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Are We Measuring Teachers' Attitudes towards Computers in Detail?: Adaptation of a Questionnaire into Turkish Culture

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Abstract

Teachers' perceptions of computers play an important role in integrating computers into education. The related literature includes studies developing or adapting a survey instrument in Turkish culture measuring teachers' attitudes toward computers. These instruments have three to four factors (e.g., computer importance, computer enjoyment, computer confidence) and 18 to 26 items under these factors. The purpose of the present study is to adapt a more detailed and stronger survey questionnaire measuring more dimensions related to teachers' attitudes. The source instrument was developed by Christensen and Kenzek (2009) and called Teachers' Attitudes toward Computers (TAC). It has nine factors with 51 items. Before testing the instrument, the interaction (e-mail) factor was taken out because of the cultural differences. The reliability and validity testing of the translated instrument was completed with 273 teachers' candidates in a Faculty of Education in Turkey. The results showed that the translated instrument (Cronbach's Alpha: .94) included eight factors and consisted of 42 items under these factors, which were consistent with the original instrument. These factors were: *Interest* (α: .83), *Comfort* (α: .90), *Accommodation* (α: .87), *Concern* (α: .79), *Utility* (α: .90), *Perception* (α: .89), *Absorption* (α: .84), and *Significance* (α: .83). Additionally, the confirmatory factor analysis result for the model with eight factors was: *RMSEA*=0.050, χ^2/df=1.69, *RMR*=0.075, *SRMR*=0.057, *GFI*= 0.81, *AGFI*= 0.78, *NFI*= 0.94, *NNFI*=0.97, *CFI*=0.97, *IFI*= 0.97. Accordingly, as a reliable, valid and stronger instrument, the adapted survey instrument can be suggested for the use in Turkish academic studies.

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1. INTRODUCTION

The use of computers is essential in educational settings. Thus, it is important for teachers to be experienced in computer related skills. Computer literacy courses are one of the required courses in Colleges of Education in the Turkish Universities. Teacher candidates are given computer related skills in these courses as it is necessary to have qualified teachers who know how

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to deal with computer related problems and keep up with technological developments. In many studies (e.g., Erkan, 2004; Usta & Korkmaz, 2010; Yıldırım & Kaban, 2010; Altun, 2011) it was mentioned that teacher candidates must be equipped with computer technology skills to achieve lifelong learning. Additionally, as a result of their study with teacher candidates and their computer and the Internet use habits, Başol and Çevik (2006) found that teacher candidates must be trained in computer and the Internet use, and necessary adjustments must be provided for them. Additionally they suggested that teacher candidates' current computer and Internet related trainings must be improved. For these reasons, they suggested that it is necessary to provide teacher candidates with technological resources and they must be encouraged to use computers.

Teachers play an important role in integrating computers into education. Hung and Koh (2004) proposed a framework in order to analyze a school's technology integration. In integrating information technologies into schools, there existed four dimensions in socio-cultural factors of schools: school set-up, classroom dynamics, students' behaviors and teachers' attitudes (Hung & Koh, 2004). The authors argue that teacher attitudes affect classroom and student behaviors, and reaching educational goals.

Attitude could be defined as a person's mental and neural readiness affecting their responses to a situation (Khine, 2001 in Erkan, 2004). It can be attributed to a person and that person's tendency to form his/her feelings, thoughts and behaviors about another person or an object (Kağıtçıbaşı, 2016). Attitudes can be shaped and learned with experience (Ekici, Uzun & Sağlam, 2010), directs our behaviors and are the psychological characteristics behind our behaviors (Tavşancıl 2014). Thus it is important to measure it in terms of individuals and community. A person's attitude towards computes, therefore, affects his computer use. Thus, it is highly possible that teachers' positive attitude towards computers is important in organizing educational settings (Aypay & Özbaşı, 2008; Cüre & Özdener, 2008). As time go by so do technological developments. Thus, teachers' perceptions about technology are reported getting more positive parallel to these developments (Cüre & Özdener, 2008). Additionally, Slough and Chamblee (2000) claim teachers, who have witnessed the positive effect of technology in their teaching activities, won't avoid taking advantage of technology.

The more one have experience in using computers, the more he or she has positive attitudes towards computers (Kinzie & Delcourt, 1991; McInerney, McInerney & Sinclair, 1994; Levine & Donitsa-Schmidt, 1998, Deniz 2000; Erkan, 2004; Cüre & Özdener, 2008; Ekici, Uzun & Saglam, 2010; Lehimler, 2016). Those who don't have enough experience in computers might develop negative attitudes towards them (Hashim & Mustapha, 2004). Mitzner et al. (2016) argued that one's attitude towards and positive experience in technology is highly related to her view of technology in terms of its usefulness and ease of use. Teo (2009) argues that teacher candidates' perceptions related to computers is explained by perceived usefulness and perceived ease of use. Cognitive attitude, awareness, and application software ability are some of the predictors for teachers' computer use (Kay, 1990). In a recent study by Teo, Milutinović & Zhou, (2016) found that attitudes towards computers are highly related to perceived usefulness, perceived ease of use, and technological complexity. How proficient one sees himself in using computers is highly related to his attitudes towards computers (Deniz & Köse, 2003). Having a computer home (Çelik & Bindak, 2005; Mumcu & Usta, 2014), and perceptions about the proficiency in computer use (Deniz, 2000) are seen positively effective in teachers' attitudes towards computers. Teacher candidates' attitudes towards computer-based education and computers are found to be positively and significantly related (Oğuz, Ellez, Akamca, Kesercioğlu & Girgin, 2011).

Aypay and Özbaşı (2008) investigated teachers' perceptions about the computer use in schools. As a result of their studies, teachers claimed that the number of computers is not enough in schools, more in-service training about computers must be provided, and teachers must be encouraged for the use of computers in their classes. In their study, Bahar and Kaya (2013) found the following comparisons regarding computer use: Female students are more anxious than male students; those who don't own computers are more anxious than those who own computers; those who easily reach computers are less anxious than those who don't. Moreover, those people with more anxiety about computers see themselves inadequate in solving technology related problems.

Çavuş and Gökdaş (2006) found that the use of computers among teacher-candidates is insufficient, there is no relationship between their gender and the frequency they use computers, and the reason they use the Internet is mostly to find information. Gender and computer ownership are not seen as an effective issues for Turkish teacher-candidates attitudes towards computers (Şahin & Akçay, 2011). However, the year of school a teacher-candidate is in is reported effective on being more/less positive about computer related education.

Determining teachers' beliefs and their attitudes towards computers is important. It was argued that having positive attitudes and beliefs about computers are necessary to be developed in a positive way (Güzeller, 2011). Rana (2012) argues that teachers must have positive attitudes towards computers because their intention for computer use is highly related to their thoughts of their success in integrating technology into their classrooms. Teachers' attitude towards computers is a strong predictor of their attitudes towards using the Internet, as well (Bahar, Uludağ & Kaplan, 2009; Ozden, Aktay, Yilmaz, Ozdemir, 2007). Mumcu and Usta (2014), in their studies, found that teacher candidates use the Internet for research and homework purposes. Teacher candidates, who have positive attitudes towards the Internet, are reported using the Internet often and every day.

There are some computer attitude survey instruments adapted from other cultures into Turkish culture (e.g., Berberoğlu & Çalıkoğlu, 1991; Demir & Yurdugül, 2014) as well as the ones developed in Turkish (e.g., Aşkar & Umay, 2001; Bindak & Çelik, 2006; Yeşilyurt & Gül, 2007). For example, Berberoğlu and Çalıkoğlu (1991) in their studies adapted a survey instrument, which includes three factors, developed by Loyd and Gressard (1984) in the USA. This survey instrument originally included 40 items which were grouped under the following factors: *computer liking* (10 items), *computer confidence* (10 items), *computer anxiety* (10 items) and *computer usability* (10 items). For the validity and reliability of the instrument, they tested the instrument with 282 students. While the factor loads ranged from .77 to .85, the Cronbach's values for the whole scale was .90, for the computer anxiety it was .57, for the computer confidence it was .72, for the computer liking it was .68 and finally for the computer usability it was .72. They found that the adapted survey included only one factor based on Turkish culture and all the factors in the original survey were not observed in the adapted version. As a result, this survey is not strongly sufficient for testing teachers' attitudes towards computers in Turkey. Demir and Yurdugül (2014) adapted a survey instrument which was originally developed by Knezek, Christensen and Miyashita (1998). This instrument included eight factors with 65 items. However, Teo (2008) used only three factors with 20 items from this original instrument and tested it with 183 students in Singapore. Demir and Yurdugül (2014) used the one which Teo (2008) has used. The factors in this instrument were *computer importance* (6 items), *computer enjoyment* (6 items) and *computer anxiety* (8 items). With the Likert scale answers from strongly disagree to strongly agree, they tested the

validity and reliability of the instrument with 1678 students. As a result, they found that the adapted survey including three factors were reliable and valid for Turkish culture.

As for the ones, which were created in Turkish, Yeşilyurt and Gül (2007) developed a computer attitude scale including three factors with 26 items. The factors included *available resources, computer-use ability* and *level of computer use in schools.* Their Cronbach's Alpha for the whole scale was .90. Additionally, Bindak and Çelik (2006) developed a scale measuring primary school teachers' attitudes towards computers. The scale included four factors with 22 items. These four factors were reported as explaining 53.8% of the total variance. Cronbach's Alpha for this scale was .91.

In this study, to present an alternative and a stronger measurement instrument to measure teachers' attitude towards computers, we used a questionnaire instrument with nine subscales with high reliability values ranged from .84 to .94. It is called *the Teachers' Attitudes toward Computers (TAC) Questionnaire Instrument,* created and developed by Christensen and Knezek (2009). The reason to select this questionnaire was to use a stronger scale to measure Turkish teachers' attitudes towards computers. Because it had more factors and more items than other questionnaires in Turkish literature (e.g., Aşkar & Umay, 2001; Bindak & Çelik, 2006; Yeşilyurt & Gül, 2007; Demir & Yurdugül, 2014), we believed that it would bring up more details about teachers' beliefs towards computers. Additionally, it contained much more detailed dimensions in computer attitudes, which is different from other questionnaires.

2. METHOD

2.1. Sample and Study Design

This study used a quantitative design method. The translation of the survey items into Turkish, item equivalency evaluation, and construct validity testing with exploratory and confirmatory factor analysis were completed in the adaptation process. The study was conducted with 273 teacher candidates from three departments in a Faculty of Education in Turkey. The departments were Elementary School Mathematics Teaching, Turkish Teaching and, Guidance and Psychological Counseling departments. The sampling method for selecting the participants was probability sampling. In this sampling method, the subjects have an equal chance of being selected (McMillan, 2012). A small percent of the population would yield a precise description of the population according to this method. After randomly selecting the participants from three departments, the study was processed.

2.2. The Survey Instrument

The Teachers' Attitudes toward Computers (TAC) Questionnaire was created and developed by Christensen and Knezek (2009). In developing the instrument, Christensen and Knezek (2009) have recruited 284 items under 32 subscales from 14 well-valid survey instruments. First of all, an exploratory factor analysis was administered to 621 educators on this version of the instrument. The results showed that 7-factor, 10-factor and 16-factor possible factor structures could be representing teachers' attitudes towards computers. A content analysis revealed that the 7-factor structure was the one that was appropriate. These factors, with the Cronbach's Alphas ranged from .85 and .98, were: *Enthusiasm/ enjoyment, anxiety, avoidance/acceptance, email for classroom learning, negative impact on society, productivity and semantic perception of computers.* They also conducted parallel forms reliability test on these factors by creating A and B forms of the instrument. The reliability results ranged from .85 to .96 in the form A and from .85 to .95 in the

form B. As a result they had 90 items from the results of the parallel forms reliability test in addition to 16 other items measuring teachers' attitude towards computers. These 106 items were then tested with an exploratory factor analysis in two refinement phases: The first phase was held between the years of 1995 and 1997 (n = 621) and the second phase was held between the years of 1997 and 1998 (n=1296). As a result, they created a scale with 85 items. The Cronbach's Alpha values for the first phase were as followings: For Interest (9 items) it was .88, for Comfort (8 items) it was .94, for Accommodation (11 items) it was .86, for Interaction (e-mail) (10 items) it was .95, for Concern (10 items) it was .84, for Utility (10 items) it was .89, for Perception (7 items) it was .92, for Absorption (10 items) it was .89, for Significance (10 items) it was .84. In the second refinement phase, they reached to a structure with 85 items. In this structure, the Cronbach's Alpha values for the second phase were as followings: For Interest (9 items) it was .90, for Comfort (8 items) it was .92, for Accommodation (11 items) it was .86, for Interaction (e-mail) (10 items) it was .95, for Concern (10 items) it was .86, for Utility (10 items) it was .92, for Perception (7 items) it was .93, for Absorption (10 items) it was .88, for Significance (10 items) it was .86. As a result of the latest factor analysis conducted in 2000, the final version (i.e., version 6) of the TAC instrument ended up having 51 items.

In 2000, the final version of the instrument (i.e. version 6) was applied to 546 teachers and had reliability values ranged from .84 to .96. These Cronbach's values were as followings: For Interest (5 items) it was .90, for Comfort (5 items) it was .94, for Accommodation (5 items) it was .88, for Interaction (e-mail) (5 items) it was .94, for Concern (8 items) it was .89, for Utility (8 items) it was .90, for Perception (5 items) it was .96, for Absorption (5 items) it was .89, for Significance (5 items) it was .84. In 2003, additionally, this instrument was retested with 786 pre-service teachers and the reliability results ranged from .84 to .94. With 306 in-service teachers, the reliability results ranged from .86 to .97. In 2006, this instrument was retested with K-12 teachers and the reliability results ranged from .89 to .95. In 2008, the reliability test, with 273 pre-service teachers in Texas and Maine, resulted in the range from .87 to .95. This instrument was adapted into other languages as well. For example, it was applied in Mexico in 2006 by Morales and the reliability results ranged from .74 to .98.

The confirmatory factor analysis administered in 2003 on the TAC with 51-item to 1176 teachers from elementary school (%49), middle school (%22), and high school (%29) in Texas, the USA. Goodness-of-fit values were as supported by the goodness of fit index (Tabachnick & Fidell, 2001) *RMSEA* = .048, *SRMR* = .0452, *CFI* = .984.

The original instrument as mentioned earlier has 51 items under the factors of *Interest, Comfort, Accommodation, Interaction (e-mail), Concern, Utility, Perception, Absorption,* and *Significance*. It was necessary to decide whether *the Interaction (e-mail)* factor in the questionnaire has a place in Turkish culture. For this reason, the e-mail factor was judged by a semi-structured interview form with 5-items developed by the researchers. This form was administered to an academician and a teacher, whose area of expertise is Computer Education and Instructional Technology. A content analysis was used in identifying the interview questions. In determining the intercoder reliability, Reliability = number of agreements/ (total number of agreements + disagreements) formula (Miles and Huberman, 1994) was used, and it was found to be .80. In the content analysis, themes and codes were composed. As a result, it was found that e-mail is not used effectively in Turkish culture. The themes and the codes revealed from the interviews with the academician, (i.e., K1) and the teacher (i.e., K2) were as followings:

In the first theme "The effectiveness of e-mail use in education process" and for *the subject differences* code in this theme, K1 reveals that "As I mentioned earlier, students prefer communicating and sharing contents on social media rather than e-mail". K2 states that "e-mail is in no way in use between teachers and students, school management and teachers, and among teachers"

In the second theme "Providing better educational experiences with e-mail use" and for "the official purposes use" code in this theme, K1 claims that "because I think that e-mail is mostly used for official purposes". K2 tells that "e-mail is for data sharing. How could it be used for classes?"

In the third theme "Making education process more interesting with e-mail use" and for "the Internet access problem" code in this theme, K1 states "students, who do not have or have limited internet access, have difficulty with sending e-mails". While for the "students' incapability" code K2 claims "students don't know what e-mail is, what it is used for although they use it to log in to Facebook, Instagram and Twitter. They don't know it could be used for sharing files"

In the fourth theme "Providing more learning opportunities in education process" and for "the internet connection difficulty" code, K1 claims that "if only internet access problem is solved, it might help". For the "lack of interactive content and teacher incapability" code K2 states that "It wouldn't have interactive content. Nothing has come to my mind. It might be my incompleteness".

Lastly in the fifth theme "Increasing motivation with e-mail use in education process" and for "the use of social media" code K1mentions that "Moreover there is Edmodo that I use for educational purposes. It is a social media platform and much more like Facebook. I add my students into the groups in this platform". For "the lack of alternative apps" code, K2, by talking about the EBA system, developed by the Ministry of National Education in Turkey, mentions that "for teachers to communicate with students there is no longer need for dealing with e-mail. The EBA system does and covers everything.

For this reason, the e-mail factor was removed from the questionnaire since it is not in use by educators for education purposes. For the future studies, it is necessary to include more up-to-date social platforms (e.g., cloud storages) in the questionnaire. As a result, because the use of e-mail is not as frequently used in Turkey, *the Interaction (e-mail)* factor was eliminated from the TAC and a 42-item version was used in the present study.

2.3. Data Analysis

In the scope of validity testing, exploratory factor analysis (EFA) was used to investigate the construct validity to evaluate the structure of the adapted survey in Turkish culture. In addition, an item-total correlation was calculated to evaluate the strength of the survey in differentiating those with high and low levels. An item analysis was conducted based on the average level of upper and lower groups. Additionally, a Cronbach's Alpha correlation coefficient was calculated to test the consistency of the survey items. A test-retest reliability analysis was also used to test the stability of the survey.

3. FINDINGS

Studies on survey instrument adaptation aim adapting a survey, developed in a culture, into different languages and cultures. There are many national and international studies focusing on adaptation surveys in the literature. These studies give information about the survey adaptation

process. In this study, the following phases, suggested by and Hambleton & Bollwark (1991), Hambleton & Kanjee (1993) and Savaşır (1994) were completed: The translation of the items, item equivalency evaluation, and reliability and validity testing of the Turkish translated form.

3.1. Translation of the Survey Instrument

As Savaşır (1994) states for the translation of the survey instrument, which is the most important part in adapted survey studies, translators should know both languages and the subject area well, and have experiences in both cultures For this reason, the translation of the instrument, from English to Turkish (i.e., from the source language to target language), was completed by an assistant professor who meets these criteria.

3.2. Item Equivalency Evaluation

Upon the completion of the translation, judgmental and statistical techniques were used in order to judge the source and translated instruments in terms of equivalency. In this study, single-translation method was used as a judgmental method. The most important reason to use this method was to investigate and evaluate the item equivalency in the target language. Thus, appropriate expressions in the target language might be chosen and adapted, so that intended meaning of the source language might convey the accurate meaning (Hambleton & Bollwark, 1991).

As one of the judgmental method, back-translation method investigates item equivalency in the source language. In this method, the translated instrument is translated back into the source language and compared to the source instrument. However, because the comparisons are made in the source language, the problems in the target language may not be determined enough (Savaşır, 1994). Additionally, in the back-translation method comprehensibility of the instrument is not taken into account. However, in the single-translation method how participants interpret the instrument can be determined. Therefore, because the back-translation method falls short (Hambleton & Kanjee, 1993; Savaşır, 1994), the single-translation method was preferred in this study.

The first version of the translated form was evaluated in terms of words, terms and expressions, and then compared to the source language. Then, necessary corrections were made to make it appropriate for the target culture. In addition, the Turkish translated draft form was evaluated in terms of Turkish linguistic by a Turkish philologist. Based on the experts' views, the survey items were evaluated one by one and all the necessary alterations were made.

Then, four graduate students from the Curriculum and Teaching department were asked to read and evaluate the form in terms of clarity and suitability. The researchers asked them what each item means to get data on item equivalency. Based on their comments, necessary corrections were made on the items. Additionally, linguistic equivalence was evaluated in terms of consistency between the source and the translated survey instruments (Hambleton & Bollwark, 1991). For this, 40 students from a Department of English were administered with the instruments. They took the English version and then the Turkish version of the instrument over two-week period, respectively. As a result, there was a strong positive relationship between the instruments ($r = 0.90$, $p < .05$).

3.3. Validity Testing: Construct Validity

Exploratory factor analysis was performed to examine the Turkish translation of the survey instrument in the frame of Turkish culture. In the exploratory factor analysis, the purpose is to bring variables together to find out new significant factors based on the relationships between the variables (Büyüköztürk, 2002). That is, in order to measure an unknown structure the results of

the scale are taken into consideration to explain the related structure. According to Deniz (2007), exploratory factor analysis is a technique to reveal the dimensions of an adapted scale in the new culture. Thus, this study was completed to determine the TAC's categories, under which the items in the Turkish form fit in. Additionally, the factor loadings of the items were investigated with regard to the scale structure in Turkish culture. Moreover, the Principle Component Analysis, which is often used in social sciences, is used as a factoring technique in the exploratory factor analysis. To reset the correlation between the factors and thus to enable the interpretation of the factors, a Varimax orthogonal rotation was performed. The lower limit was set to 1.00 for the item eigen values to determine the number of factors (Tabachnick & Fidell, 2001; Büyüköztürk, 2002).

The sample size was taken into consideration for the exploratory factor analysis. The sample size was 273 for this study. Before testing the factor analysis, the data was examined in terms of appropriateness for a factor analysis. For this, a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Barlett's test of Sphericty were performed. The KMO was used to assess the adequacy of the sample size. A KMO value might be between 0 and 1 with the following labels: 0.90 to 1.00 is marvelous, 0.80 to 0.89 is meritorious, 0.70 to 0.79 is middling, 0.60 to 0.69 is mediocre, 0.50 to 0.59 is miserable and 0.00 to 0.49 is unacceptable (Tabachnick & Fidell, 2001; Cohen, Cohen, West & Aiken, 2003). In addition, if Bartlett's Test of Sphericity value is significant, then the sample size is considered as adequate for the factor analysis. Also, this test shows whether the correlation matrix is appropriate (Tabachnick & Fidell, 2001; Büyüköztürk, 2002). The results suggested that both values are appropriate for a factor analysis. (KMO =.903; Barlett's Test of Sphericty $\chi 2=6.820$ df =861 $p<.001$).

The scale included 42 items under 8 factors. As a result of applying the scale to 273 students, Cronbach's Alpha for the scale in total was found to be .94. For the sub-factors the Cronbach's alpha values were: .90 for the first sub-factor (Utility) (7 items), .90 for the second sub-factor (Comfort) (5 items) , .89 for the third sub-factor (Perception) (5 items) , .84 for the fourth sub-factor (Absorption) (5 items) , .87 for the fifth sub-factor (Accommodation) (5 items), .79 for the sixth sub-factor (Concern) (6 items), .83 for the seventh sub-factor (Significance) (4 items), and .83 for the eighth sub-factor (Interest) (5 items). Preliminary results for the factor analysis indicated that there were ten components with eigen value above 1.00. The scree plot for the eigen values showed that the most important break points were in the eighth factor. In deciding the total number of factors, the eigen value, the percentage of contribution and the scree plot were three criteria that were used the most (DeVellis, 2003). It was argued that the number of factors to the point, where the scree plot takes a horizontal shape, could be used as criteria to specify the appropriate number of factors (DeVellis, 2003).

In addition, the original scale has nine sub-factors. However, the e-mail sub-factor was taken out because of the cultural differences. Thus, the factor analysis for the scale with eight sub-factors (i.e., F1: Utility, F2: Comfort, F3: Perception, F4: Absorption, F5: Accommodation, F6: Concern, F7: Significance, and F8: Interest) were re-applied.

Table-1 shows the structure with eight factors, which was obtained after the factor analysis with two iterations. The factors, which were obtained from the reliability analysis, factor loadings, factor eigen values, percentage of variance, which was explained by the factors, and the Cronbach's Alpha values were included in the table. Additionally, it shows the revised item-total correlations (*r*), common variances and t-values.

Table 1. Factors, Factor Loadings, Percentage of Variances Explained by Factors, and Item-Total Correlations Values (r) r: item-total correlations. * Significant at .05 level

Item #	F1	F2	F3	F4	F5	F6	F7	F8	$\bar{X}$	T	SS	R
m26	.80								4.44	-7.62	.87	.48*
m25	.78								4.23	-8.96	.75	.53*
m24	.77								4.03	-8.90	.82	.56*
m31	.71								4.20	-7.84	.81	.52*
m28	.71								3.83	-8.43	.89	.49*
m27	.70								4.07	8.53	.88	.49*
m30	.66								4.13	-7.60	.80	.52*
m6		.79							4.05	-6.91	.99	.47*
m9		.79							4.12	-7.61	1.02	.53*
m7		.76							4.09	-9.52	.96	.59*
m8		.75							4.21	-8.62	.94	.59*
m10		.62							4.30	-7.82	.88	.59*
m34			.87						4.78	-9.34	1.79	.42*
m35			.86						4.90	-10.21	1.88	.49*
m33			.85						4.62	-8.79	1.84	.44*
m36			.80						4.48	-9.14	1.84	.42*
m32			.63						5.37	-11.81	1.81	.56*
m40				.72					3.05	-9.56	1.12	.53*
m38				.72					3.42	-6.76	1.10	.40*
m37				.72					3.11	-11.24	1.08	.55*
m42				.72					3.16	-7.34	1.07	.42*
m39				.71					3.32	-8.24	1.02	.50*
m13					.73				4.60	-6.23	.71	.54*
m11					.72				4.52	-7.68	.84	.57*
m12					.71				4.41	-7.99	.86	.50*
m14					.64				4.65	-5.53	.66	.51*
m15					.57				4.32	-8.44	.90	.62*
m20						.73			2.73	-6.94	1.13	.34*
m21						.71			3.36	-6.90	1.08	.39*
m23						.71			3.30	-6.21	1.12	.36*
m18						.68			3.38	-7.01	1.17	.39*
m19						.66			2.73	-5.08	1.07	.28*
m17						.56			3.07	-5.57	1.10	.31*
m45							.73		4.25	-7.34	.83	.50*
m46							.73		4.19	-6.84	.90	.45*
m44							.72		4.39	-7.73	.83	.52*
m43							.52		4.09	-7.58	.84	.53*
m4								.65	3.95	-9.57	1.04	.61*
m2								.65	4.18	-7.41	.89	.52*

m1								.60	4.00	-10.14	1.03	.64*
m3								.59	3.10	-8.30	1.14	.45*
m5								.54	4.18	-8.07	.83	.55*
Rank	.66-.80	.62-.79	.63-.87	.71-.72	.57-.73	.56-.73	.52-.73	.54-.65	2.73-5.37	-11.81--5.08	.66-1.88	.28-.64
												Total
Variance %	11.41	9.25	8.56	8.46	8.23	7.66	6.18	5.95				65.38
Cronbach's Alpha	.90	.90	.89	.84	.87	.79	.83	.83				.94

Note: To make it easier to follow, factor loadings lower than .30 are not given in the table. F1: Utility, F2: Comfort, F3: Perception, F4: Absorption, F5: Accommodation, F6: Concern, F7: Significance, and F8: Interest

4. DISCUSSION

The factor structure of the TAC was investigated with exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The purpose of exploratory factor analysis is to explore factor structure regarding to the relationship between the variances. Confirmatory factor analysis, investigating the model-data compatibility, tests the hypothesis in regard to the variables (Tabachnick & Fidell, 2001).

The first factor, F1, labeled as "Utility", includes 7 items (i.e., i26, i25, i24, i31, i28, i27 and i30). For example, one item in this factor is "Computer can help me learn". Factor loading within the F1 factor is between .66-.80 and item-total correlation is between .48-.56. Cronbach's Alpha value is .90 for this factor.

The second factor, F2, labeled as "Comfort", includes 5 items (i.e., i6, i7, i8, i9, i10). One example item in this factor is "Working with a computer makes me feel tense and uncomfortable". Factor loading within the F2 factor is between .62-.79 and item-total correlation is between .47-.59. Cronbach's Alpha value is .90 for this factor.

The third factor, F3, labeled as "Perception", includes 5 items (i.e., i32, i33, i34, i35, i36). In this factor the items included adjective-pairs that could explain one's feelings for computer use (e.g., unplesant-plesant). Factor loading within the F3 factor is between .63-.87 and item-total correlation is between .42-.56. Cronbach's Alpha value is .89 for this factor.

The fourth factor, F4, labeled as "Absorption", includes 5 items (i.e., i37, i38, i39, i40, i42). One example item in this factor is "I like to talk to others about computers". Factor loading within the F4 factor is between .71-.72 and item-total correlation is between .40-.55. Cronbach's Alpha value is .84 for this factor.

The fifth factor, F5, labeled as "Accommodation", includes 5 items (i.e., i11, i12, i13, i14, i15). As an example, one item in this factor is "Studying about computers is a waste of time". Factor loading within the F5 factor is between .57-.73 and item-total correlation is between .50-.62. Cronbach's Alpha value is .87 for this factor.

The sixth factor, F6, labeled as "Concern", includes 6 items (i.e., i17, i18, i19, i20, i21, and i23). "Computers dehumanize society by treating everyone as a number" is one of the items in this factor. Factor loading within the F6 factor is between .56-.73 and item-total correlation is between .28-.39. Cronbach's Alpha value is .79 for this factor.

The seventh factor, F7, labeled as "Significance", includes 4 items (i.e., i43, i44, i45, i46). One example item in this factor is "Students should understand the role computers play in society". Factor loading within the F7 factor is between .52-.73 and item-total correlation is between .45-.53. Cronbach's Alpha value is .83 for this factor.

The eighth factor, F8, labeled as "Interest", includes 5 items (i.e., i1, i2, i3, i4, i5). As an example, one item in this factor is "I want to learn a lot about computers". Factor loading within the F8 factor is between .54-.65 and item-total correlation is between .45-.64. Cronbach's Alpha value is .83 for this factor. As a result of the analysis, 5 items were eliminated from 47 items in the translated Turkish scale. The items related to the email factor were removed from the questionnaire with 51 items for the reasons stated above. For this reason, we started to the analysis with 47 items. 29th and 47th items were removed from the analysis after the first phase of the exploratory factor analysis since they did not fit under the *Utility* and the *Significance Factors*, respectively. Similarly, 16th and 22nd items were removed from the *Concern Factor*. The 41st itemwas also removed from the analysis because its factor loading was under .30. Accordingly, the draft scale ended up with having 42 items.

65.38 % of the variances were explained by eight sub-factors. The Cronbach's Alpha for the TAC scale in total was .94. The stability and consistency between the two halves were calculated with Guttman and Split Half test. As a result, the values were .83 for the first sub-factor, .84 for the second sub-factor, .83 for the third sub-factor, .82 for the fourth sub-factor, .79 for the fifth sub-factor, .77 for the sixth sub-factor, .85 for the seventh sub-factor and .80 for the eighth factor. For the whole scale it was .75.

As it can be seen in the Table 1, factor loadings for the entire survey was between .52-.87. For the items, which fit in a certain sub-factor, the factor loadings are generally greater than and equal to .30 in fitting in related sub-factors.

The arithmetic means and the standard deviations for the 42 items ranged from 2.73 to 5.37, and .66 to 1.88, respectively. The participants' total scores were sorted in ascending order to form the top 27% and the bottom 27%. These two groups were labeled as upper and lower groups. These groups were then compared to each other to make sure that the items of the survey differentiate these two from each other. As a result, all the items were found to be significantly differentiating these groups (p<.001).

The confirmatory factor analysis was used to test the correctness of the survey with eighth sub-factors. The most common statistical tests to evaluate model fit are χ^2, χ^2/df, RMSEA, NNFI, CFI and GFI (Sümer, 2000; Hoe, 2008; Çokluk, Şekercioğlu & Büyüköztürk 2012). A chi-square test of model-data fit was performed to determine whether the model with eight factors was appropriate. The results were found to be statistically significant for the model-data fit (χ^2=1338.53, sd= 791, p<.01). As a result of the confirmatory factor analysis, the goodness of fit index for the model with seven factors was: *RMSEA*=0.050, χ^2/df=1.69, *RMR*=0.075, *SRMR*=0.057, *GFI*= 0.81, *AGFI*= 0.78, *NFI*= 0.94, *NNFI*=0.97, *CFI*=0.97, *IFI*= 0.97. Thus, these results were compatible with the suggested criteria. The standardized coefficients indicating the relationship between the items and the factors ranged from .28 to .64 and all the items were found to be statistically significant (p<.01).

In general, the model showed a perfect fit to the data (*RMSEA*=0.050, χ^2/df=1.69) as supported by the goodness of fit index (Tabachnick & Fidell, 2001; Dorman & Knightley, 2006).

4.1. Test-Retest Reliability

Test-retest reliability is a measure showing the stability of a test overtime (Çokluk et al., 2012). Thus in this study, the consistency of Turkish version of the survey is measured with this method. To determine the test-retest reliability coefficient, 60 students from the Faculty of Education were administered with the survey twice over a two-week period. Pearson's Correlation coefficient results showed that there is a strong positive relationship between the test results (r=.85, p<0.5). It can be concluded that the adapted test is stable and reliable.

5. RESULTS

Knowing teacher candidates' attitudes towards computers may contribute to their educational process. The original instrument, Teachers' Attitudes toward Computers (TAC), has nine factors. By taking cultural differences into account, the email factor was eliminated in this study. As a result, the instrument with eight factors was adapted into Turkish culture. As a result of the exploratory factor analysis, Kaiser-Meyer-Olkin (KMO) coefficient and Barlett Sphericty test results were found to be statistically significant.

The confirmatory factor analysis, performed for investigating the compatibility of the model with the collected data and a Chi-Square value, calculated for investigating model-data compatibility were found to be statistically significant. The results of the confirmatory factor analysis for the model with eight sub-factors were appropriate with the suggested criteria. Standardized coefficients, indicating the relationships between the items and relevant factors, ranged from .28 to .64 and were significant at .01. In general, by taking a closer look at the model-fit indexes it can be concluded that the model perfectly fits with *RMSEA* = 0.050, χ^2/df=1.69 values (Tabachnick & Fidell, 2001; Jacobucci, Grimm & McArdle, 2016).

As a result of the confirmatory factor analysis, it can be told that the adapted instrument was confirmed to be a valid measurement tool for teacher candidates' computer attitudes. These values indicate that model-data compatibility was sufficient as supported by the literature (e.g., Ingles, Hidalgo & Mendez, 2005; Hoe, 2008). All the sub-factors were consistent with the original sub-factors in the source instrument. Additionally, it can be concluded that the adapted instrument can be used as a valid and reliable measurement tool for determining teachers' computer attitudes. Additionally, by using this instrument more comprehensive intercultural studies can be completed in experimental and action studies.

Also, measuring teachers' attitudes towards computers can contribute to the quality of in-service training about computer and technology for teachers. Specifically when we evaluate teachers' attitudes based on the sub-factors of the adapted instrument, we would know teachers' *interest in, confidence to, adaptation to,* and *perception of* using computers. Accordingly, based on such results the quality of education might be improved. Thus, teachers would be more sensitive in using technology in their educational process and in their daily lives. By offering appropriate education based on computer skill needs in our age, we would have active participants in international platforms. In addition, by using the adapted instrument in different meta-analytic studies would give us feedback in necessary evaluations. Many dimensions, which are absent from the studies in the literature, can be measured with this adapted instrument. As a result, this instrument can be suggested for the use in Turkish academic studies, as a reliable, valid and stronger instrument.

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