JOLTIDA Journal of Learning and Teaching in Digital Age, 2022, 7(2), 210-221
https://dergipark.org.tr/en/pub/joltida
ISSN: 2458-8350 (online)

Research Paper

The Development and Validation of Technological Leadership Behavior Instrument for School Principal

Mehmet Durnali*[a]

[a](ORCID ID: 0000-0002-1318-9362), Zonguldak Bülent Ecevit University, Turkey, durnali@beun.edu.tr
*Corresponding author

ARTICLE INFO

Received: 12 December 2021
Revised: 21 February 2022
Accepted: 22 February 2022

Keywords:
Technological leadership
School principal
Leadership
Behavior
Teacher
Technology

doi:xx/joltida.xx

OPEN ACCESS CC BY NC ND

ABSTRACT

The Technological Leadership Behavior Instrument for School Principal (TLBISP) was developed and validated to examine technological leadership behaviors of secondary school principals in the use of technology by teachers according to secondary school teachers' views. The content and construct validity were ensured, and the internal consistency and reliability coefficients were calculated. While the sample of Explanatory Factor Analysis (EFA) consisted of 308 teachers, Confirmatory Factor Analysis (CFA) consisted of 240 teachers from the secondary schools in Mamak district of Ankara city in the spring semester of the 2017-2018 academic year. While EFA showed four-factors with 24-items structure, the CFA showed 18-items with four-factors which called as motivation, orientation, precaution, and support. CFA showed that model fit indices (such as goodness-of-fit) values were acceptable. Cronbach Alfa coefficient value was .72, and Pearson coefficients of factors were between .22 and .60. In conclusion, TLBISP is a valid and reliable measurement instrument.

INTRODUCTION

Mainly, technological leadership can mean to create adequate and necessary policies, practices, measures, and strategies so that it can enable technology to be used at a high level of efficiency in management processes of educational organizations, staff, and students. It is to use information and communication in the administration of human and material resources and the subordinate and upper systems outside the school (parents, non-governmental organizations, associations, and so on) mainly for realizing the objectives of education and training at the highest level. That is to say, technological leadership is the leadership in the subject of ensuring the benefits of technology at the highest level of effectiveness in creating and sustaining an effective education and training system (Durnalı, 2018; 2019). Technological leadership covers a wide area from the lighting system of traditional classrooms or technology classes to the necessary security measures during the use of technology (Micheal, 1998). Effective school principals should use technology actively, should be modelled and maintained with personal technology skills equal to the intermediate level teacher users. They should consult with people who are knowledgeable about technology, should use school-level decision-making bodies such as the technology committee. They should motivate teachers whose motivation to use technology is low (Inkster, 1998). Equal access to technology in the school, using the Internet, the creation of a democratic climate in the school, finding solutions to all kinds of school discrimination, and income inequality are associated with the technology leadership of school principals (Flanagan & Jacobsen 2003). Technology leaders have five key roles in the realization of the goals of information communication technologies (ICT) integration: 1) student participation, 2) shared vision, 3) access equality, 4) effective professional development, and 5) networks (Flanagan & Jacobsen, 2003). Based on Collis (1988)'s work, Kearsley & Lynch (1992) claimed those skills indispensable for the leadership of educational technology are:

Building a culture or a commitment to a set of beliefs and values,
Providing emotional and political support for technology innovation,
Providing equal access and opportunity to technology resources,
Creating policies on the ethical use of computers,
Ensuring that technology benefits are appropriate,
Identifying priorities for the use of technology in school,
Providing time for technology education,
Awarding superior technology applications,
Finding the necessary financial resources for technology,
Leading the way to a visionary reality by knowing who to work with and then a combination of personal communication ,influence, and management skills

Furthermore, the fact that school principals form clear expectations may help to increase the success level of technology use at school (Valdez, 2004). Another important behavior expected from technological leaders is that they should inform teachers about the use of technology in school unnecessarily. Furthermore, technological leaders are expected to be aware of this situation. According to Chin and Horton (1993), among the problems about not using the technology adequately by the staff, there are funds, under-service facilities, shortcomings in time and facilities, as well as negative attitude, concern, and dissatisfaction with technology (cited in Stegall, 1998). The role of school administrators is critical for teachers to accept, adapt, integrate, and implement technology successfully (Murphy & Gunter, 1997). It is the duty of the school principal to design and implement new strategies in order to help teachers to be aware of the technology, and to help them understand and integrate with the classroom environment (Creighton, 2003). A school administrator as a technology leader should be an effective education and training leader to provide technologies for the school to communicate with school-environment to the extent required (Banoğlu, 2011). Moreover, school administrators should provide software update and hardware upgrades and their acquisitions (Schoeny Heaton & Washington, 1999). With a similar approach, technological leadership is a combination of strategies and techniques which can be seen in all other leadership approaches. In particular, it requires focusing on some aspects of the technology such as providing hardware, adapting to rapidly changing technology, ensuring professional development, and being aware of the continued use of technology (Valdez, 2004). According to Grady (2011), as a technological leader, the roles of the school director include 'providing resources to support the use of technology at school'.

According to Akbaba Altun (2004), 'to ensure that the software used in schools is licensed and not illegally copied’ is among the expected roles of school principals based on the data from the circular of MEB (2001) on the Use of Information Technologies and various other documents and interviews. According to Schoeny, Heaton, & Washington (1999), school administrators should be able to comprehend the ethical and legal issues related to the use of technology. Based on Collis (1988)'s work, Kearsley & Lynch (1992) argued that 'to create policies on the ethical use of computers' is among the skills which are indispensable for the leadership of educational technology. According to Dönmez and Sincar (2008), the task of school administrators is to take measures to prevent possible information technology (IT)-based offenses.

It has been examined that technological leadership has been studied in Turkey from different and various perspectives. The first thesis (Tanzer, 2004) among these studies was conducted in 2004. With the implementation of the Ministry of National Education ICT projects such as E-School and the widespread use of the Internet in the last decade, it can be claimed that the number of these studies has widely increased (Çalık, Çoban, & Özdemir, 2019; Çoban, 2021; Durnalı, 2019; Turan, 2020; Turan & Gökbulut, 2022). Specifically, Sincar (2009)'s study on the technology leadership roles of primary school administrators (the example of Gaziantep province) is said to be a turning point for technological leadership studies in Turkey because eight studies focusing on technological leadership have used the instrument developed by Sincar (2009). This situation can be considered as an indicator that one of the specific certain dimensions of technological leadership has been investigated in depth by the studies conducted on. However, beyond the perspective of Sincar (2009), a study in accordance with the purpose of this study has been needed in the literature.

The studies have been carried out in the literature on the different/various perspectives (dimension) of the subject of technological leadership, and the issue has been studied at various universities in the United States as in Turkey. The first study was conducted in 1996 as a Ph.D (Aten, 1996). thesis in this field. In most of the studies reached, the technological leadership issue was analyzed on the basis of the National Educational Technology Standards for Administrators (NETS-A) which was developed in 2002 and updated in 2009 by International Society for Technology in Education (ISTE) organization. Apart from these dimensions, there is also a need for the development of the current technological leadership conceptual framework appropriate to the organization. Especially, it is considered as one of the missing dimensions in the literature in which the framework (instrument) of technological leadership behaviors of secondary school principals in the use of technology by teachers according to secondary school teachers’ views need to be developed based on the related knowledge in the literature.

According to Durnalı (2019), in our age, technology and knowledge have an important place in every field of society both at the individual level and at the organizational level. The societies that are leading in technology and knowledge production can lead other societies in terms of development and economic growth. On this basis, the competence, roles, and responsibilities should be given to the educational organization in order to provide the qualified human force necessary for all kinds of desired growth and development efforts, particularly economic, social, and cultural dynamics of a society. At this point, teachers have a major role in raising this manpower. The main factors leading, motivating, and orienting teachers, who are the main employees of educational organizations, are the school administrators. In this context, in order to make the school organization more efficient and effective, this study focused on the need to gain and develop the technological leadership behaviors in the teachers’ use of technology in an effective, efficient and ideal way by the school administrators who play high-level roles in schools. By means of the instrument developed through this study, the new and synthesized information introduced to the literature will contribute to the efforts to develop and execute the technological leadership behaviors of school principals in the use of technology by teachers.

METHOD

Content validity (item creating, draft item creating, expert opinions), construct validity (exploratory factor analysis (EFA), confirmatory factor analysis (CFA)), and instrument's reliability test were the basic steps taken in the process of development and validation of TLBISP. SPSS and LISREL were used.

Study Group

A purposeful sampling strategy was used. While the sample of Explanatory Factor Analysis (EFA) consisted of 308 teachers, Confirmatory Factor Analysis (CFA) consisted of 240 teachers from the secondary schools in Mamak district of Ankara city in the spring semester of the 2017-2018 academic year.

RESULT / FINDINGS AND DISCUSSION

The Content Validity of the Instrument

Validity is a concept related to the degree to which an instrument is able to analyze the subject properly (Karasar, 2009; Tezbaşaran, 1997). In the process of creating an item pool for technological leadership behaviors of the school principals in the use of technology by teachers at school, first of all, the literature was examined comprehensively, and a conceptual framework was established on the basis of the literature in accordance with the purpose of this study. The citing parts regarding the technological leadership of school principals were re-expressed without loss of the meaning. At the end of this process, a pool of approximately 300 items (expression) was created. The sample of an item's statement and its basis are given in Table 1. It is a further condition that these statements are about the technological leadership behaviors of the school principal in which the teacher can face. Finally, 88 items (expressions) were selected.

Table 1. The Sample Item of TLBISP and its Roots in the Literature

The literature	The instrument's sample item
School managers' clear expectations can help to increase the success of using technology at school (Valdez, 2004).	My school principal creates clear expectations about using technology at school.

These statements were then re-examined several times. In this review process, expressions emphasizing similar themes were combined. Moreover, some expressions –such as teaching national technology standards to teachers- were excluded from the item pool as they were not in accordance with the Turkish education system. At the end of this process, 54 items remained to be submitted to expert opinions in the draft instrument item pool. Fifty-four items in this pool corresponded to three times the TLBISP of 18 items that were reached at the end of the instrument development process. Three times situation overlapped with the proposal of Slavec and Drnovsek (2012) which is to create a draft instrument with minimum three to four times the amount of the items included in the last instrument. Furthermore, the draft instrument item pool prepared in the present study met Nunnally (1978)'s proposal which is there must be at least 30 items for a high level of reliability of a measurement instrument. The final version of the item pool also corresponded with the proposal of Aguinis, Henle, and Ostroff (2001). They argued that there should be at least 60 items initially. For the statements in the item pool, expert opinions were consulted on the following three bases:

Content validity of items,
Expression of items,
Suitability of items to the target population

In order to analyze the validity of the instrument developed in this study, the Content Validity Ratio (CVR) of the technique called Lawshe technique (Lawshe, 1975; Yurdugül, 2005) was used. This technique suggests that a minimum of five and maximum of 40 experts' opinions should be taken. In this study, a 54-item form was sent to 18 professors who are working at various positions in nine different universities in the field of educational sciences via electronic mail. Within a week, feedback was received from 13 professors. However, only nine of these feedbacks were evaluated. Then, according to the Lawshe (1975:567) formula, the opinions obtained from the experts were collected, and the CVR was calculated separately for each of the 54 items.

According to the minimum CVR values, proposed by Lawshe (1975), for each item to work, the CVR values based on the calculation result of the data obtained from nine experts should be at least 0.75. In this study, when two or more experts put forward negative opinions to an item, this item was excluded from the item pool. On the other hand, the item was not excluded from the item pool only when it was an item for which an expert reported a negative opinion. The total number of items in which the CVR value was greater than 0.75 was 30 (I3, I4, I5, I6, I7, I8, I13, I14, I17, I18, I19, I20, I21, I22, I23, I28, I30, I31, I34, I35, I37, I39, I43, I44, I45, I50, I51, I52, I53, and I54). The CVR values of these items ranged from 0.78 to 1.00. All nine experts considered 22 items as 'Essential'. However, only one expert considered seven items as 'Not necessary', and only one expert considered one item as 'Essential but not necessary'. As a final point, the CGI values regarding all items with a CVR value of greater than 0.75 were calculated as 0.94 very close to 1. Finally, three experts on the Turkish language has evaluated the instrument items whether the items were written properly, grammatically correct, and expressed well. The five familiar teachers then checked the intelligibility of the items. In line with the suggestions, necessary corrections were made, and the final draft of the instrument items was achieved before the EFA.

The Construct Validity Test of the Instrument

Factor analysis is carried out in order to reveal the potential structures or factors in the data collected by the instrument items that are formed after the final form based on expert opinion. It is aimed to create smaller cases of variable structures by factor analysis. On this basis, it is possible to interpret the subject easily by saving time (Yong & Pearce, 2013). Construct validity is the ability to measure the whole subject at the focus - which is very important for psychological analysis (Westen & Rosenthal, 2003) - of the measuring instrument (Tezbaşaran, 1997). In this study, EFA and CFA were performed to test the construct validity of TLBISP.

Exploratory Factor Analysis (EFA)

In the instrument development process, EFA study was conducted to analyze the construct validity of the draft instrument after the content validity ratio and index, and concept and expression control studies. The instrument was applied to the EFA study groups. The instrument included five (5) Likert type items which have five choices: 'strongly disagree', 'disagree', 'neither agree nor disagree', 'agree', 'strongly agree'. The answers to the items in the collected data were scored from 1 to 5 (strongly disagree = 1, ...strongly agree = 5), and statistical analysis was performed.

The 30-item instrument was applied to 308 volunteer teachers. At this point, in the literature, there are some opinions about the minimum number that should be able to constitute the study group for factor analysis. This research supports the appropriateness of the size of the EFA study group. The study group should include a number of participants not less than 100 participants and at least five times bigger than the number of items to be applied (Bryman & Cramer, 1999; Hatcher,1994; Tavşancıl, 2002), According to Comrey and Lee (1992), the number of the study group between 300 and 500 is called 'good'. Furthermore, according to Cattell (1978), this number should be at least 250.

While performing the EFA with the data obtained from 308 teachers, it was observed that seven factors in which eigenvalue larger than 1.00 were formed on the basis of 30 items before the rotation technique. The factors constructed accounted for 73.431% of the variance. The procedure to test the validity of the size of the study group resulted in that Kaiser-Meyer-Olkin (KMO) value was found to be .842. That value is very good according to Coakes (2005). He puts forward that the KMO value should be a minimum of .60. Furthermore, it was concluded that Bartlett's Sphericity test and Chi-Square value were significant ($p < .05$), and the data obtained was factorized. It was appropriate for factor analysis [$X^2 = 5250.53$, $df = 276$, $p < .001$] (Büyüköztürk, 2016; Tabachnick & Fidell, 2013).

However, the Scree Plot showed a sharp turning point after the fourth dimension. Four factors with 5% or more of the total eigenvalue of the dimension to be considered were accepted. On this basis, the number of factors is limited to four according to the result of the EFA analysis. Prior to rotation, items with an equal or a low load factor (0.40 or 0.45) values - the factor load value which is a measure of how much the factor contributes to the factor (Yong and Pearce, 2013) - were discarded. This discarding operation was executed on the bases of the views of Stevens (2002), Worthington and Whittaker (2006), Büyüköztürk (2016) and Çokluk, Şekercioğlu and Büyüköztürk (2012). In the factor development process, while Stevens (2002) always emphasizes that factor load value must be bigger than 0.40, Worthington and Whittaker (2006) emphasizes that it should be above 0.32, and Büyüköztürk (2016) emphasized that factor load values sub-cut points can range from .30 to .45. Furthermore, Çokluk, Şekercioğlu, and Büyüköztürk (2012) suggested that the lower limit of factor load value should be .40 for an item to be excluded from the scale. On this basis, items 8, 18, 22, 23, 24, and 25 below .40 were excluded from the scale, and analysis continued with the remaining twenty-four items. Subsequently, Varimax vertical axis rotation using the principal component analysis was applied for the four factors structures entered manually.

As a result of the analysis, the total eigenvalue of the four factors obtained was 15.389, and the variance explained was 64.117%. Scherer, Luther, Wiebe, and Adams (1988; Tavşancıl, 2002) stated that the total variance ratio between 40% and 60% is a sign of the strength of the instrument factor structure in the studies conducted in disciplines of the social sciences. In Table 2, the eigenvalue of the first factor is 8.546 and the variance explained is 35.607, the eigenvalue of the second factor is 3.321 and the variance explained is 13.836%, the eigenvalue of the third factor is 2.091 and the variance explained is 8.711, and the eigenvalue of the fourth factor is 1.431 and the variance explained is 5.963%. Four-factor structures of the TLBISP are named in accordance with both themes inferred from common meanings of grouped items and the information in the literature. In our study, the first factor was named as 'motivation', the second as 'orientation', the third as 'precaution', and the fourth as 'support'.

Table 2. EFA item-total correlations and factor load values after rotation

Item No.	New Item No.	Item Total Correlation	Motivation	Orientation	Precaution	Support
2	1	.50	.85			
1	2	.50	.82			
3	3	.50	.81			
6	4	.47	.80			
5	5	.50	.80			
4	6	.50	.70			
20	7	.64		.80		
19	8	.44		.75		
21	9	.50		.73		
17	10	.53		.68		
15	11	.52		.66		

16	12	.67		.65		
7	13	.51		.62		
9	14	.59		.50		
28	15	.50			.83	
27	16	.50			.81	
29	17	.58			.76	
26	18	.62			.68	
30	19	.55			.62	
12	20	.62				.82
11	21	.61				.76
13	22	.58				.75
14	23	.42				.63
10	24	.68				.59
Self-value			8.546	3.321	2.091	1.431
Variance			35.607	13.836	8.711	5.963

As given in Table 2, item-total correlations of the instrument range from .42 to .68. There are various opinions in the literature on this coefficient value. If the item-total correlation coefficient signs minus, items' coefficient value of zero or close to zero should be excluded (Karasar, 2009; Tezbaşaran, 1997). Field (2009) and Kline (2011) suggested that this coefficient should be above .30 while Büyüköztürk (2016) emphasized that the coefficient value is 'high level' if between .70 and 1.00, 'moderate level' if between .70, and .30, and 'low level' if between .30 and .00. The total correlation value of the item considered in the present study is .40. Therefore, it can be argued that the total correlation values of the items obtained in this study are moderate. The factor load values of the instrument were between .70 and .85 in the first factor, between .50 and .80 in the second factor, between .62 and .83 in the third factor, and between .59 and .82 in the fourth factor. Based on Büyüköztürk (2016)'s proposal, it can be stated that factor load values in this instrument have a moderate and high-level relationship.

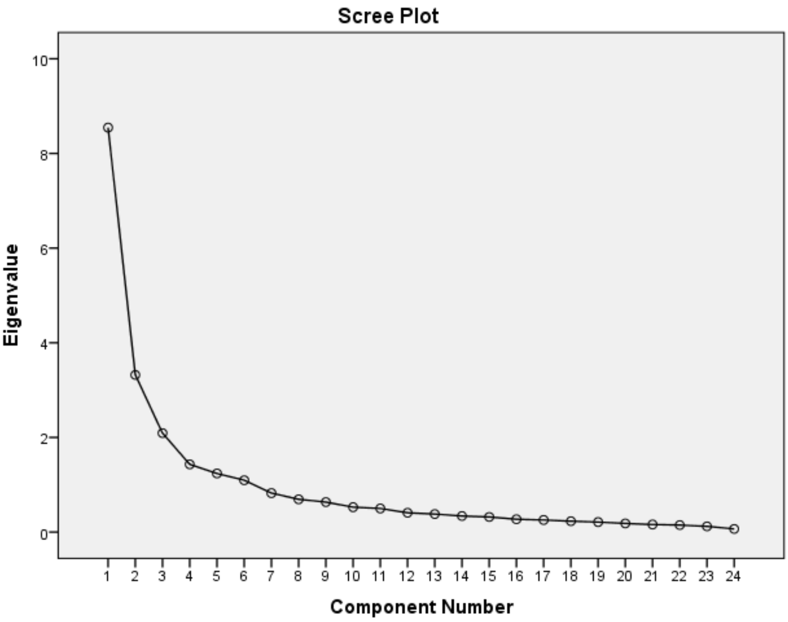

Figure 1. EFA Scree plot

When the eigenvalue graph in Figure 1 is examined, it is seen that the values of the items after the third item are close to each other, and based on this finding, the instrument is considered as four factors.

Table 3. t-test results for item means of %27 of the Lower and Upper group of the TLBISP

Item No	Group	N	X	Sd	t	p	IRT
I1	Upper % 27	83	2,30	,979	10,887	,00	,496
	Lower % 27	83	3,93	,959			
I2	Upper % 27	83	2,34	1,085	11,124	,00	,499
	Lower % 27	83	4,06	0,902			
I3	Upper % 27	83	2,45	1,140	11,661	,00	,505
	Lower % 27	83	4,23	0,801			
I4	Upper % 27	83	2,46	1,016	11,234	,00	,502
	Lower % 27	83	4,05	0,795			
I5	Upper % 27	83	2,27	1,200	11,776	,00	,502

	Lower % 27	83	4,12	0,787			
I6	Upper % 27	83	2,49	1,162	10,57	,00	,472
	Lower % 27	83	4,11	0,765			
I7	Upper % 27	83	2,81	1,204	10,688	,00	,507
	Lower % 27	83	4,41	0,645			
I9	Upper % 27	83	2,24	1,066	15,761	,00	,594
	Lower % 27	83	4,37	0,619			
I10	Upper % 27	83	1,95	0,882	21,800	,00	,679
	Lower % 27	83	4,49	0,592			
I11	Upper % 27	83	2,45	0,887	15,679	,00	,611
	Lower % 27	83	4,34	0,649			
I12	Upper % 27	83	2,70	0,852	13,490	,00	,619
	Lower % 27	83	4,37	0,744			
I13	Upper % 27	83	2,84	0,904	10,525	,00	,583
	Lower % 27	83	4,19	0,740			
I14	Upper % 27	83	3,53	1,203	6,744	,00	,412
	Lower % 27	83	4,54	0,650			
I15	Upper % 27	83	2,63	1,207	10,342	,00	,521
	Lower % 27	83	4,18	0,647			
I16	Upper % 27	83	2,63	1,044	12,169	,00	,666
	Lower % 27	83	4,30	0,694			
I17	Upper % 27	83	2,86	1,170	9,679	,00	,535
	Lower % 27	83	4,29	0,672			
I19	Upper % 27	83	3,14	0,843	9,163	,00	,444
	Lower % 27	83	4,24	0,691			
I20	Upper % 27	83	3,07	0,866	12,562	,00	,636
	Lower % 27	83	4,47	0,526			
I21	Upper % 27	83	2,99	1,121	8,794	,00	,502
	Lower % 27	83	4,24	0,655			
I26	Upper % 27	83	2,64	1,019	12,601	,00	,617
	Lower % 27	83	4,39	0,746			
I27	Upper % 27	83	2,73	1,138	7,451	,00	,498
	Lower % 27	83	4,00	1,048			
I28	Upper % 27	83	2,63	1,176	8,183	,00	,503
	Lower % 27	83	3,99	0,956			
I29	Upper % 27	83	2,57	1,061	11,392	,00	,577
	Lower % 27	83	4,30	0,894			
I30	Upper % 27	83	2,78	1,269	8,727	,00	,546
	Lower % 27	83	4,27	0,885			

*%27 Upper-Lower, t-test, N= 308, %27 n1=n2=83, sd= 164, *p=,01, IRT: İtem Response Theory*

Table 3 shows the significance of the difference between the Upper-Lower 27% groups and the item-total correlation values. The difference between the Upper-Lower 27% groups was statistically significant in all items. This finding is an indication that items are good at differentiating individuals. The item-total correlations of the items in the Lower group range from 0.412 to 0.679 indicate that the items have high internal consistency and can measure similar behaviors (Field, 2009).

Confirmatory Factor Analysis (CFA)

In some studies, CFA is performed based on the knowledge obtained as a result of EFA (Huck, 2012). CFA reserves the existence of knowledge regarding the structure/model in which the analysis will be carried out and the existence of the statistical control of this model (Kline, 2013). In this context, the four factors and 24-item structure of the TLBISP as a result of EFA were tested with CFA with a total of 240 teachers.

As a result of CFA, when the correlation values between the items were checked, some items were found to be not significant at .05 level. Therefore, taking the proposal of Büyüköztürk (2016) into consideration, which is the items under .20 can be excluded, items 14, 15, 16, 17, 20, and 21 were excluded from the instrument. Finally, the instrument was tested with 18 items under four factors. The t-test values of the four-factor models formed as a result of CFA are presented in Table 4.

Table 4. CFA t-test value

Item No	t value	Item No	t value	Item No	t value
I1	8.26*	I7	4.32*	I19	4.29*
I2	8.24*	I9	3.76*	I26	6.76*
I3	10.31*	I10	10.30*	I27	3.75*
I4	7.87*	I11	9.34*	I28	4.82*
I5	7.80*	I12	7.62*	I29	6.70*
I6	5.58*	I13	6.29*	I30	4.95*

**p<.01*

When Table 4 is examined, it is seen that t values have meaningful values as a result of CFA. According to Kline (2011), if t-values are greater than 1.96 it is significant at .05 and if greater than 2.58 it is significant at .01. In this context, it is understood that all of the t-values are meaningful at .01 level.

The path diagram of this model is seen as in Figure 2. In Figure 2, the factor load values for CFA ranges from .30 to .70, and the error variance values range from .51 to .91 and all these values were significant. The path coefficients between the items and factors were found between .40 and .68 for motivation, .33 and .39 for orientation, .30 and .53 for precaution, and 45 and .70 for support. These values are considered to be sufficient since the variance and relationship values are moderate (Büyüköztürk, 2016). As shown in Figure 2, in order to decrease the Chi-Square value, the error variance values of items 27 and 28 were equalized. Item 27 is *'My school principal ensures that the software (s) I use in the school is (are) licensed',* and Item 28 is *'My school principal takes measures to prevent illegal copying of the software (s) I use in school'*. Both items are parallel to each other in terms of meaning and they have been combined under the factor of the precaution. Therefore, it can be concluded that equalization of error variances in CFA is a proper process.

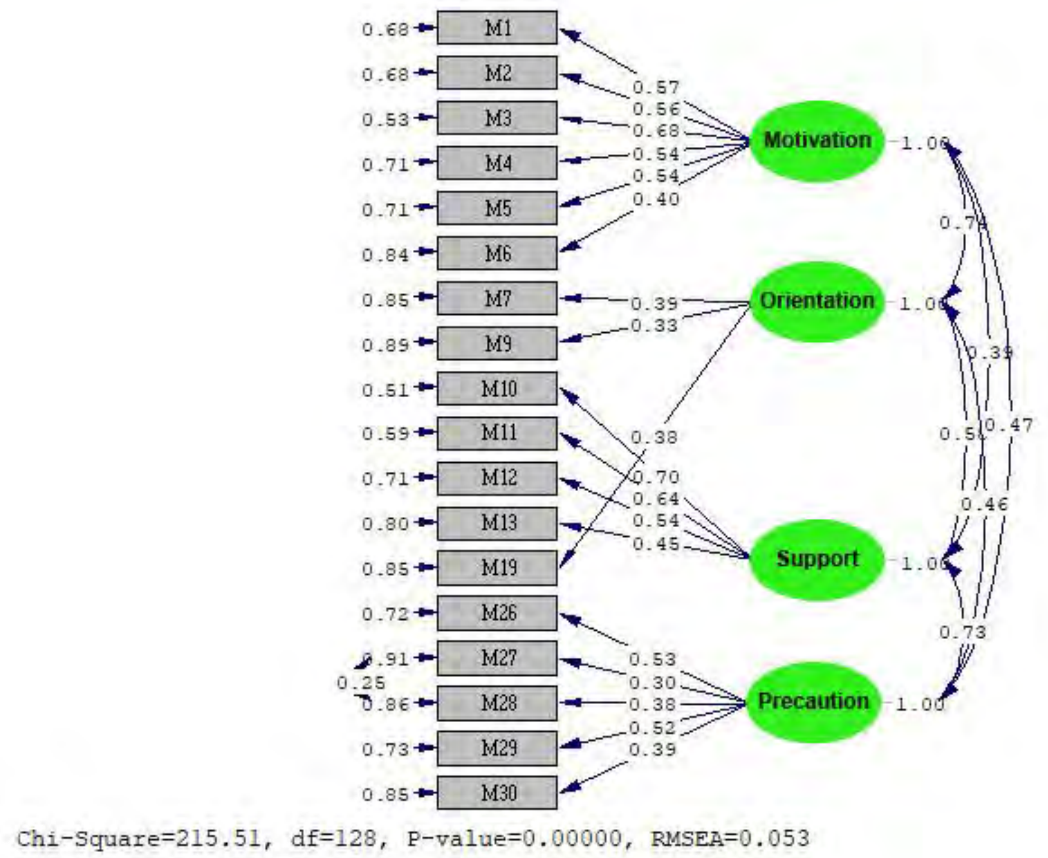

Figure 2. Path diagram of the TLBISP model

 © 2022,

Table 5. The findings for model fit indices

Parameters	Normal Value	Acceptable Value	Obtained Value	Result
p	*P*>.05	-	0.0	Perfect
x2 /df [1,5]	<2	<5	1.68	Perfect
RMSEA[3,5]	<.05	<.08	.053	Acceptable
SRMR[4,5]	<.05	<.08	.060	Acceptable
CFI[3,5]	>.95	>.90	.92	Acceptable
NFI[3,5]	>.95	>.90	.83	Acceptable
NNFI[1,5]	>.95	>.90	.90	Acceptable
GFI[2,5]	>.95	>.90	.91	Acceptable

[1] *(Hoe, 2008),* [2] *(Schermelleh-Engel, Moosbrugger, and Müller, 2003),* [3] *(Hooper, Coughlan, and Mullen, 2008),* [4] *(Hu and Bentler, 1999),* [5]*(Wang and Wang, 2012).*

When Table 5 is examined, the Chi-square value is found to be $\chi 2$ (128, N=240) = 215.51, $p <.001$. As a result of the calculation, $\chi 2/sd = 1.68$ value was found to be in the perfect fit level. RMSEA = .053, SRMR = .060, CFI = .92, NFI = .83, NNFI = .90, and GFI = .91 were found to be at acceptable levels of goodness-of-fit values (Hu & Bentler, 1999). The RMSEA and SRMR values of the model are less than 0.08, indicating a strong fit between the model and the data (Hu & Bentler, 1999). The findings obtained from CFA have shown that the factor structure of the instrument has at least minimum acceptable goodness-of-fit values in the literature.

Reliability of the Instrument

According to Huck (2012), the reliability of a measuring instrument is consistency. Although it is taken from different perspectives, reliability is related to how well / to what extent the instrument measures data consistently. In other words, reliability is related to the consistent measurement of the desired behavior as a result of each different approach when approaching from different angles. According to Tezbaşaran (1997), the capacity of an instrument if sensitive and consistent and measuring the same result with different measurement initiatives is called reliability.

In the literature, it was found that the coefficient 'α', developed by Cronbach (1951) and also referred to as Cronbach Alpha, was used in the reliability analysis of a Likert-type instrument. In this study, Cronbach Alpha and Correlation Coefficient were calculated as well, and the obtained values are given in Table 7 in order to determine the internal consistency coefficient of TLBISP.

Table 6. Correlation Coefficient, Mean, Standard Deviation (SD) and Cronbach Alpha Values of the Factors

		Factors			
		Motivation	*Orientation*	*Precaution*	*Support*
Factors	*Motivation*	1.00	-		
	Orientation	.33**	1.00		
	Precaution	.42**	.44**	1.00	
	Support	.22**	.60**	.37**	1.00
	Mean	19.27	14.13	10.35	17.73
	Sd	6.00	3.69	2.65	4.66
	Cronbach Alpha	.90	.88	.87	.70

***p<.01*

As a result of the analysis, the Cronbach Alpha reliability coefficient for the four factors of the instrument was found to be .72. As shown in Table 6, the Cronbach Alpha reliability coefficient for the factors was .90 in the first factor, .88 in the second factor, .87 in the third factor, and .70 in the fourth factor. Kalaycı (2010) emphasized that the reliability of the instrument is very reliable between .60 and .80, and highly reliable between .80 and 1.00 depending on the Cronbach Alpha reliability coefficient. Moreover, Kline (2009) argued that the reliability coefficient should be higher than .70, and Nunnally (1978) argued that when used in basic social sciences research, values of .70 or higher were acceptable for reliability. Therefore, according to Cronbach Alpha values determined for the instrument and factors, the reliability of the items forming the instrument was found to be high, and the items were found to be suitable for measuring the same behavior in the instrument structure. Furthermore, as can be seen from Table 6, the correlation values range from -1 to +1 (Alpar, 1998). The Pearson correlation coefficients of the instrument vary between .22 and .60. Based on this finding, it can be said that there is a positive and significant linear relationship in the relations presented in Table 6 (Russo, 2004). This is another indicator of internal consistency of the instrument.

CONCLUSION

This study provided information about the development and validation of School Principals' Technological Leadership Behavior Instrument . It aims to provide a measurement instrument for examining the level of technological leadership behaviors of the secondary school principals in the use of technology by teachers according to secondary school teachers' views.
In the instrument development process, the content validity of the instrument (item creating, draft item pool, expert opinion), construct validity of the instrument (exploratory factor analysis (EFA), confirmatory factor analysis (CFA)) and reliability test of the instrument (Cronbach Alpha and Pearson Correlation calculations) which are the methods included in the instrument development literature were performed.

The EFA's result of the four-dimensional 24-items structure was finalized by falling into 18 items under four factors: motivation, orientation, precaution, and support as a result of CFA. The CFA findings showed that the factor structure of the instrument had at least minimum acceptable compliance values emphasized in the literature. The Cronbach Alpha reliability coefficient for the overall instrument was .72. According to Kalaycı (2010), this finding indicated that the instrument was very reliable. The Cronbach Alpha reliability coefficients for the factors were determined as .90 in the factor of motivation, .88 in the factor of orientation, .87 in the factor of precaution, and .70 in the support factor. The Pearson correlation coefficients between the factors of the instrument were between .22 and .60. As a result, TLBISP was found to be a valid and reliable measurement instrument.

In TLBISP, there are expressions such as *'My school principal ensures that the software (s) I use in the school is(are) licensed'* and *'My school principal orients me to the security measures I need to take during my technology use at school'.* Those expressions are related to technological leadership behaviors of the secondary school principals in the use of technology by teachers according to secondary school teachers' views. The instrument has five Likert-type items which have five choices: 'strongly disagree', 'disagree', 'neither agree nor disagree', 'agree', and 'strongly agree'. The answers to the items in the collected data can be scored from 1 to 5 (strongly disagree = 1, ...strongly agree = 5). If the score obtained from the instrument is high, the related behaviors of the school principals are exhibited at a high level according to the school teacher views; in case of low, it can be stated that the related behaviors are exhibited at a low level by the school principals.

Thanks to this study, an instrument to collect data on technological leadership behaviors of the secondary school principals in the use of technology by teachers according to secondary school teachers' views was developed. All of the scale's items were based on the knowledge obtained from the literature except for one item. It is highly valid and reliable. School principals may have the opportunity to identify and implement appropriate technological leadership behaviors that they should exhibit in the use of technology by teachers at school based on data-based knowledge within the framework of this study and the instrument.

Ethics and Consent: Ethics committee approval for this study was received from the Ethics Committee of Hacettepe University (Date: March 29, 2018; Approval Number: 35853172/433-1406).

Acknowledgements: The author would like to thank Dr. İbrahim Limon, Prof. Dr. Mehmet Akif Ocak, the reviewers and the participants heartily for thier efforts and time

REFERENCES

Ağaoğlu, E., Ceyhan, E., Ceyhan, A. & Şimşek, Y. (2008). The Validity and Reliability Studies of The Computer Anxiety Scale on Educational Administrators [Elektronik versiyon]. *Turkish Online Journal of Distance Education- TOJDE July, 9*(3), Article 4.
Aguinis, H., Henle, C. A., & Ostroff, C. (2001). Measurement in work and organizational psychology. In N. Anderson, D.S. Ones, H.K. Sinangil, & C. Viswesvaran (Eds.), *Handbook of Industrial, Work and Organizational Psychology* (Vol. 1, pp. 27-50). London: SAGE
Akbaba Altun, S. (2004). Information technology classrooms and elementary aschool principals' roles: Turkish experience. *Education and Information Technologies, 9*(3), 255-270.
Alpar, R. (1998). *İstatistik ve spor bilimleri.* Ankara: Bağırgan.
Aten, B. M. (1996). *An analysis of the nature of educational technology leadership in California's SB 1274 restructuring schools* (Doctoral Dissertation). The University of San Francisco, San Francisco, CA, United States.
Banoğlu, K. (2011). Okul müdürlerinin teknoloji liderliği yeterlikleri ve teknoloji koordinatörlüğü. *Kuram ve Uygulamada Eğitim Bilimleri, 11*(1), 199-213.
Bryman, A., & Cramer, D. (1999). *Quantitative Data Analysis with SPSS Release 8 for Windows.* London & New York: Taylor & Francis.
Büyüköztürk, Ş. (2016). *Veri analizi el kitabı.* Ankara: Pegem Akademi.
Çalık, T., Çoban, Ö., & Özdemir, N. (2019). Okul yöneticilerinin teknolojik liderlik öz yeterlikleri ve kişilik özellikleri arasindaki ilişkinin incelenmesi. *Ankara University Journal of Faculty of Educational Sciences (JFES), 52*(1), 83-106.
Cattell, R. B. (1978). *The Scientific Use of Factor Analysis.* New York: Plenum
Coakes, S.J. (2005). *SPSS: Analysis without Anguish Using SPSS Version 12.0 for Windows (v. 12).* Australia: John Wiley & Sons.
Çoban, Ö. (2021). Okul yöneticisinin liderlik özellikleri. N. Özdemir, S. Turan ve Ö. Çoban (Ed.). *21. yüzyıl okullarını yeniden düşünmek* (ss. 45-68). Ankara: Pegem Akademi.

Çokluk, Ö., Şekercioğlu, G., & Büyüköztürk, Ş. (2012). *Sosyal bilimler için çok değişkenli istatistik: SPSS & LISREL uygulamaları.* Ankara: PEGEM Akademi.
Comrey, A. L., & Lee, H. B. (1992). *A first Course in Factor Analysis.* Hillsdale, NJ: Erlbaum.
Creighton, T. (2003). *The principal as technology leader.* Thousand Oaks, California: Corwin Press.
Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297-334.
Dede, C. (1993). Leadership without followers. In G. Kearsley & W. Lynch (Eds.). *Educational technology: Leadership perspectives*, 19-28. New Jersey: Educational Technology Publications Inc.
Dönmez, B., & Sincar, M. (2008). Avrupa Birliği sürecinde yükselen ağ toplumu ve eğitim yöneticileri. *Elektronik Sosyal Bilimler Dergisi, 24*(24), 1-19.
Durnalı, M. (2018). *Öğretmenlere göre okul müdürlerinin teknolojik liderlik davranışları ve bilgi yönetimini gerçekleştirme düzeyleri* (Doktora Tezi). Hacettepe Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara.
Durnalı, M. (2019). Ortaokul öğretmenlerinin görüşlerine göre okul müdürlerinin sergilediği teknolojik liderlik davranış düzeyi. *Journal of Theoretical Educational Science, 12*(2), 401-430.
Field, A. (2009). *Discovering statistics using SPSS (Third Edition)*. London: SAGE Press.
Flanagan, L., & Jacobsen, M. (2003). Technology leadership for the twenty-first century principal. *Journal of Educational Administration, 41*(2), 124-142.
Grady, M. L. (2011). *Leading the technology-powered school.* Thousand Oaks, California: Corwin Press.
Hailey, S. C. (2017). *The Impact of leadership on technology ıntegration practices in K-12 schools* (Doctoral dissertation). Delaware State University, Dover, Delaware, United States.
Hatcher, L. (1994). *A Step-by-Step Approach to Using the SAS® System for Factor Analysis and Structural Equation Modeling*. Cary, NC: SAS Institute, Inc.
Hoe, S. L. (2008). Issues and procedures in adopting structural equation modeling technique. *Journal of Applied Quantitative Methods*, *3*(1), 76-83.
Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *Electronic Journal of Business Research Methods, 6*(1), 53-60.
Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.
Huck, S. W. (2012). *Reading Statistics and Research.* Boston: Pearson.
Inkster, C.D. (1998). *Technology leadership in elementary school principals: A comparative case study* (Doctoral Dissertation). The University of Minnesota, Minneapolis, Minnesota, United States.
International Society for Technology in Education (ISTE) (2009). *ISTE Standarts Administrators.* 17 December 2017 retrieved from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-A_PDF.pdf
Kalaycı, Ş. (2010). Faktör analizi, (Ed. Şeref Kalaycı), *SPSS Uygulamalı Çok Değişkenli İstatistik Teknikleri*, Ankara: Asil Yayın Dağıtım.
Karasar, N. (2009). *Bilimsel Araştırma Yöntemleri*, Ankara: Nobel Yayınları.
Kearsley, G., & Lynch, W. (1992). Educational leadership in the age of technology: The new skills. *Journal of Research on Computing in Education, 25*(1), 50-60.
Kline, R. B. (2009). *Becoming a Behavioral Science Researcher: A Guide to Producing Research That Matter.* New York: The Guilford Press.
Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3nd Ed.). New York London: The Guilford.
Kline, R. B. (2013). Exploratory and Confirmatory Factor Analysis. Y. Petscher, & C. Schatsschneider (Eds.), *Applied quantitative analysis in the social sciences* (ss. 171-207). New York: Routledge.
Lawshe, C. H. (1975). A quantitative approach to content validity. *Personnel Psychology*, *28*(4), 563-575.
MEB (Milli Eğitim Bakanlığı) (2001). *Eğitim Teknolojileri Genel Müdürlüğü, 27/06/2001 tarih ve 53 No'lu Bilgi Teknolojilerinin Kullanımı konulu Genelge.* 15 December 2017 retrieved from http://www.cep.edu.rs/sites/default/files/greenpaper.pdf
Micheal, S.O. (1998). Best practices in information technology (IT) management: Insight from K-12 schools' technology audits. *International Journal of Educational Management, 12*(6), 277-288.
Murphy, D. T., & Gunter, G. A. (1997). Technology integration: The importance of administrative supports. *Educational Media International, 34*(3), 136-139.
Nunnally, J. C. (1978). *Psychometric theory, 2nd Ed.* New York: McGraw-Hill.
Ropp, M. (1999). Exploring individual characteristics associated with learning to use computers in pre-service teacher preparation. *Journal of Research on Computing in Education, 31*, 402–24.
Russo, R. (2004). *Statistics for the behavioural sciences: An introduction.* New York: Psychology Press.
Scherer, R. F., Luther, D. C., Wiebe, F. A., & Adams, J. S. (1988). Dimensionality of coping: Factor stability using the ways of coping questionnaire. *Psychological Reports, 62*(3), 763-770.
Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*(2), 23-74.
Schoeny, Z. G., Heaton, L. A., & Washington, L. A. (1999). *Perceptions and educational technology needs of school administrators.* 15 December 2017 retrieved from https://files.eric.ed.gov/fulltext/ED4322 44.pdf (ERIC ED 432 244)
Sincar, M. (2009). *İlköğretim okulu yöneticilerinin teknoloji liderliği rollerine ilişkin bir inceleme (Gaziantep ili örneği)* (Doktora Tezi). İnönü Üniversitesi, Sosyal Bilimler Enstitüsü, Malatya.
Slavec, A., & Drnovsek, M. (2012). A perspective on scale development in entrepreneurship research. *Economic and Business Review for Central and South-Eastern Europe, 14*(1), 39.
Stegall, P. (1998). The principal: Key to technology implementation, ERIC Document Reproduction Service No. ED424614

Stevens, J. P. (2002). *Applied multivariate statistics for the social sciences (4th ed.).* Hillsdale, NS: Erlbaum.
Tabachnick, B., & Fidell, L. (2013): *Using multivariate statistics* (6th international ed. cover edn). Thousand Oaks, NJ: Sage Publications.
Tanzer, S. (2004). *Mesleki ve teknik öğretim okulu yöneticilerinin teknolojik liderlik yeterlikleri* (Yüksek Lisans Tezi). Abant İzzet Baysal Üniversitesi, Sosyal Bilimler Enstitüsü, Bolu.
Tavşancıl, E. (2002). *Tutumların Ölçülmesi ve SPSS ile Veri Analizi.* Ankara: Nobel Akademi.
Tezbaşaran, A. (1997). *Likert tipi ölçek hazırlama kılavuzu.* Ankara: Türk Psikologlar Derneği.
Turan, S. (2020). COVID-19 sürecinde okul müdürlerinin teknolojik liderliği. *Milli Eğitim Dergisi, 49*(1), 175-199.
Turan, S., & Gökbulut, B. (2022). An analysis of the technology leadership behaviours of school principals from the perspective of teachers. *TOJET, 21*(1).
Valdez, G. (2004). Critical issue: Technology leadership: Enhancing positive educational change. *North Central Regional Educational Laboratory, 6*(7), 12.
Wang, J., & Wang, X. (2012). *Structural equation modeling: Applications using MPLUS: Methods and applications.* West Susex: John Wiley & Sons.
Westen, D., & Rosenthal, R. (2003). Quantifying construct validity: Two simple measures. *Journal of Personality and Social Psychology, 84*(3), 608-618.
Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist, 34*(6), 806-838.
Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology, 9*(2), 79-94.
Yurdugül, H. (2005). Ölçek Geliştirme Çalışmalarında Kapsam Geçerliği İçin Kapsam Geçerlik İndekslerinin Kullanılması. XIV. Eğitim Bilimleri Kongresi Bildiri Kitabı, 771-774, 28-30 Eylül, Pamukkale Üniversitesi, Denizli.

Appendix A: Technological Leadership Behavior Instrument for School Principal (Okul Müdürü Teknolojik Liderlik Davranış Ölçeği)

My School Principal (Okul müdürüm)	**Strongly Disagree**	**Disagree**	**Undecided**	**Agree**	**Strongly Agree**
1. Tries to address my concerns about my use of technology at school. (Okulda teknoloji kullanımıma ilişkin endişelerimi gidermeye çalışır.)					
2. Guides me about the safety precautions I should take during my use of technology at school. (Okulda teknoloji kullanımım sırasında almam gereken güvenlik önlemleri konusunda beni yönlendirir.)					
3. Creates clear expectations about my use of technology at school. (Okulda teknoloji kullanımıma ilişkin açık beklentiler oluşturur.)					
4. It motivates me to use technology at school. (Okulda teknoloji kullanmam noktasında beni motive eder.)					
5. Gives me access to technology on an equal basis with other employees in the school. (Okuldaki diğer çalışanlarla eşit olarak teknolojiye erişmemi sağlar.)					
6. Informs me about unnecessary use of technology at school. (Okulda gereksiz şekilde teknoloji kullanımı konusunda beni bilgilendirir.)					
7. Enables me to interiorize the importance of using technology at school. (Okulda teknoloji kullanımının önemini benimsememi sağlar.)					
8. Enables me to apply technology successfully to the teaching process at school. (Okulda teknolojiyi başarılı bir şekilde öğretim sürecine uygulamamı sağlar.)					
9. Ensures that the information technology tools I need at school are ready for use. (Okulda ihtiyacım olan bilgi teknolojileri araçlarının kullanıma hazır olmasını sağlar.)					
10. Provides the software(s) I need in the teaching process at school. (Okulda öğretim sürecinde ihtiyacım olan yazılım(ları) sağlar.)					
11. Provides the equipment I need in the teaching process at school. (Okulda öğretim sürecinde ihtiyacım olan donanımı sağlar.)					
12. Provides the hardware upgrades I need in the teaching process at school. (Okulda öğretim sürecinde ihtiyacım olan donanım yükseltmelerini sağlar.					
13. Supports me to use technological tools in communicating with the school environment. (Okul çevresi ile iletişime geçmemde teknolojik araçları kullanmamı destekler)					
14. States that he is aware of legal issues related to the use of technology. (Teknoloji kullanımı ile ilgili yasal konuların farkında olduğunu yaptığı açıklamalar ile belirtir.)					
15. Ensures that the software(s) I use at school are licensed. (Okulda kullandığım yazılım(lar)ın lisanslı olmasını sağlar.)					
16. Takes measures to prevent illegal copying of the software(s) I use at school. (Okulda kullandığım yazılım(lar)ın yasadışı olarak kopyalanmasını önleyici tedbirler alır.)					

17. Leads the use of computers in accordance with ethical values at school. (Okulda bilgisayarların etik değerlere uygun olarak kullanımıma öncülük eder.)					
18. Leads me to take measures to prevent possible IT-based crimes that may occur at school. (Okulda gerçekleşebilecek olası bilişim temelli suçları önlemeye yönelik tedbirleri almama öncülük eder.)					

***Note**: You can use the scale for your scientific research, provided that you cite it without getting permission from the author. However, if you are going to use it for projects that have a budget, or for some efforts to generate income, it is mandatory to contact the author for the license.*