

Figure 2: Path Diagram and Factor Loads

Table 2: Fit Index Compatibility Table

Examined Fıt Index	Perfect Cohesion Criteria	Accepted Cohesion Criteria	Obtained Fıt Indices	Result
X^2 / sd	$0 \leq x^2/sd \leq 2$	$2 \leq x^2/sd \leq 3$	2,9018	Accepted compliance
RMSEA	.00 ≤ RMSEA ≤ .05	.05 ≤ RMSEA ≤ .08	.075	Accepted compliance
CFI	.95 ≤ CFI ≤ 1.00	.90 ≤ CFI ≤ .95	.96	Perfect compliance
SRMR	.00 ≤ SRMR ≤ .05	.05 ≤ SRMR ≤ .10	.060	Accepted compliance
PNFI	.95 ≤ PNFI ≤ 1.00	.50 ≤ PNFI ≤ .95	.83	Accepted compliance
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .95	.99	Perfect compliance
PGFI	.95 ≤ PGFI ≤ 1.00	.50 ≤ PGFI ≤ .95	.69	Accepted compliance

In the confirmatory factor analyzes implemented on the construct consisting of four factors, no modification was performed on the model. Obtained fit index values; χ2/sd=2.9018, RMSEA=.075, CFI=.96, SRMR=.060, PNFI=.96, IFI=.96, and PGFI=.69. According to Çokluk, Şekercioğlu, and Büyüköztürk (2012), this fit index data can be interpreted as a good construct fit of the scale.

In order to determine whether the standardized analysis values of each item related to the CFA analysis of the scale were significant, t values were evaluated. The obtained t values ranged from 11.14 to 19.86. The calculated t-values were explored to be significant at p <.01 level for all items. As a result, when the fit index values obtained after CFA were examined, it can be indicated that the 22-item assessment instrument demonstrated a good fit and was applicable.

The Findings Regarding Item Analysis and Reliability

Firstly, total-item correlations were calculated to determine whether each item in the scale measures the property that aimed to measure and how sufficient it was to distinguish individuals in terms of the property they measure.

Table 3: Total-Item Correlations and Cronbach Alpha Reliability Co-efficient

Factors and Items	$\overline{X}$	S	Total-Item Correlations
Factor 1: Attitudes toward the information technology usage (α=.894)			
I 2	4.21	0.83	.798
I 1	3.98	0.87	.675
I 3	4.15	0.85	.791
I 6	4.08	0.95	.650
I 8	4.17	1.01	.679
I 13	4.19	0.90	.646
I 11	4.14	0.92	.638
Factor 2: Attitudes toward keeping up the information technology (α=.865)			
I 34	3.83	1.02	.711
I 33	3.78	1.05	.721
I 38	3.77	1.17	.571
I 32	3.67	1.10	.526
I 35	3.88	0.96	.646
I 28	3.67	1.10	.639

I 37	4.05	0.92	.658
Factor 3: Attitudes towards the interest on the information technology (α=.788)			
I 22	4.22	0.87	.669
I 18	4.12	0.91	.610
I 24	4.09	1.02	.556
I 19	4.00	1.02	.555
I 9	4.24	0.98	.458
Factor 4: Attitudes towards creating content with the information technology (α=.765)			
I 17	3.59	1.05	.627
I 15	3.78	1.07	.544
I 14	3.75	1.03	.622

The Cronbach-alpha value for the first dimension of the scale was .894, the Cronbach-alpha value for the second dimension was .865, the Cronbach-alpha value for the third dimension was .788, and the Cronbach-alpha value for the fourth dimension was .765. The Cronbach-alpha value of the whole scale was calculated as .92.

The item analysis of 22 items of four dimensions determined by factor analysis was conducted to determine whether the selected items serve the purpose of measuring the desired property and to distinguish between individuals who have the desired property to be measured or not. In order to determine whether the items of the scale serve the purpose of measuring the desired property, the results of the item analysis summarized in Table 3 were examined. Accordingly, when the total-item correlations were examined in the dimension of attitudes towards the information technology usage, it was explored that values were between (r=.63) and (r=.79) and values in the attitudes of keeping up the information technology were between (r=.63) and (r=.63). (r=.72), attitudes toward the interest in the information technology were between (r=.45) and (r =.66), and attitudes towards creating content with the information technology were between (r=.54) and (r=.62).

Item Analysis

Corrected total-item correlation was calculated in order to determine the level of discrimination of the items in the Attitudes Scale towards the Use of Information Technology in Education and to determine the predictive power of total score, and 27% sub-upper group comparisons were included. The findings obtained from the item analysis are shown in Table 4.

Table 4: Item Reliability Analysis of the Attitudes Scale Towards the Use of Information Technology in Education

Item No	Scale Average When Item Is Removed	Scale Variance When Item Is Deleted	Total-Item Score Correlation	Cronbach's Alpha When Item Is Removed	t
1	83.8537	159.766	.558	.917	8.086
2	83.6149	158.220	.663	.915	9.521

3	83.6836	156.936	.705	.914	10.628	
6	83.7493	157.985	.580	.916	9.460	
8	83.6597	156.123	.620	.916	11.993	
13	83.6448	157.152	.656	.915	9.473	
11	83.6925	156.770	.654	.915	11.247	
34	84.0000	156.994	.575	.917	11.197	
33	84.0537	155.991	.596	.916	12.580	
38	84.0597	157.248	.482	.919	11.086	sd=190
32	83.6866	160.144	.522	.918	8.512	p<.001
35	83.9493	157.168	.608	.916	12.005	
28	84.1642	154.461	.623	.916	16.684	
37	83.7791	156.706	.659	.915	13.187	
22	83.6060	161.210	.492	.918	12.597	
18	83.7134	160.205	.509	.918	10.296	
24	83.7373	159.859	.463	.919	10.507	
19	83.8299	160.160	.446	.919	10.215	
9	83.5851	161.285	.423	.920	9.566	
17	84.2358	157.588	.533	.917	10.193	
15	84.0478	158.537	.487	.919	10.547	
14	84.0806	155.775	.621	.916	11.834	

The results of total-item correlation of items in the Attitudes Scale towards the Use of Information Technology in Education ranged from .423 to .705. When interpreting total-item correlation, items with a value of 30 or higher are regarded to distinguish the property to be measured well (Büyüköztürk, 2012).

Based on these findings, all items of the scale can be stated to differentiate between those with and without characteristics, in other words, they reveal differences between individuals.

CONCLUSION and DISCUSSION

This study has an attempt to develop a scale that aims to measure the attitudes of prospective teachers towards the use of information technology in education. In the development of the scale, the literature was reviewed and a draft scale was shaped and applied to prospective teachers on a voluntary basis. To determine the construct of this draft scale prepared after the application, a scale consisting of 22 items was developed by conducting validity and reliability studies. Croanbach-Alpha coefficients were calculated for reliability and the scale was concluded to be reliable according to the obtained values. For validity, construct and content validity were analyzed. EFA was firstly utilized for the construct validity and CFA was utilized to verify the construct. The results of the EFA revealed that the scale had a four-factor construct.

The first of these factors was named as “attitudes towards the information technology usage”, the second was “attitudes towards keeping up the information technology”, the third was “attitudes towards the interest in the information technology”, and the fourth was “attitudes towards creating content with information technology”. This four-factor scale was determined to refers to 61.175% of the variance.

The results of CFA explored the fit index values and that this model shaped in regard to the fıt index values was in good agreement with the data. Based on EFA and CFA analysis, this four-factor scale can be regarded to be valid.

When Turkish literature was examined, an attitude scale for the use of information technology in education could not be found. Although there are many attitude scales for technology, there are only 2 such studies on the use of technology. (Öksüz, C. & Ak, Ş. 2010; Kol, S. 2012).

The scale for determining the level of technology use in mathematics classes in primary schools, developed by Öksüz, C. & Ak, Ş. (2010), is a single factor 5-point Likert type scale consisting of 28 items.

The attitude scale for the use of technological equipment in preschool education, developed by Kol, S. (2012), is a single factor 5-point Likert type scale consisting of 20 items.

The fact that these studies are limited to pre-school and mathematics areas, and the changes and developments in information technologies that have occurred since the publication of these studies, necessitated the creation of new scales to determine the current attitudes of teachers and prospective teachers about using information technologies.

SUGGESTIONS

The validity and reliability studies of the scale should be performed by other researchers who will use the scale.

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