EXTERNAL AND INTERNAL BARRIERS IN TECHNOLOGY INTEGRATION: A STRUCTURAL REGRESSION ANALYSIS

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ABSTRACT

Aim/Purpose	The aim of this study is to propose and test a model in which perceived barriers to technology integration are handled within a broad framework. It can be argued that the proposed model will have the dynamics to examine the studies performed on technology integration in a generic way and to have an important place in explaining the technology barriers at individual and school level under internal and external barriers. This can then be used to minimize such barriers and facilitate technology integration.
Background	As seen in previous studies, barriers constitute a complex structure that is encountered in almost every environment for different reasons, affects the teaching-learning process, and contains several variables under primary and secondary barriers. It is thought that exploring this complex structure plays a key role in technology integration. In many studies, it is observed that the barriers are addressed as internal and external aspects but work on such aspects is quite limited.
Methodology	Based on the convenience sampling method, the research was planned and conducted in accordance with the relational survey model. A structural regression model was used to examine the barriers that teachers perceive in technology integration. The sample of the study involved 449 teachers working in different branches at nine public schools in the academic year of 2018-2019 at the city center of Kirsehir province, and they participated on a voluntary basis. The number of teachers in the research sample corresponds to 73% of the total number of teachers in Kirsehir.

Contribution	The contribution to the literature is proposing and testing a model which can be used to measure technological barriers in technology integration in education considering internal and external factors with a large perspective and holistically.
Findings	The findings of the structural regression model used in this study showed that beliefs towards learning-teaching activities (BLTA), beliefs towards the expert support (BES), technological self-efficacy beliefs (TSEB), family resistance (FR), assessment (ASSES), and pedagogical self-efficacy beliefs (PSEB) are located under internal barriers and that lack of vision (LV), lack of money (LM), lack of training (LT), infrastructure (INF), content (CONT), and time (TIME) are all part of external factors. Furthermore, the results showed that external barriers affect the internal barriers directly and positively. Finally, it was observed that beliefs towards change (BC) and lack of leadership (LL) had no effect on internal or external barriers.
Recommendations for Practitioners	As the findings of this study were discussed under internal and external barriers to technology integration, the results of the study could shed a light for managers, teachers or candidate teachers within the framework of "technology integration." The identification of barriers in different settings should be used as the first step in minimizing the impact of such barriers in technology integration in education.
Recommendations for Researchers	The work done can form the basis of investigating the impacts of latest technology on education, and necessary dimensions on the technology integration within the context of internal and external factors in the classroom or in a virtual learning environment for further research. Findings should then be used to aid technology integration in education.
Impact on Society	The effective and successful technology integration may be reached by minimizing the barriers identified.
Future Research	Future research can investigate technological barriers with reference to external variables (e.g., motivation, acceptance, satisfaction) using the developed scale. The findings can then be used to eliminate the barriers and facilitate technology integration.
Keywords	external barriers, internal barriers, teacher, technology integration

INTRODUCTION

Educational technologies have existed for decades and are constantly changing. There are no doubts that effective use of such technologies benefits teaching and learning in educational establishments. However, technology integration into education is a complicated process and there are barriers in front of this process. Since it is widely accepted that such integration will improve education, the concept of "technology integration" has become a focus point in almost every educational institution. This concept goes beyond possessing new technologies, enriching learning-teaching environments, and transferring content with advanced technologies, dictating that the role of technology in the learning-teaching environment cannot be limited to "use" of technologies. "Use" of technologies in question in learning environments is quite simplistic and a far cry from discipline while it is thought that the concept of "integration" makes use of several variables within and brings about reinforcing them through pedagogical approaches.

As seen in previous studies, barriers constitute a complex structure that is encountered in almost every environment for different reasons, affect the teaching-learning process and contain several

variables under primary barriers, such as lack of equipment, unreliability of equipment, lack of technical support, and issues related to other resources, and the secondary barriers as school-level factors, such as institution's culture, and teacher-level barriers, such as beliefs and attitudes about teaching and technology and openness to change (Belland, 2009; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Franklin, Turner, Kariuki, & Duran, 2001; D. M. Jacobsen,1998; Kopcha, 2012; Schoepp, 2005). It is thought that exploring this complex structure plays a key role in technology integration. In many studies, it is observed that the barriers are addressed as internal and external aspects, but such aspects are quite limited (Ertmer, 1999, Çakıroğlu, 2013; Hendren, 2000; İnan, 2007; Kilinc, Tarman, & Aydin, 2018; Rogers, 2003; Sánchez-Prietoa, Hernández-Garcíab, García-Peñalvoa, Chaparro-Peláezb, & Olmos-Migueláñeza, 2019; Wachira, & Keengwe, 2011). The qualitative study conducted by Kopcha (2012), which took teachers' opinions on technology barriers, features the factors of vision, access, beliefs, professional development, and time, and emphasizes that the most important barriers faced by teachers in technology integration are vision, belief, and access. However, it can be said that internal and external factors discussed in several studies are quite limited.

AIMS AND OBJECTIVES

This study investigates the barriers that teachers perceive in technology integration in education. Within this, it is aimed to identify the perceived barriers and test the proposed model considering the scope of technology integration to help improve educational practices with structural regression analysis. A validated and reliable scale, which was developed by Basarmak and Hamutoglu (2020), was used to test such barriers within the framework of external and internal barriers (See the Appendix). It can be argued that the obtained model will have the dynamics to examine the studies performed on technology integration in a generic way and to have an important place in explaining the technology barriers at individual and school levels in relation to internal and external barriers.

To this end, direct and indirect effects of internal and external variables were tested on several variables. Hence, the research questions are as follows:

1. What are the direct and indirect effects of internal barriers on beliefs towards learning-teaching activities (BLTA), beliefs towards the expert support (BES), technological self-efficacy beliefs (TSEB), pedagogical self-efficacy beliefs (PSEB), family resistance (FR), and assessment (ASSES)?

2. What are the direct and indirect effects of external barriers on lack of vision (LV), lack of leadership (LL), lack of money (LM), lack of training (LT), infrastructure (INF), content (CONT), and time (TIME)?

3. What are the effects of external variables on internal variables?

RELATED WORK

Through the concept of technology integration in education, Information and Communication Technologies (ICTs) allow the educational-instructional process to be transformed to a more functional and effective one. The subject of "barriers" in front of integrating technologies into education is deemed to have a very important place, and it has been the subject matter of several studies to date (Belland, 2009; Çakıroğlu, 2013; Ertmer, 1999; Franklin, Turner, Kariuki & Duran, 2001; Johnson & Maddux, 2006; Lucas, 2018; Snoeyink & Ertmer, 2001). "Barriers to technology integration" can be compared to a "pomegranate", which is frequently addressed in the relevant literature (Brush, Glazewski, & Hew, 2008; Butler & Sellbom, 2002; Schoepp, 2005,), and currently involves several variables (Ertmer, 1999; Muilenburg & Berge, 2005). Even though a pomegranate looks like one piece as "barriers" do when looked from outside, it contains many interrelated dynamics.

INTERNAL AND EXTERNAL BARRIERS

Barriers are classified as primary and secondary barriers or as internal and external barriers in the literature. External and internal barriers are described in Ertmer (1999). Schoepp (2005) developed a scale named "Barriers" to address technological barriers. However, the barriers are a bit parsimony and not in depth, and stated from a general perspective. However, it can be observed that the barriers are addressed from many different perspectives in the literature. Schoepp (2005) states that the most frequently stated barriers are associated with "how the faculty can be effectively integrated with technology and the existing deficiencies." Belland (2009) argues that the barriers related to technology integration stem from the beliefs of teachers. Franklin et al. (2001) state that the common problems identified by teachers for technology integration are vision, access, time, evaluation, and professional development. Ertmer et al. (2012) stated that the most challenging barriers preventing teachers from using technology are their current knowledge and skills as well as their current attitudes and beliefs about technology. In addition to this, Ertmer (2005) stated that, in technology integration, pedagogical beliefs of teachers can change the roles of teaching and learning. D. Jacobsen (1998) examined technology integration under the headings of change, encouragement, assistance, and barriers. The study carried out by Snoeyink and Ertmer (2001), addressing barriers as primary and secondary barriers, describes the primary barriers as lack of equipment, unreliability of equipment, lack of technical support, and issues related to other resources, and the secondary barriers as school-level factors, such as the institution's culture, and teacher-level barriers, such as beliefs and attitudes about teaching and technology and openness to change. Wachira and Keengwe (2011) discuss the variables related to technology access, reliability of technology, technology support, and leadership under external barriers, and lack of time, anxiety, and lack of confidence and knowledge in technology usage under internal barriers. In research carried out on the use of technology by social sciences teachers in Turkey, commenting on the self-sufficiency of teachers, Gülbahar and Güven (2018) state that most of the teachers are not technologically literate and lack technical knowledge in the preparation of digital materials. In a successful technology integration, educational institutions should provide both teachers and students with adequate equipment, training, time, technical support and content (Lucas, 2018), which are handled with the lack of as external barriers in the study conducted by Sánchez-Prietoa et al. (2019). Although the barriers encountered in technology integration are discussed from different perspectives, it is thought to be important to focus on internal and external factors in technology integration at school and teacher level. Kilinc et al. (2018) focus on internal and external factors in their study. The scale development study named "Student Barriers to Online Learning" conducted by Muilenburg and Berge (2005) states that the barriers to online learning are caused by administrators and educators, lack of social interaction, academic skills such as language, reading, writing, technical tools and their use, motivation and willingness, time and support, Internet access and financial barriers, and technical problems. The transactional distance perception (Moore, 1993) of distance education theories handles barriers related to the elements of structure, interaction and autonomy. On the other hand, Çakıroğlu (2013) states that the barriers to technology integration are classified at school and teacher levels. It is emphasized in the literature by Ertmer (1999) that external barriers include access to technology, institutional and technical support, time and financial issues at the teacher level, while internal barriers include computer beliefs and attitudes of teachers, classroom practices and unwillingness to change, stating that external barriers precede internal barriers. In line with this consideration, Rogers (2003) states that internal barriers stem from teacher attitudes towards and perceptions of a new technology but are also fed by external barriers (accessibility and usability, institutional and technical support, stakeholder interactions). According to Chere-Masopha (2018), the personal beliefs of teachers are shaped by their personal experiences and past lives. Hendren (2000), in another study, addresses barriers related to teachers, administrators, and individuals as internal barriers and barriers caused by organizations as external barriers. İnan (2007) states that barriers at the teacher level are also about variables such as age, experience, belief and attitude, and preparedness. Among the studies investigating barriers at the school level, Mazman and Usluel (2011) highlight that cultural and social impact, institutional support, and technological infrastructure are

important in integration. In general, in technology integration, teachers have some common barriers across the world, such as lack of the use of technology, experience, technical support, financial support, time and administrative support (Bala & TAO, 2018). Barriers handled at the school and teacher level are thought to have a very important place in technology integration. Johnson and Maddux (2006) refer to their idea that technology integration models are addressed at the teacher level as "impossibility of instructing the course without that technology." That means it will not possible to instruct the course content without the integrated technology.

METHODOLOGY

This study aimed to examine the barriers that teachers perceive in technology integration with the structural regression model. Based on the convenience sampling method, the research was planned and conducted in accordance with the relational survey model. Relational survey models aim to measure the presence and degree of the change among two or more variables (Karasar, 2008, p. 81) rather than the causes of opinions and characteristics regardless of the effort to change and influence the situation in question (Fraenkel & Wallen, 2006). Hence, the model is appropriate for the aim of this study, studying the effects of several variables (perceived barriers) on internal and external variables. The data obtained from the model tested with structural regression are given below.

PARTICIPANTS

The participants of the study are teachers working in different branches at nine public schools in the academic year of 2018-2019 at the city center of Kirsehir province. Of the teachers, 41.0% are female (f=184) and 59% are male (m=265), and a total of 449 teachers participated in the research voluntarily, and the number of teachers in the research sample corresponds to 73% of the total number of teachers in Kirsehir.

INSTRUMENT: PERCEIVED BARRIERS TO TECHNOLOGY INTEGRATION (PBTI) SCALE

Introduction to the scale

The PBTI scale developed by Basarmak and Hamutoglu (2020) comprises of 51 items and has a construct of 14 factors: beliefs towards learning-teaching activities (BLTA), beliefs towards the expert support (BES), technological self-efficacy beliefs (TSEB), pedagogical self-efficacy beliefs (PSEB), beliefs towards change (BC), lack of vision (LV), lack of leadership (LL), lack of money (LM), family resistance (FR), lack of training (LT), infrastructure (INF), content (CONT), time (TIME), and assessment (ASSES). (These items are shown in the Appendix.) The 14-factor construct composed of 51 items with an eigenvalue greater than 1 explains 63.17% of total variance with a rotation of 25%. The KMO value testing the sample size was found to be 0.86 in EFA performed to test the factorial validity, and it was observed in Bartlett's Test for Sphericity ($\chi2 = 9632.856$; df=1275; p=0.000) that the data showed a significant difference. Fit indexes achieved in the Confirmatory Factor Analysis are $\chi2/sd$ (1806.387/1131) =1.597; CFI=0.92; IFI=0.92; GFI=0.88; AGFI=0.86; RMSEA=0.03; SRMR=0.04. Furthermore, analyses performed for the construct validity show that the scale has convergent validity, and the analysis of variances (AOVs) for each factor confirm convergence and all values are higher than .50 (Bagozzi & Youjae, 1988) having values as follows: 0.94 for BILTA, 0.94 for BIES, 0.90 for TSEB, 0.97 for PSEB, 0.83 for BIC, 0.93 for LV, 0.79 for LL, 0.87 for LM, 0.90 for FR, 0.92 for LT, 0.92 for INF, 0.90 for CONT, 0.89 for TIME, and 0.88 for ASSES, respectively. Additionally, the calculated values for discriminant validity showed that AOV square roots of the scale were both above the correlation between constructs and 0.70, and the fact that the scale has discriminant validity (Fornell & Larcker, 1981). Finally, the internal consistency coefficient of the scale calculated with Cronbach's Alpha and composite coefficient indicates a high reliability. The calculated values for both Cronbach's Alpha internal consistency and composite coefficients were as

follows: 0.78 and 0.98 for BILTA, 0.80 and 0.99 BIES, 0.75 and 0.97 for TSEB, 0.86 and 0.99 PSEB; 0.55 and 0.90 for BIC, 0.73 and 0.98 for LV, 0.62 and 0.86 for LL, 0.62 and 0.93 for LM, 0.75 and 0.97 for FR, 0.71 and 0.96 for LT, 0.80 and 0.98 for INF, 0.64 and 0.96 for CONT, 0.63 and 0.96 for TIME, and 0.66 and 0.95 for ASSES, respectively. Calculations are made with mean score in factors of the scale, and higher mean score means higher perceived barrier to technology integration. This 5-point Likert scale is graded as follows: 1= Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

DATA ANALYSIS

SPSS 20.0 software package was used to obtain descriptive statistics, and the procedures for the structural regression model were performed with AMOS 21 in the study.

FINDINGS

The construct of the developed scale was confirmed with Confirmatory Factor Analysis (CFA). The findings achieved in regard to the factor structure and the results obtained in the examination of relationships among the internal and external barriers, which was performed with the structural regression technique of structural equation models, are presented below.

CONFIRMATORY FACTOR ANALYSIS

CFA confirmed that the group used for scale development compares positively to the group of teachers used in this study.

Table 1. Fit Index Values Obtained in the Level-One CFA

Fit index values	Perfect fit	Acceptable fit	Fit Index Value Obtained in the Level-One CFA
x^2/sd	$0 \leq \chi^2/sd \leq 2$	$2 \leq \chi^2/sd \leq 3$	1.815
GFI	$0.95 \leq GFI$	$0.85 \leq GFI$	0.85
AGFI	$0.90 \leq AGFI \leq 1.00$	$0.85 \leq AGFI$	0.85
CFI	$0.95 \leq CFI \leq 1.00$	$0.90 \leq CFI \leq 0.95$	0.93
IFI	≥ 0.95	≥ 0.90	0.93
RMSEA	$0.00 \leq RMSEA \leq 0.05$	$0.06 \leq RMSEA \leq 0.08$	0.04
SRMR	$0.00 \leq SRMR \leq 0.05$	$0.06 \leq SRMR \leq 0.10$	0.05

Regarding the fit indexes given in Table 1, the model seems to have perfect and acceptable fit indexes (χ^2/sd =2045.436/1127) =1.815; CFI=0.93; IFI=0.93; GFI=0.85; AGFI=0.85; RMSEA=0.04; SRMR=0.05) (Bentler & Bonett, 1980; Bollen, 1990; Browne & Cudeck, 1993; Byrne, 2006; Byrne & Campbell, 1999; Hu & Bentler, 1999; Kline, 2011; Schermelleh-Engel & Moosbrugger, 2003; Steiger, 2007; Tanaka & Huba, 1985).

FINDINGS OF THE STRUCTURAL REGRESSION MODEL

Structural regression model

In the study, structural regression analysis was used to test the developed model, which is a form of structural equation modeling. According to Raykov and Marcoulides (2006) this technique handled the observed variables and helped to examine causation among two or more variables. Regarding the fit indexes in the structural regression model, it is understood that the model has perfect and acceptable fit indexes (χ^2/sd (2038.695/1015) =2.009; CFI=0.92; IFI=0.92; RMSEA=0.04; SRMR=0.08) (Bentler & Bonett, 1980; Browne & Cudeck, 1993; Byrne, 2001; Byrne, 2006; Hu & Bentler, 1999; Joreskog & Sorbom, 1993; Kline, 2011; Schermelleh-Engel & Moosbrugger, 2003; Steiger, 2007; Tanaka & Huba, 1985). Goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) values obtained in the study were found to be at the limit (GFI=0.84; AGFI=0.82). Nevertheless, it can be argued, considering that such values are affected by the sample size, that they were caused by the limitation of the study. While these values obtained being close to 1 refer to perfect fit, negative values indicate very poor fit of the model; accordingly, the results achieved in the study show that the model shows a good fit but it is close to the acceptable limit due to the sample size. Given the other values in the study, it is stated by researchers that different fit indexes can be reported. Although there is consensus among researchers on the reporting of $\chi2$ /sd (Mulaik et al., 1989), this is not the case in the reporting of other indexes. There are arguments on the reporting of different fit indexes such as CFI, GFI, NFI and NNFI (TLI) (İlhan & Çetin, 2014; McDonald & Ho, 2002); RMSEA, CFI and NNFI (TLI) (Garver & Mentzer, 1999); RMSEA, SRMR, CFI and NNFI (TLI) (Brown, 2006) and CFI and SRMR (Iacobucci, 2010). The model developed and tested with the structural regression technique is shown in Figure 1.
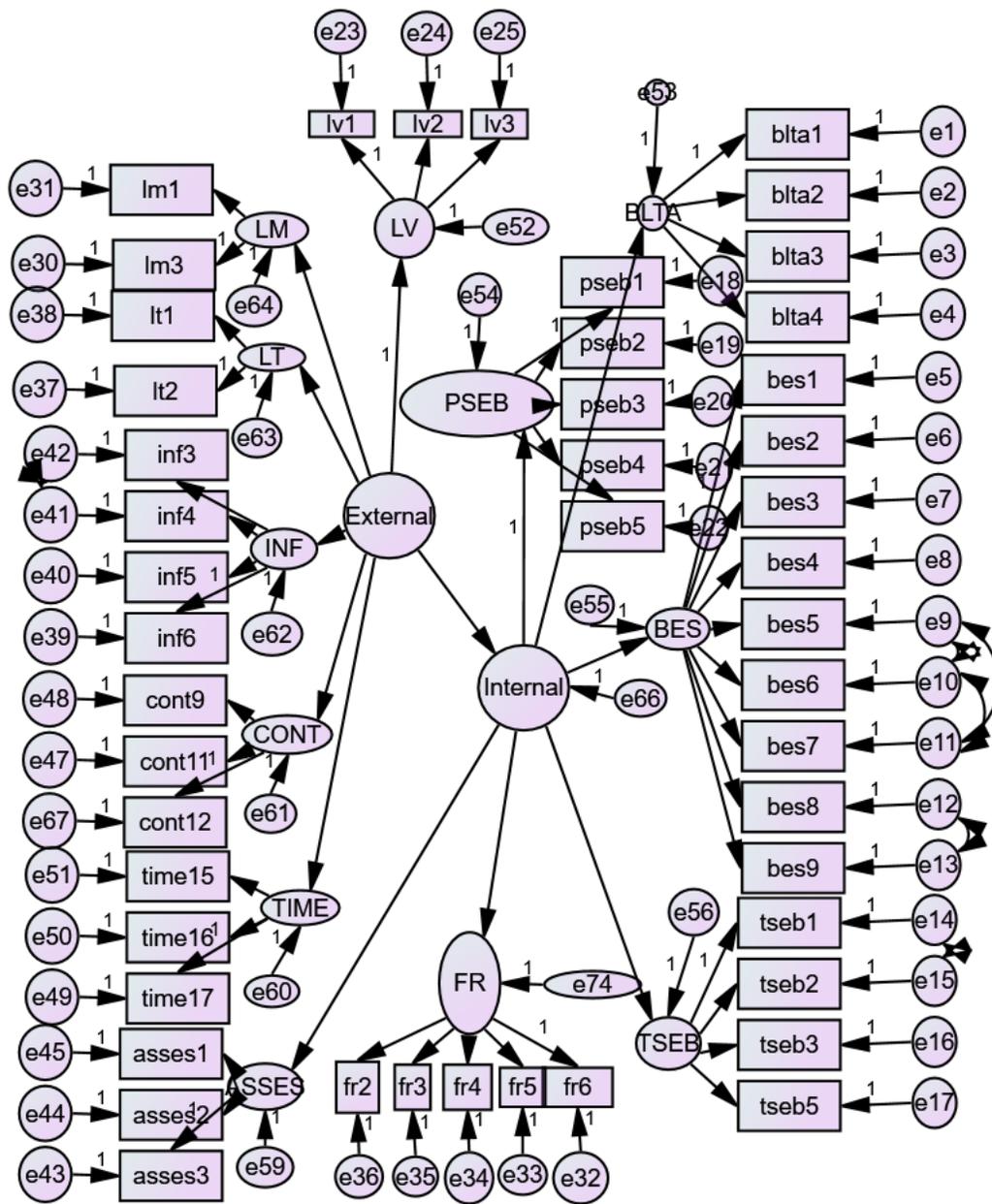
Figure 1. Testing of Internal and External Barriers and Family Resistance Barriers to Technology Integration with Structural Regression Model

Table 2. Direct, indirect and total effect on dependent and independent variables

Dependent Variable	Independent Variable	Total Effect	Direct Effect	Indirect Effect	SE	Critical ratio (t)
BLTA	Internal Barriers	0.680	0.680	-	0.145	8.776***
BES	Internal Barriers	0.576	0.576	-	0.130	8.547***
TSEB	Internal Barriers	0.360	0.360	-	0.126	5.783***
PSEB	Internal Barriers	0.795	0.795	-	0.011	5.702***
FR	Internal Barriers	0.292	0.292	-	0.127	4.739***
ASSES	Internal Barriers	0.201	0.201	-	0.114	3.400***
LM	External Barriers	0.751	0.751	-	0.117	9.234***
LT	External Barriers	0.588	0.588	-	0.113	7.409***
LV	External Barriers	0.742	0.742	-	0.030	6.610***
INF	External Barriers	0.243	0.243	-	0.110	4.150***
CONT	External Barriers	0.703	0.703	-	0.071	8.412***
TIME	External Barriers	0.450	0.450	-	0.107	7.089***

Dependent Variable	Independent Variable	Total Effect	Direct Effect	Indirect Effect	SE	Critical ratio (t)
ASSES	External Barriers	-	-	0.144	-	-
FR	External Barriers	-	-	0.209	-	-
PSEB	External Barriers		-	0.569	-	-
TSEB	External Barriers	-	-	0.258	-	-
BES	External Barriers	-	-	0.413	-	-
BLTA	External Barriers	-		0.487	-	-
Internal Barriers	External Barriers	0.716		-	0.057	8.172***

*p<0.05; **p<0.01; *** p< 0.001 (beliefs towards learning-teaching activities-BLTA, beliefs towards the expert support-BES, technological self-efficacy beliefs-TSEB, pedagogical self-efficacy beliefs-PSEB, lack of vision-LV, lack of money-LM, family resistance-FR, lack of training-LT, infrastructure-INF, content-CONT, time-TIME, assessment-ASSES)*

As seen in Figure 1 and Table 2, the independent variable "internal barriers to technology integration" was affected directly and positively by the dependent variables of BLTA (β=0.68, p<0.001), BES (β=0.58, p<0.001), TSEB (β=0.36, p<0.001), FR (β=0.29, p<0.001), ASSES (β=0.20, p<0.001), and PSEB (β=0.80, p<0.001).

The independent variable of "external barriers to technology integration" was affected directly and positively by the dependent variables of LM (β=0.75, p<0.001), LT (β=0.59, p<0.001), INF (β=0.24, p<0.01), CONT (β=0.70, p<0.001), TIME (β=0.45, p<0.001), and LV (β=0.74, p<0.001). However, the independent variable of "external barriers to technology integration" was affected indirectly and positively by the dependent variables of BLTA (β=0.49, p<0.05), BES (β=0.41, p<0.05), TSEB (β=0.26, p<0.05), FR (β=0.21, p<0.05), ASSES (β=0.14, p<0.05), and PSEB (β=0.57, p<0.05).

It was also observed that the independent variable "external barriers to technology integration" had a direct and positive effect on the "internal barriers to technology integration" variable (β=0.72, p<0.05). Finally, factors of BC and LL (p>0.05) were not significantly predicted by the dependent variables of internal and external barriers (p>0.05). In the model, the "internal barriers to technology

integration" variable is explained by the "external barriers to technology integration" variable at 51% (r2=0.51).

Lastly, the effect size was calculated to test whether the significant results achieved on the dependent variable of "internal barriers to technology integration" in the model and its significance in practice. Cohen (1988) suggested the calculation of the standardized effect size ($f2$) in the calculation of the effect size for regression analyses and linear models. $f2$ value is calculated by the division of multiple correlation coefficient (R2) by its subtraction from 1 (1–R2) (f2 = R2 /(1 – R2)). Accordingly, $0.02 \leq f2 < 0.15$ refers to small effect, $0.15 \leq f2 < 0.35$ to medium effect and $0.35 \leq f2$ to large effect (Cohen, 1988). It can be therefore argued that the effect on the calculated equation is large ($f2$=1.04).

DISCUSSION

This study examined the internal and external barriers to technology integration with a structural regression model. The results showed that "internal barriers to technology integration" were affected directly and positively by BLTA, BES, TSEB, FR, ASSES, and PSEB variables while "external barriers to technology integration" were affected directly and positively by LM, LL, INF, CONT, TIME, and LV variables. Furthermore, it was found in the study that external barriers had a strong direct and positive effect on internal barriers. It was consequently seen that factors of BC and LL were not significantly predicted by the dependent variables of internal and external barriers.

INTERNAL FACTORS IN BARRIERS TO TECHNOLOGY

Since internal barriers, as a latent variable, could not be measured directly, they were discussed through the variables observed in the study. Accordingly, it was seen that internal barriers were significantly predicted by the factors of BLTA, BES, TSEB, FR, ASSES, and PSEB. There are studies in the literature which show that internal barriers are related to individuals' beliefs and attitudes (Belland, 2009; Ertmer et al., 2012; Hew & Brush, 2007), self-efficacy (Sang, Valcke, Braak & Tondeur, 2010), and the institution's culture they interact with (Ertmer et al., 2012; Hew & Brush 2007; Snoeyink & Ertmer; 2001). Although studies have been carried out on barriers to date, they seem to have been more detailed over time. As seen in the study in which Snoeyink and Ertmer (2001) described barriers as primary and secondary, primary barriers refer to external barriers while secondary barriers refer to internal barriers. Ertmer et al. (2012) stated that passion for technology, problem-solving mentality, administrator support, and personal learning are related to the internal barriers of teachers. In addition, the study in question looking for answers to *compliance of pedagogical beliefs in regard to the use of technology in the classroom practices* also found that current knowledge and skills as well as attitudes and beliefs towards technology were addressed as pedagogical beliefs (Ertmer et al., 2012). Hew and Brush (2007) also emphasize that attitudes and beliefs as well as knowledge and skills are discussed as internal barriers. It can be accordingly argued that findings of the studies in the literature show parallelism with the findings on internal barriers in this study. Sang et al. (2010) deal with belief, attitude, and self-efficacy under the factor of internal barriers. There is a significant interaction between beliefs and attitudes (Taşkın, Cantürk, & Öngel, 2005). Similarly, there are studies showing that motivation and preparedness are associated with beliefs (Günel & Tanrıverdi, 2014; Karataş, 2011). Hence, it can be said that individuals' beliefs toward the "ability to overcome something" can be discussed as self-efficacy beliefs and under internal factors.

As a matter of fact, beliefs towards learning-teaching activities (BLTA) can be regarded as internal barriers to technology integration. It is observed that individuals' beliefs that technology can be integrated into the teaching process are described as being internal. That is to say, it is possible to argue that a teacher who believes in the use of technology in learning-teaching processes *increases learning, facilitates the design of learning activities and reinforces students' advanced thinking levels* has overcome the internal barrier to integrating technology into learning processes. Such teachers' belief towards their ability to overcome barriers they face during learning-teaching processes can indeed affect the teaching process positively in technology-aided learning environments. Barriers to technology integration have

been found to be affecting the teaching process adversely in several studies (Mama & Hennessy, 2013; Voogt & McKenney, 2017). It can be therefore said that beliefs towards learning-teaching activities can also be handled under internal barriers to technology integration. Chere-Masopha (2018) indicated that the personal beliefs of teachers impact on their professional conduct and teachers' beliefs are shaped by their personal experiences.

Another variable discussed under internal barriers is beliefs towards expert support (BES). Teachers who are aware that it is important to ask for expert support in technology integration for reliably facilitating *selecting, planning, and managing* the technology appropriate for content during the teaching processes can internally eliminate possible barriers to integration. It is possible to see in the literature that beliefs towards expert support are named differently under external barriers rather than internal barriers (Wachira & Keengwe, 2011).

Another internal barrier, which is thought to be important in technology integration, is observed to be individuals' technological self-efficacy beliefs (TSEB). It can be argued that barriers in individuals' technological self-efficacy beliefs can be internally overcome by *knowing how to use technology in courses and feeling competent to use technology,* which will mitigate anxiety, stress, and worry when using technology. Indeed, it is observed in the literature that technological self-efficacy beliefs are discussed as internal factors (Mei, Brown, & Teo, 2018; Sang et al., 2010). Research carried out by Gülbahar and Güven (2018) is in line with the results of the present study.

The findings in regard to family resistance (FR), discussed as an internal barrier to technology integration, show that families can prevent children from using a new technology through "lack of encouragement, resisting it and regarding it as unnecessary." It is anticipated that cases where families create barriers to the use of technology may present problems in proper and effective use of technology by individuals in future. Parents should be aware of the negative educational consequences when technology is misused, raise their children's awareness of the correct use of technology, and stop seeing technology as an unnecessary tool. In this way, it is thought that this internal barrier can be eliminated by the children seeing technology as a useful tool used in the field of education. Whereas parents are discussed as an external barrier to technology integration (Ertmer et al., 2012), this study structured them as family resistance under internal barriers. In their work, Magliaro and Ezeife (2007) investigated the self-sufficiency beliefs of pre-service teachers in the use of computers. The qualitative findings showed that the factors that most positively impact on their approach to computers are the society and the school while family has the most negative impact on this. Despite all the efforts in technology integration at schools, many families are reluctant to use technology in their daily lives (Ghavifekr, Kunjappan, Ramasamy, & Anthony, 2016).

Even though how assessment (ASSES), which is another variable, was discussed under internal barriers leaves a question in the minds, current mechanisms in schools coincide with this case given the opinions on technology integration. Thus, the fact that use of technology by teachers in schools is based on the *assessment* process rather than serving the learning-teaching process paves the way for discussing the assessment variable as an internal barrier. Since the focus is mostly on the success indicators through the use of expensive technologies in the assessment of multiple-choice exams in our country, it often overshadows the fact that technology is mainly to serve the learning-teaching processes. Although the assessment factor is considered an external barrier in the literature (Ertmer et al., 2012), it was structured under internal factors in this study. One should think that technology contributes to assessment in learning processes. Pre-service teachers are expected to use relevant technologies to maximize students' learning and improve their teaching (International Society for Technology in Education [ISTE], 2003).

It is possible to see in the study that pedagogical self-efficacy beliefs (PSEB), which is another variable, constitute internal barriers to technology integration. Pedagogical self-efficacy beliefs can be regarded as internal barriers to the choice of technology appropriate for course objectives, characteristics of the target group, convenience of the classroom environment, and assessment criteria. It is

possible to argue that having pedagogical self-efficacy beliefs in accordance with the nature of technology to be used in the course are important in eliminating or minimizing the internal barriers to technology integration. In fact, it can be observed in the literature that there are studies showing the importance of pedagogical self-efficacy beliefs in technology integration (Liu, Lin, & Zhang, 2017). In their work, Al-Awidi and Aldhafeeri (2017) attempted to establish the level of readiness of teachers in integrating digital technology into school curriculum in an effective and productive way. An on-line questionnaire taken by 532 teachers showed that the teachers are not ready technically and pedagogically. Another study conducted by M. Jacobsen, Clifford, and Friesen (2002) showed that class teachers committing themselves to teaching at high technological levels were disappointed because of the barriers confronting them and, hence, could not continue doing so.

EXTERNAL FACTORS IN BARRIERS TO TECHNOLOGY

External barriers were discussed through the variables observed in the study because they could not be measured directly as a latent variable. Accordingly, it is seen that internal barriers were significantly predicted by the factors of LM, LT, INF, CONT, TIME and LV. External barriers described by Ertmer (1999) as involving access to the technology, institutional and technical support, time, and financial issues are in parallel with the findings of this study. The findings achieved by Hew and Brush (2007) on resource, institution, culture and assessment, however, have similarities as well as differences under external barriers.

Not to fall behind the advancing technology in the educational-instructional process, educational institutions have to invest in technology. Considering the financial aspects of the investments made, it may not be possible to take place in all institutions. This comes across as a barrier to technology integration. Thus, it is quite normal today that a teacher needs technological support to provide attainments in the teaching content. However, inadequate budget allocated to technology by institutions is an external barrier to technology integration. Ertmer (1999), indeed, states that the lack of money is one of the perceived external barriers to technology integration. In a piece of research conducted to identify the barriers of technology integration in Rwanda, one of the four barriers identified is the lack of teachers' teaching motivation due to financial concerns (Munyengabe, Yiyi, Haiyan, & Hitimana, 2017).

In-service training on the effective use of technology can be said to be important in technology integration because how individuals are required to equip and improve themselves in using technology is thought to be important in the integration process. Nevertheless, the fact that individuals are not provided with the training to use technology effectively in their classroom environments is not caused by internal factors regarding individual's psychological and physiological condition but is considered an external barrier. As a matter of fact, it can be argued that lack of training (LT) is important in technology integration as an external barrier and is in line with the findings of this study (Lucas, 2018; Sánchez-Prietoa, et al., 2019).

Barriers due to not having a technologically advanced infrastructure (INF), such as lack of Internet access in institutions, lack of functioning laboratories, and inability of installing current programs on computers, seems to be external barriers to the integration. Mazman and Usluel (2011) emphasize the importance of infrastructure-related problems in technology integration. Technology integration in education is essential, however, in the educational system of Iran, the lack of necessary infrastructure is considered to be one of the barriers preventing this (Mostafa, Hashemi, Sosahabi, & Berahman, 2017).

It is observed that the content (CONT) problems stemming from the fact that educational-instructional contents are not up to date for the use of today's technologies are prominent external barriers to technology integration. Then, in classrooms supported by the latest technology, how teachers can make the best of that technology depends on teaching content's compatibility with the technology. In fact, it can be said that the problems caused by outdated content may have negative

implications in terms of other factors perceived as external barriers. Future studies can try to explore the relationship between lack of training and the problem due to incompatibility of the technology used for communicating the existing content and the content itself. It is recommended that experts should keep a close eye on the developing technologies to ensure the update of the existing content in accordance with these technologies.

Another barrier considered among external factors in the integration of educational technologies is lack of time (TIME). When it comes to the use and management of technology in the classroom environment, time appears to be an important variable because it is possible to say that the applications to be performed depending on the time before, during, and after the course are quite important in communicating the content technologically in the educational-instructional processes. Franklin et al. (2001) state that problems due to lack of time are among the barriers to technology integration. Gülbahar and Güven (2008) stated that the main barrier to the application of technology is the incompatibility between technology and the existing curriculum and classroom-time. More recent research showed that many teachers have the ability to use technology but fail to use technology sufficiently due to time constraint (Ghavifekr et al., 2016). This has also been confirmed in another piece of research (Al Mulhim, 2014; Kamaruddin, Abdullah, Idris, & Nawi, 2017).

It is observed how teachers reflect their own and their institution's lack of vision (LV) to the educational-instructional process is associated with perceived external barriers to technology integration. Individuals and institutions with vision think that they will overcome barriers when achieving their objectives and know how to use technology efficiently in almost every stage of the educational-instructional process especially in this era. Indeed, Kopcha (2012) and Franklin et al. (2001) emphasize that the vision factor is one of the most expressed barriers by teachers.

Imagine that a teacher feels incompetent in the effective use of technology in learning-teaching processes. Such situations may be caused by internal factors such as technological self-efficacy belief, pedagogical self-efficacy belief, and expert support. The study showed that factors perceived by individuals as external factors, impact on internal barriers. This leads to the conclusion that lack of technology training (an external factor) to help self-development of an individual may reflect on the individual's self-beliefs (internal factors). As a matter of fact, there are studies in the literature suggesting that external (e.g., time, support) and internal factors (e.g., beliefs) may hamper the use of technology for pedagogical purposes (Mama & Hennessy, 2013; Voogt & McKenney, 2017). While Mei et al. (2018) also state that technology self-efficacy is the first factor that comes to mind when integration is in question, according to Liu et al. (2017) this variable is associated with pedagogical beliefs. As it is stated by Bala and TAO (2018) in their work, the lack of the use of technology, experience, technical support, financial support, time, and administrative support are common barriers faced by teachers in technology integration. It is possible to argue that findings achieved in the literature coincide with the findings of this study, which discussed direct and indirect effects of external factors on internal factors. The findings showed that beliefs towards learning-teaching activities (BLTA), beliefs towards the expert support (BES), technological self-efficacy beliefs (TSEB), family resistance (FR), assessment (ASSES), and pedagogical self-efficacy beliefs (PSEB) are located under internal barriers and that lack of vision (LV), lack of money (LM), lack of training (LT), infrastructure (INF), content (CONT), and time (TIME) are all part of external factors. Furthermore, the results showed that external barriers affect the internal barriers directly and positively. Finally, it was observed that beliefs towards change (BC) and lack of leadership (LL) had no effect on internal or external barriers. Then, given such effects of external barriers on internal barriers, it can be suggested that minimizing external barriers to technology integration plays a key role in individuals' perceived internal barriers based on the present study's results.

CONCLUSION

It is seen that there are similar and different findings achieved in this study compared to the studies in the relevant literature. It is obvious that there have been different opinions on perceived barriers

to technology integration to date. Indeed, it is observed in the studies on the subject matter that these barriers have been modified over time (Ertmer, 1999; Ertmer et al., 2012; Snoeyink & Ertmer, 2001). As the findings of this study were discussed under internal and external barriers to technology integration, it is possible to exhibit that they have similarities with and differences from the literature (Ertmer, 1999; Ertmer et al., 2012; Lucas, 2018; Sánchez-Prietoa et al., 2019; Snoeyink & Ertmer, 2001; Wachira & Keengwe, 2011). It is thought that the differences are due to the institution's perspective of technology over time and the sample size because technology is developing day by day and institution's investment in technology to improve their infrastructure may have an impact on individuals' perceptions. Thus, it is possible to suggest that the reason why lack of time is described as an internal barrier in the literature but as an external barrier in the study and assessment as an external barrier in the literature but as an internal barrier in the study is the modifications due to the above mentioned.

Ertmer et al. (2012) state that teachers' attitudes and beliefs, technology support, government standards, access to technology, assessment in accordance with government standards, technical problems, institution's management, culture, students' knowledge and skills, and parents' attitudes and beliefs are perceived as external barriers to technology integration. In the study of Ertmer et al. (2012) assessment was perceived as an external barrier to technology integration in the study in question. This is in contrast with the findings of this study. This is thought to be caused by the fact that teachers could not participate in the evaluation independently; they were required to follow the assessment policy of the system. It can also be argued that teachers' inability to use technology in relation to the course content is because they are hindered by bureaucratic procedures such as indicators reflecting quantity rather than quality. Hence, this is considered as an internal barrier. In summary, it is possible to say that the findings achieved in this study and barriers in the culture of Turkey are quite similar to the Western barriers described in the literature; however, there are differences in both internal and external factors.

Identifying barriers to technology integration is just the first step in enabling technology integration for improved teaching and learning. Depending on economic, social, political, and cultural circumstances, the challenges in front of removing or even minimizing barriers may change. Pilot studies are a convincing approach. Initially, work may concentrate on selected educational establishments. The first barrier is the resistance of teachers as well as parents to such integration. The best way of fighting this is "training the trainers" for teachers and educating parents on technology uses, benefits, and ways of preventing usage that may damage students' development. With pilot studies, funding will be easier to allocate for investment into appropriate technologies. Then, technology integration can be promoted to successful pilot studies.

LIMITATIONS, IMPLICATIONS, AND RECOMMENDATIONS

Although the number of participants seems to be sufficient in the study, the generalization of the results is a limitation to the study. It can be said that the data of the study do not reflect the population completely since Kirsehir, where the data were collected, is in the middle of the country, the population is low in the central district, and the city is in the small provincial status. Nevertheless, it should be stated that the study is also strong in that it consisted of teachers with different levels of technology use. It is also thought that the study paves the way for an important area for future studies and researchers, considering the big impact of external barriers on internal barriers found in the study. In terms of describing perceived internal and external barriers to technology integration, this study can be repeated with different variables and qualitative findings in future. Accordingly, minimization of external barriers may have a significant impact on perceived internal barriers for teachers to support technology integration in classrooms.

It is also recommended that studies are performed within Eastern cultures to compare perceived internal and external barriers to technology integration. This is important for examining the relationship with technology acceptance because ease of use and perceived benefit in technology acceptance

differ in Eastern and Western cultures (Lee, Kozar, & Larsen, 2003). In this way, findings can be compared to the functioning of a technology-aided learning-teaching process in learning.

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APPENDIX: PERCEIVED BARRIERS TO TECHNOLOGY INTEGRATION (PBTI) SCALE

Beliefs towards Learning-Teaching Activities	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1. I believe that the use of technology in learning-teaching activities enhances learning.	( )	( )	( )	( )	( )
2. I believe that it is easy to design learning activities by using technology.	( )	( )	( )	( )	( )
3. I believe that technology facilitates my work just like a teacher.	( )	( )	( )	( )	( )
4. I believe that use of technology in learning-teaching activities supports students' advanced thinking skills (creative thinking, problem-solving skills, critical thinking, etc.).	( )	( )	( )	( )	( )
Beliefs towards Expert Support	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
5. I believe that it makes my job easier to ask for expert support when using technology.	( )	( )	( )	( )	( )
6. I believe that expert support is important in selecting technology appropriate for content.	( )	( )	( )	( )	( )
7. I believe that expert support is important in planning technology appropriate for content.	( )	( )	( )	( )	( )

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
8. I believe that expert support is important in using instructional technology.	( )	( )	( )	( )	( )
9. I believe that I will get rid of my concerns about the use of technology in my courses by taking expert support.	( )	( )	( )	( )	( )
10. I believe that expert support is important in demonstrating my competence in technology.	( )	( )	( )	( )	( )
11. Having expert support makes me feel safe about using technology.	( )	( )	( )	( )	( )
12. I do not think that resources are reliable without expert support.	( )	( )	( )	( )	( )
13. I believe that expert support is important in the emergence of new ideas about the use of technology.	( )	( )	( )	( )	( )
Technological Self-Efficacy Beliefs	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
14. I do not know how technology is used in courses.	( )	( )	( )	( )	( )
15. I feel lacking in using technology in courses.	( )	( )	( )	( )	( )
16. I worry about using technology in my courses.	( )	( )	( )	( )	( )
17. When I need to use technology in my courses, I feel afraid of doing it wrong.	( )	( )	( )	( )	( )
Pedagogical Self-Efficacy Beliefs	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
18. When using technology, I consider the characteristics of the target group.	( )	( )	( )	( )	( )
19. I care about the attainments of the subject while using technology in the course.	( )	( )	( )	( )	( )
20. The features of the classroom environment are important to me when using technology in the course.	( )	( )	( )	( )	( )
21. Teaching methods appropriate for the course objectives are effective in my choice of technology.	( )	( )	( )	( )	( )

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
22. The assessment-evaluation approach in accordance with the course objectives is effective in my choice of technology.	( )	( )	( )	( )	( )
Belief towards Change	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
23. I believe that the use of technology will not bring success right away.	( )	( )	( )	( )	( )
24. Although I use technology in the courses, I believe that change takes time.	( )	( )	( )	( )	( )
Lack of Vision	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
25. The institution I work for expects me to use technology effectively.	( )	( )	( )	( )	( )
26. The administrators in my institution support me to use technology.	( )	( )	( )	( )	( )
27. I find it logical to use technology in my courses in the institution I work for.	( )	( )	( )	( )	( )
Lack of Leadership	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
28. The managers/administrators of the institution do not insist on us using technology in the courses.	( )	( )	( )	( )	( )
29. Using technology in courses is optional.	( )	( )	( )	( )	( )
Lack of Money	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
30. If it is important to use a new technology in the course, institution managers/administrators procure that technology.	( )	( )	( )	( )	( )
31. Even if the budget is limited, the use of technology in the courses is in the forefront.	( )	( )	( )	( )	( )
Family Resistance	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
32. Families do not insist on using new technologies.	( )	( )	( )	( )	( )
33. Families resist children's desire to use a new technology.	( )	( )	( )	( )	( )
34. Families do not tolerate the use of a new technology by their children.	( )	( )	( )	( )	( )
35. Families see technology as something new and unnecessary.	( )	( )	( )	( )	( )
36. The idea that children can learn without the technology is dominant in families.	( )	( )	( )	( )	( )
Lack of Training	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
37. I think that the training I received in the use of technology is easily applicable in the classroom.	( )	( )	( )	( )	( )
38. I think that I have been sufficiently trained in the skills required to use technology.	( )	( )	( )	( )	( )
Infrastructure	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
39. Our schools do not have enough infrastructure such as hardware, software, Internet access, etc.	( )	( )	( )	( )	( )
40. Access to computer laboratories in schools is insufficient.	( )	( )	( )	( )	( )
41. Software on computers in laboratories is not up to date.	( )	( )	( )	( )	( )
42. Laboratories do not have a fast Internet infrastructure.	( )	( )	( )	( )	( )
Content	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
43. I have the appropriate curriculum content for the technology I use in the course.	( )	( )	( )	( )	( )
44. I think that the technology to be used in the course and the content to be taught complement each other.	( )	( )	( )	( )	( )
45. I think that the current technology is useful for teaching.	( )	( )	( )	( )	( )

Time	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
46. Technology integration takes less time than I thought.	( )	( )	( )	( )	( )
47. I have time to learn how to integrate technology into my courses.	( )	( )	( )	( )	( )
48. I have time to plan/prepare the courses in which I use technology.	( )	( )	( )	( )	( )

Assessment	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
49. The use of technology in schools serves the assessment process rather than the teaching process.	( )	( )	( )	( )	( )
50. The main purpose of using technology in schools is based on the assessment of the courses.	( )	( )	( )	( )	( )
51. Since teachers focus on multiple-choice exams, which are success indicators, to meet standards, there is no need to use technology in courses.	( )	( )	( )	( )	( )

BIOGRAPHIES

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