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# The Impact of School Culture, Technology Leadership, and Support Services on Teachers' Technology Integration: A Structural Equation Modeling *

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## Abstract

Technology integration into educational settings is a multi-dimensional and complex process affected by many factors. Previous modeling studies focused on mostly factors germane to technological infrastructure and teacher competencies. Only a few studies investigated some school-level factors and suggested further research for others especially those related to socio-cultural characteristics of schools. Therefore, the purpose of this study is to propose and test a structural model explaining teachers' technology integration through school culture, technology leadership and support services. The model was tested using structural equation modeling on a convenience sample of high school teachers (n=396). The results demonstrate that school culture indirectly influences technology integration through the mediation of technology leadership and support services. Also, support services have direct and largest total effect on technology integration. Positive school climate can result in effective leadership behaviors and adequate support and encouragement for the increased use of technology. Implications were discussed within the context of teachers' technology integration into learning and teaching in the schools.

## Keywords

Technology Integration
School Culture
Technology Leadership
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Structural Equation Modeling

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## Introduction

Technology integration into educational settings is a multi-dimensional and complex process. It requires a number of factors to work together in a harmonious way. This is mostly due to the comprehensive definition of the concept of technology. Many people conceptualize technology entirely with its instrumental or technical aspect since it firstly and usually evokes machines, technical equipments and appliances in the society. Pacey (2000) identifies this definition as a restricted meaning of technology and highlights to consider human and social aspects that influence both production and consumption of technological tools. The broader meaning can be derived from the examination of the ways technology is practiced. Therefore, he conceptualizes technology practice as a triad of technical, organizational and cultural aspects and describes it as "the application of scientific and other knowledge

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to practical tasks by ordered systems that involve people and organizations, living things and machines (p.6)." The organizational aspect here deals with administration, public policy, professional organizations, and activities of designers, engineers and users while the cultural aspect concerns goals, values, ethical codes, and creativity. Such aspects should also be considered when discussing technology use in education, which is a special case of technology practice. Investing a lot of money to provide schools with high-tech hardware and software is required but not sufficient alone to ensure their innovative and effective usage.

There have been various definitions of technology integration in the classrooms because of changing nature of both quantity and quality of technological tools and related research studies. Nevertheless, the common point of these definitions is the use of all kinds of technology to increase student success (Hew & Brush, 2007), to support students' thinking skills (Lim et al., 2003), and thus to improve learning and teaching (Wang & Woo, 2007). According to Inan and Lowther (2010), technology integration is comprised of three broad categories of technology use. The first involves teachers' professional use of technology for instructional purposes such as preparing lesson plans, developing instructional materials, and communicating with colleagues and students. The second category refers to the use of technology for instructional delivery including but not limited to presentation of course content, drill and practice, and simulations. The third one views technology as a learning or cognitive tool and involves students' use of computer applications to facilitate problem solving, critical and creative thinking, and collaborating. In a similar vein but using a multifaceted approach, Bebell, Russell, and O'Dwyer (2004) proposed seven general categories of technology integration including teachers' use of technology for class preparation, e-mail use, delivering instruction, accommodating lessons, grading, and teacher-directed student use of technology for classroom learning activities and creating products.

#### *Determinants of Technology Integration*

In these days in which technology is rapidly progressing and penetrates into every aspect of our lives, the number of research studies on successful integration of technology in education and instruction is rapidly increasing. When analyzing previous studies in the relevant literature, it is seen that teachers' technology integration is often associated with different factors such as technology infrastructure, teacher qualifications, attitudes and beliefs about teaching and technology, support, lack of time, and so on. Researchers have used different classification of these factors. Ertmer (1999) categorized them in two main groups: first-order and second-order barriers. The former includes characteristics that are extrinsic to teachers such as access, time, support, resources and professional training. The latter is intrinsic to teachers and involves teachers' attitudes, beliefs, practices, and resistance. Pelgrum (2001) classified them in two types of conditions: material and non-material. The material conditions refer to the availability of hardware and software while non-material conditions refer to teachers' technology knowledge and skills. Inan and Lowther (2010) grouped them into two categories of teacher-level and school-level barriers. Teacher-level barriers include teacher beliefs, demographics (e.g., age, years of experience), and readiness to technology. School-level factors involve overall support, technical support, and computer availability. After reviewing various definitions and models of technology integration in the literature, Mazman and Usluel (2011) classified barriers into internal or individual group (innovativeness, beliefs, competencies, etc.) and external or environmental group (technological infrastructure, organizational support, social and cultural impacts, etc.).

Several empirical modeling studies have been conducted to examine the relationships among aforesaid factors impacting teachers' use of technology. Extending widely-accepted Technology Acceptance Model (Davis, 1989), Robinson (2003) explored the roles of demographic and contextual variables in 116 teachers' use of computers in private charter schools. Demographic variables included age, gender, education level, school level, computer experience and previous computer training. Other variables were teachers' having the necessary software on their computer at school, having adequate technical and administrative support. He found that teachers' computer usage for enhancement activities (classroom management, presenting information, and designing learning materials) and their computer proficiency positively affected their actual computer usage. Van Braak, Tondeur, and Valcke (2004) studied a path model that explained two types of computer usage (in class and out of class) of 486 primary school teachers. Predictors included only teacher-level variables including demographic characteristics, computer experience and some attitude measures. The results revealed that attitudes towards computer use in education, computer training, technological innovativeness and gender had positive direct effects whereas age and computer experience had positive indirect effects on in class computer use. Usluel, Aşkar, and Baş (2008) created a structural model of instructional and managerial usage of technology in Turkish higher education and tested it on the data gathered from 814 faculty members. They found that technology facilities (computer, Internet, projector) offered in classrooms, labs and offices and perceived attributes related to relative advantages, compatibility, ease of use and observability had positive direct effects on technology usage.

Furthermore, Inan and Lowther (2010) developed a path model to examine casual relationships among 1382 public school teachers' individual characteristics, perceptions of environmental factors, and technology integration in their classrooms. Their model expanded Robinson's (2003) model mentioned above by including both teacher-level and school-level variables. They found that teachers' computer proficiency, readiness to use technology, and beliefs about the impact technology make on student learning positively, but their age and years of experience negatively affected technology usage. Integrating popular technology acceptance models and behavior theories, Teo (2011) proposed and tested a model predicting 592 teachers' intention to use technology from perceived usefulness, perceived ease of use, subjective norms, facilitating conditions, and attitude towards use. The results showed that perceived usefulness, attitude towards use, and facilitating conditions had direct influences whereas perceived ease of use and subjective norms had indirect influences on intention to use technology. He inferred that teachers' positive feelings about the use of computers reinforced their intentions to use technology. In a recent study, Karaca, Can, and Yıldırım (2013) tested a path model explaining the relationships between 1030 elementary teachers' technology integration and teacher- and school-related factors. The results revealed that teachers' technology competency was the most influential factor explaining their technology usage. Moreover, principal support, years of computer use, colleague support and teachers' attitude and belief were found to have important influences on technology integration.

***Research Model and Hypotheses***

As can be seen from the review of previous models above, researchers have focused on mostly factors germane to technological infrastructure and teacher competencies. The importance of these factors in teachers' technology integration is well established in the relevant literature. Studies show that such factors' barrier effects are disappearing as access to technology in the schools and teachers' knowledge and skills have improved (Ertmer, 2005; Koc, 2013). For example, technical shortcomings have been solved to a great extent in Turkey by means of major educational reform initiatives (e.g., Basic Education Project, FATİH project) and support from parent-teacher associations and various organizations. In this context, teachers' proficiencies in the use of current technologies have been improved through professional development programs or in-service training activities. Similar attempts have been taken in other countries as well. Nevertheless, there are still school-level or environmental factors that persist to influence technology integration and their influences need to be investigated. Recent modeling studies explored the impact of some school related factors and suggested further research for others especially those related to socio-cultural characteristics of schools (Inan & Lowther, 2010; Karaca et al., 2013). Therefore, the purpose of this study is to propose a structural model (Figure 1) explaining teachers' technology integration (TI) through school culture (SC), technology leadership (TL) and support services (SS) and test it on a sample of high school teachers.

The hypothesized model was based on the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh, Moris, Davis, and Davis (2003). The UTAUT is a relatively new and thus underinvestigated theory that was constituted through the synthesis of previous models explaining technology acceptance (Kabakçı-Yurdakul, Ursavaş, & Becit-İşcitürk, 2014). Individuals' behavioral intensions and use of technology primarily in organizational settings are argued to be influenced by four main constructs: performance expectancy, effort expectancy, social impact, and facilitating conditions. It defines performance expectancy as the degree of individuals' motivation toward using technology to increase job performance (e.g., perceived usefulness, outside motivation, expected outcomes); effort expectancy as the degree of ease for individuals to use technology (e.g., perceived ease of use, complexity); social impact as the degree of importance that other people give to technology use (e.g., subjective norms, social factors, image); facilitating conditions as organizational and technical support necessary for technology use (Venkatesh et al., 2003). Within the scope of the present study, the variables of SC, TL and SS were treated as characteristics or operational indicators of these determinants of technology adoption in UTAUT. Therefore, it is aimed to explore what UTAUT can contribute to technology integration into schools within the context of such variables and ultimately to embody its theoretical tenets. The primary contribution of the study is that it will help policymakers and school administrators identify the importance of some socio-cultural and institutional factors in technology use. The research model and related six hypotheses are presented in Figure 1. The model treats TI as the dependent and SC, TL, and SS as the independent variables and aims to explore structural relationships among them. The following subsections introduce independent constructs and provide the underlying justification for research hypotheses.

***Support Services (SS)***

SS is regarded as a part of facilitating conditions that impacts teachers' perception of how easy or difficult to use technology in their schools. High quality SS is multifaceted concept comprising convenient access to educational technology resources, providing teachers with one-on-one support, teaching them about integrating educational technology, and encouraging professional collaboration (Dexter, Anderson, & Ronnkvist, 2002). Teachers need modeling and instructional support for effective technology implementation in the schools. Ertmer (2005) states that teachers can increase their knowledge and confidence for successful use of technology as long as they have a chance to observe and discuss its examples and consequences. In this study, SS was conceptualized as the amount of overall support (OS) and technical assistance (TA) that teachers get from administration, colleagues, parents, and community. OS includes having a technology plan guiding overall technology use in the schools, parents' support, administration's appreciation, modeling and encouragement, and peers' cooperation and sharing for the use of instructional technology and materials in classroom activities. TA involves having a good working condition of technical equipments, adequate access to necessary and current hardware and software, and constant on-site support for technical troubleshooting.

Previous studies indicated that administrative support, peer collaboration, and technical help were influential factors on teachers' beliefs and readiness to integrate technology (Butler & Sellborn, 2002; Davis, Preston, & Sahin, 2009; Inan & Lowther, 2010). Observation and cooperation among the colleagues was shown to be a significant predictor of technology adoption level (Aşkar & Usluel, 2003; Sahin & Thompson, 2007). Shiue (2007) found that technical support had either positive direct or indirect effects on computer self-efficacy, attitude towards technology, perceived usefulness and ease of use, and intention to use and actual use of technology. Dexter et al. (2002) investigated that teachers' frequency, variety, or progressive use of computer technology was positively correlated with the availability of quality technology support. Another study showed that lack of technical support and insufficient instructional technology lab organization were impeding conditions (Aşkar & Usluel, 2003). These evidences suggest that teachers are likely to use technology if they have adequate opportunities and support. Consequently, the following research hypothesis was formulated:

$H_1$: SS will have a significant and positive influence on teachers' TI.

***Technology Leadership (TL)***

TL is a kind of leadership that comprises to motivate, support, direct, and manage employees for efficient and effective use of technology in the institutions (Anderson & Dexter, 2005; Can, 2008). Studies in the relevant literature emphasized that school managers had a key role in the effective integration of educational technologies in the classrooms (Hacıfazlıoğlu, Karadeniz, & Dalgıç, 2011; Sincar & Aslan, 2011). Therefore, some studies were conducted for the establishment of standards relating to TL. In this context, National Educational Technology Standards for Administrators (NETS-A) developed by International Society for Technology in Education (ISTE) in 2009 have been recognized all over the world. These standards play a guiding role in enriching the educational environments according to innovations of the digital age.

ISTE (2009) categorizes TL standards in five dimensions: visionary leadership (VL), digital age learning culture (DALC), excellence in professional practice (EPP), systemic improvement (SI), and digital citizenship (DC). VL requires school administrators to promote and lead the development and implementation of a shared vision for comprehensive technology integration (ISTE, 2009). This involves not only giving instruction for school staff about what they have to do but also collaborating with stakeholders (teachers, students, parents, etc.) to develop and implement a strategic plan. This plan contains future goals and strategies that will help in achieving these goals. In the DALC dimension, managers are expected to create a dynamic learning culture that is consistent with digital age and interesting for students (ISTE, 2009). To accomplish this, they need to provide both technological tools and pedagogical innovation and learning experiences supported by these tools. Also, school staff should be urged to participate in national and international learning communities aiming at the effective use of educational technologies. EPP refers to the preparation of a professional learning environment supported by modern technology and digital resources (ISTE, 2009). In this regard, managers are expected to ensure necessary time, funding, support, effective communication, and professional development required for technology integration. SI contains administrative practices that advance schools through the use of information and communication technologies (ISTE, 2009). Managers need to start a change process to improve educational outcomes and benefit from technology to assess this process. They need to collaborate with relevant institutions to create human resources. Finally, DC refers to being a model and supportive for understanding social, ethical and legal concerns related to digital culture (ISTE, 2009). School mangers should prepare and enforce policies germane to equal, acceptable, and safe use of technology.

With the establishment of TL standards for school managers, the relevant research studies have been undertaken as well. Several studies revealed that TL was one of the positive predictors of school technology outcomes (Anderson & Dexter, 2005; Chang & Hsu, 2009; Marulcu, 2010). Similarly, Chang (2012) showed that principals' TL improved teachers' technological literacy and directly encouraged teachers to integrate technology into their teaching. Piper and Hardesty (2005) indicated that leadership behaviors such as inspiring, motivating, and providing assistance are effective when encouraging teachers to incorporate technology in their classrooms. Bülbül and Çuhadar (2012) found a positive significant correlation between school leaders' TL competencies and their perceived usefulness and ease of use dimensions of technology acceptance. As a result, they concluded that those school managers whose TL proficiency and technology acceptance levels are high would play crucial role in successful technology integration. Corroborating these findings, Şişman-Eren (2010) demonstrated that primary school managers exhibited high level of TL behaviors during the provision and use of technology. She identified these TL behaviors as enthusiasm about using new technologies, openness to innovation, encouragement for the use of technology in the courses, and providing school staff with equal access and benefit of technology. Sincar and Aslan (2011) concluded that school leaders should master technology and accordingly lead teachers in order to increase technology integration. Combining the above theoretical concepts and research evidences, it is reasonable to think that school managers with high self-efficacy of TL are more likely to provide teachers with necessary support and motivation required for instructional use of technology. Hence, the following research hypotheses were proposed:

$H_2$: TL will have a significant and positive influence on teachers' TI.

$H_3$: TL will have a significant and positive influence on SS.

***School Culture (SC)***

SC refers to the unity of fundamental values, norms, beliefs, symbols, perceptions, and emotions shared amongst the school stakeholders including administrators, teachers, students, parents and so on (Schein, 2004; Şahin, 2004). Briefly, it focuses on organizational life in the school. It is based on the collective perceptions of behaviors in the schools and directly affects school staff's practices, formal and informal interactions, and success and failure of reform initiatives (Hoy & Miskel, 2008). Şahin (2011a) conceptualizes SC under five dimensions: school leadership (SL), teacher collaboration and solidarity (TCS), unity of purpose and vision (UPV), improvement culture (IC), and teaching culture (TC). SL includes having a common vision, leading to instructional development, supporting collaboration, and helping problem solving. TCS refers to positive relationships, collaborative learning and teaching, and respect for diverse views among school staff. UPV requires cooperation, taking responsibility and implementation of decisions for common mission and vision. IC refers to school improvement and professional development whereas TC involves considering students' individual needs, believing that every student can learn, and risk-taking to improve teaching (Şahin, 2011a).

School atmosphere promotes openness, colleagueship, professionalism, trust, loyalty, commitment, pride, and academic excellence and cooperation, which are all required for developing a positive work environment (Hoy, Tarter, & Kottkamp, 1991). Thus, those schools with positive climate are expected to create a supportive environment. Such schools show evidence of cohesion to beliefs and values and create commonality of purpose directed towards enhancement in students' learning (Cavanagh, MacNeill, & Reynolds, 2004). Furthermore, leadership behaviors are closely linked to the culture of school because school managers are role models that represent schools' values and beliefs. Bulach, Boothe, and Pickett (2006) found a strong positive relationship between the way principals interact with teachers and the overall climate and culture of the school. Watts (2009) showed a correlation between school climate and technology leadership characteristics and concluded that technology integration may be seen as an outside disruption unless school leaders take into account the existence culture. According to Davidson and Olsen (2003), effective leadership for technology integration is most likely accomplished once school managers seek to promote a positive school climate. Demiraslan and Usluel (2008) showed the lack of common understanding in the school as a significant problem for the use of technology. Therefore, they highlighted the importance of setting common objectives and rules and collegial cooperation related to integrating technology into courses. Similarly, Tezci (2011) found that perceived positive school culture increased the level of teachers' technology usage. From the discussion above, the following research hypotheses were generated:

$H_4$: SC will have a significant and positive influence on SS.

$H_5$: SC will have a significant and positive influence on TL.

$H_6$: SC will have a significant and positive influence on teachers' TI.

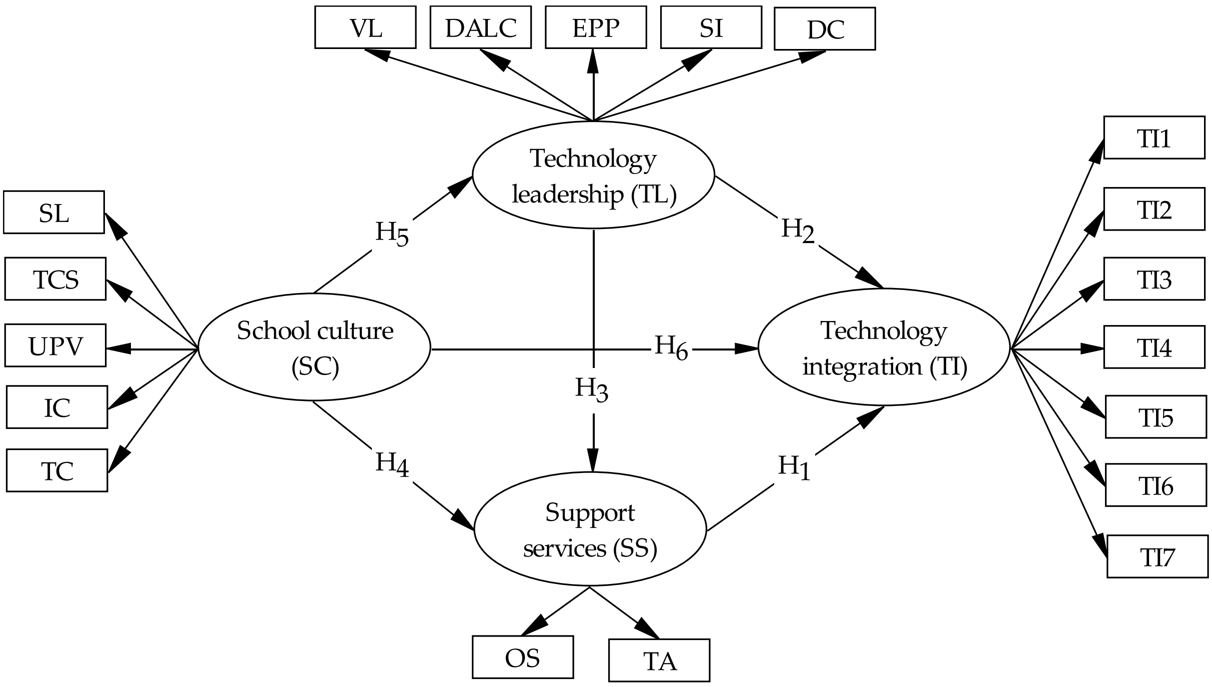


**Figure 1.** Research Model

## Method

### *Research Design*

This study was designed as a correlational survey within the quantitative research paradigm and utilized a structural equation modeling (SEM) approach to test the hypothesized model in Figure 1 that represents multiple relationships among SC, TL, SS and TI. Data were collected through a paper-and-pencil and self-reported questionnaire that was made up of demographic questions and measures for research variables. Although SEM is perceived as a complex technique, its application as research framework in social sciences has increased over the last decade along with the advancement of SEM software packages. It has been used to investigate technology acceptance, attitude towards specific technological tools, Internet usage, and scale development in educational technology research (Teo, 2010a). It offers a powerful statistical method with several advantages such as taking a confirmatory approach to theory development, testing causal models that have both latent and observed variables, correcting measurement errors, and estimating multivariate relations among the variables under study (Byrne, 2010; Hair, Black, Babin, & Anderson, 2010).

### *Participants*

Participants were recruited through convenience sampling on a voluntary basis from the population of high school teachers working in a southwestern city of Turkey, Isparta, during the 2015/2016 academic year. The data were collected in Science High School (n=1), Fine Arts and Sport High School (n=1), Religious Vocational High Schools (n=4), Vocational and Technical High Schools (n=4) and Anatolian High Schools (n=10). The study focuses on high schools because their technological infrastructures have already been completed with the installation of interactive smart boards and connection to high-speed Internet, e-learning materials and laser printers in every classroom. Also, their teachers have been provided with professional development programs to enhance their teaching with such educational technologies. All these implementations were carried out through the FATIH project, an ongoing nationwide reform of Turkish government to integrate state-of-the-art technology into public education system. The first author visited high schools and invited teachers to participate in this study by completing the questionnaire form. Permission to administer this questionnaire and human subject approval were obtained from the office of city governor. The overall administration took an average of 20 minutes per participant and ended approximately in one month. The completed forms were subjected to preliminary inspection and those that were simply blank, considerably incomplete or negligently responded were eliminated from the further analysis. Accordingly, the final sample consisted of 396 teachers.

Of the sample, 239 (60%) were male and 157 (40%) were female. Participants ranged from 22 to 63 years old with a mean age of 40.28 (SD=8.56). The length of teaching career varied from 1 to 40 years with a mean years of 16.38 (SD=8.57). Teaching fields included math and sciences (Math, Physic, Biology etc.) (26%), social sciences (Turkish, History, Geography etc.) (37%), foreign languages (13%), gym and fine arts (11%), and other courses. The average year of computer usage was 14.6 (SD=4.38) while the actual usage ranged from 2 to 30 years. The majority of the participants (83%) reported less than three hours of daily computer usage while the remaining reported more than three hours. When asked about the frequency of technology use in their teaching, their responses distributed as seldom (8%), sometimes (29%), often (44%), and always (18%).

***Measures***

Teachers' perception of their own school culture was measured by using School Culture Instrument (SCI) developed by Şahin (2011b) based on the previously validated questionnaires in published studies (Camburn, Goldring, Supovitz, Spillane, & Barnes, 2005; Cavanagh et al., 2004). The SCI was used because its items were conceptually supported with the relevant literature as well as adapted to Turkish culture and school system. It has 37 items with five factors: school leadership (SL, 10 items), teacher collaboration and solidarity (TCS, 8 items), unity of purpose and vision (UPV, 8 items), improvement culture (IC, 5 items), and teaching culture (TC, 6 items). Each item was rated on a five-point Likert-type scale ranging from "1=strongly disagree" to "5=strongly agree". Item points were averaged to construct factor scores. Şahin (2011b) adapted all items from English to Turkish language and provided evidence for validity and reliability of the scale. For the present study, a confirmatory factor analysis (CFA) was conducted to validate factorial structure of the SCI. The original five-factor model acceptably fit the data ($\chi^2$=1550.68, df=619, p<.01, $\chi^2$/df=2.36, SRMR=.029, RMSEA=.068, TLI=.87, CFI=.87) with all standardized item factor loadings being statistically significant and meaningful in size ranging from .50 to .83 (p<.01). Cronbach alpha internal consistency coefficients for the factors varied between .76 and .93, suggesting acceptable reliabilities (Nunnally & Bernstein, 1994).

Teachers' perception of their school managers' technology leadership competencies was measured using Technology Leadership Competency Scale for School Administrators (TLCSSA). The scale was developed in Turkish language by Hacıfazlıoğlu et al. (2011) based on the educational technology standards for administrators (NETS-A) published by the International Society for Technology in Education (ISTE) in 2009. Therefore, it was preferred to use because of its substantial reference to such international standards as well as its adaption to Turkey via qualitative studies. The TLCSSA has 21 items with five factors: visionary leadership (VL, 3 items), digital age learning culture (DALC, 5 items), excellence in professional practice (EPP, 4 items), systemic improvement (SI, 5 items), and digital citizenship (DC, 4 items). Participating teachers were asked to rate their managers in terms of technology leadership competencies given in the items on a five-point Likert-type scale ranging from "1=very insufficient" to "5=very sufficient". Item points were summed to construct factor scores. Hacıfazlıoğlu et al. (2011) assessed the psychometric properties of the TLCSSA and reported that it was a valid and reliable instrument. The CFA analysis conducted in the present study confirmed the five-factor construct of the TLCSSA ($\chi^2$=377.86, df=177, p<.01, $\chi^2$/df=2.14, SRMR=.026, RMSEA=.054, TLI=.97, CFI=.97). All standardized item factor loadings were statistically significant and ranged from .73 to .89 (p<.01). Cronbach alpha internal consistency coefficients for the factors ranged from .87 and .90.

Teachers' perception of support services available in their schools was measured through "overall support" and "technical assistance" subscales of the Teacher Technology Questionnaire (TTQ). The TTQ was originally developed by Lowther and Ross (2000) to collect teachers' perceptions of computers and technology integration. The overall support (OS) subscale has 4 items asking teachers to indicate their opinions about support from administration, peers, parents, and community for technology integration in the school. Similarly, the technical assistance (TA) subscale has 4 items asking teachers to indicate their opinions about adequacy of technical support, availability of resources, and assistance with computer software and troubleshooting. Both subscales were rated on a five-point Likert-type scale ranging from "1=strongly disagree" to "5=strongly agree". Item points were averaged to construct subscale scores. The TTQ was selected for this study because it has been commonly used in various research and evaluation studies and proved to be a valid and reliable tool (Lowther & Ross, 2000). In the present study, the CFA analysis revealed that these two subscales of the TTQ fit the data well ($\chi^2$=21.68, df=19, p>.05, $\chi^2$/df=1.14, SRMR=.021, RMSEA=.02, TLI=.97, CFI=.97). All standardized factor loadings were statistically significant and ranged from .50 to .81 (p<.01). Cronbach alpha internal consistency coefficients for OS and TS subscales were .75 and .85 respectively.

Teachers' use of technologies available in their schools for instructional purposes in their lessons was measured using Technology Integration Scale (TIS). This scale was originally developed in Turkish language by Karaca et al. (2013) based on the qualitative data derived from semi-structured interviews with in-service teachers and expert reviews. The TIS has 10 items asking how often teachers use technologies for a variety of instructional activities such as preparing lesson plans, accessing information resources, developing learning materials, tests and exams, making demonstrations, providing drill and practice, and communicating with students and colleagues. Participants rated each item on a five-point Likert-type scale ranging from "1=never" to "5=always". A composite variable was generated by summing up the scores of all items. Karaca et al. (2013) examined construct validity of the TIS through factor analyses and concluded that it was a unidimensional scale with a high internal consistency. The CFA analysis conducted for the present study suggested excluding three items because their factor loadings were lower than recommended value of .50 (Hair et al., 2010). The follow-up CFA with the remaining seven items confirmed one-factor structure of the TIS with satisfactory goodness of fit ($\chi^2$=61.04, df=13, p<.01, $\chi^2$/df=4.69, SRMR=.038, RMSEA=.09, TLI=.95, CFI=.97). All standardized factor loadings were between .50 and .89 (p<.01). Cronbach alpha coefficient was calculated as .88 for the seven items.

***Data Analysis Procedures***

First of all, a psychometric investigation of each scale used in the study was conducted through CFA to ensure their validity and reliability. The results of each CFA were already given in the preceding section and they qualified the data suitable for SEM. Next, descriptive statistics and correlation analyses were carried out via SPSS 18 software. Finally, SEM analyses were performed via AMOS 19 software. Maximum likelihood estimation technique and the covariance matrix were preferred for parameter estimation. All assumptions of SEM were investigated before model testing. The overall SEM process took place in accordance with the commonly employed two-step order suggested by Anderson and Gerbing (1988). The first step assessed the measurement model to demonstrate construct dimensionality, validity and reliability. The second step tested the structural model to estimate significant relationships among the constructs.

A variety of goodness-of-fit indices were used for testing the overall fit of the models to the sample data. To begin with, the chi-square statistic ($\chi^2$) was calculated since it is known as the fundamental absolute fit index. However, $\chi^2$ is known to be biased toward large samples and complex models. Hence, $\chi^2$/df ratio is recommended and values less than 3 are considered to indicate good model fit (Kline, 2005). Alternatively, the following various fit indices were also employed: Standardized Root Mean Square Residuals (SRMR), Root Mean Square of Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI). The SRMR and RMSEA values equal or less than .05 and CFI and TLI values greater than .95 indicate a good fit (Hair et al., 2010).

## Results

### *Descriptive Statistics for Model Variables*

The descriptive statistics for model variables are presented in Table 1. The mean value of each construct was above the midpoint of its scaling range, which indicated that participants had overall positive responses or perceptions about the characteristics measured. The standard deviations showed moderately narrow dispersions of the data, suggesting that participants' scores were closely clustered around their means. Moreover, the skewness and kurtosis values ranged from -.37 to -.52 and .10 to .61 respectively. They were quite below the threshold value of |3| for skewness and |10| for kurtosis recommended by Kline (2005) and provided evidence for univariate normality assumption for SEM. Bivariate correlation coefficients were all significant ($p<.01$) and show that SC, TL and SS are strongly and positively associated with each other while they were weakly and positively related to TI.

**Table 1.** Descriptive Statistics and Correlation Coefficients for Model Variables

| Variable | Min-Max | Mean | SD | Skewness | Kurtosis | Correlations | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | TL | SS | TI |
| School culture (SC) | 1.84-5 | 3.77 | .57 | -.50 | .61 | .67* | .55* | .18* |
| Technology leadership (TL) | 25-105 | 79.15 | 14.60 | -.52 | .48 | | .66* | .22* |
| Support services (SS) | 1.75-5 | 3.91 | .61 | -.47 | .38 | | | .26* |
| Technology integration (TI) | 8-35 | 25.71 | 5.25 | -.37 | .10 | | | |

*p<.01

### *Measurement Model Testing*

Data were subjected to preliminary examination to ensure that there was no violation of issues and assumptions of SEM including sample size, multicollinearity, and multivariate normality (Teo, 2010b). The sample size of the study (n=396) met Kline's (2005) recommended value of 100-150 cases to obtain reliable results in SEM. Besides, it exceeded the Hoelter's (1983) critical N, which was 186 for the measurement model at the significance level of .01. The Pearson correlation coefficients between each pair of the observed variables ere not too high except for one between DALC and EPP, which was .87. In order to decide whether this cause multicollinearity problem, the Tolerence and VIF (variance inflation factor) values for these two variables were calculated as well. The Tolerance values were greater than commonly used cut-off point of .20 and the VIF values were lower than cut-off point of 10. Overall, it was decided that multicollinearity did not exist and the analysis proceeded with keeping both variables. Since the measurement model was assessed using the maximum likelihood estimation, multivariate normality was also checked through Mahalanobis $D^2$ distance values for the observed variables. Twenty five cases were found to have Mahalanobis values exceeding the critical Chi-square value of 42.31 (df=18, p=.001) and thus were considered as multivariate outliers (Tabachnick & Fidell, 2007). Since the sample size of the study was large enough, these cases were not included in the further analyses.

**Table 2.** Results of the SEM Analysis for the Measurement Model

| Latent construct | Observed variable/item | Mean | SD | Standardized factor loading (λ) | t-value | Composite reliability (CR) | Average variance extracted (AVE) |
|---|---|---|---|---|---|---|---|
| SC | SL | 3.84 | .68 | .84 | f | .95 | .78 |
| | TCS | 3.69 | .64 | .95 | 25.71* | | |
| | UPV | 3.84 | .65 | .89 | 22.72* | | |
| | IC | 3.88 | .55 | .85 | 20.71* | | |
| | TC | 3.59 | .64 | .87 | 21.64* | | |
| TL | VL | 11.30 | 2.30 | .83 | f | .96 | .82 |
| | DALC | 18.90 | 3.59 | .92 | 23.11* | | |
| | EPP | 15.26 | 2.99 | .92 | 23.31* | | |
| | SI | 18.47 | 3.77 | .94 | 24.21* | | |
| | DC | 15.21 | 3.12 | .90 | 22.54* | | |
| SS | OS | 3.84 | .64 | .89 | f | .84 | .72 |
| | TA | 3.99 | .69 | .81 | 16.55* | | |
| TI | TI1 | 4.02 | .93 | .62 | 13.17* | .88 | .52 |
| | TI2 | 4.19 | .99 | .50 | 9.92* | | |
| | TI3 | 3.66 | 1.02 | .86 | f | | |
| | TI4 | 3.75 | .99 | .89 | 22.19* | | |
| | TI5 | 3.85 | 1.00 | .74 | 16.65* | | |
| | TI6 | 3.30 | 1.07 | .83 | 20.01* | | |
| | TI7 | 2.96 | 1.07 | .51 | 10.35* | | |

Note. CR is calculated by $(\sum\lambda)^2/(\sum\lambda)^2+\sum(1-\lambda^2)$ and AVE is calculated by $\sum\lambda^2/p$ where $\lambda$ is standardized factor loading and p is the number of items. "f" indicates fixed parameter estimate.
*p<.01

The SEM analysis for testing the measurement model revealed that the model had a good fit to the data ($\chi^2$=405.17, df=146, p<.01, $\chi^2$/df=2.78, SRMR=.049, RMSEA=.069, CFI=.96, TLI=.95). As can be seen from Table 2, standardized factor loadings for all items were statistically significant (p<.01) and not less than the recommended value of .50 (Hair et al., 2010), ranging from .84 to .95 for SC, .83 to .94 for TL, .81 to .89 for SS, and .50 to .89 for TI construct. These findings support the convergent validity of observed variables/items. Conservatively, further exploration of psychometric properties of the measurement model was undertaken using the composite reliability (CR) and average variance extracted (AVE). The CR reflects the degree that a latent construct is explained by its observed variables, and a CR value of .70 and higher is recommended (Nunnally & Bernstein, 1994). Table 2 shows that all constructs have good construct reliability with their CR estimates varying between .84 and .96. The AVE measures the amount of variance captured by a latent construct in relation to the amount of variance due to its measurement error and a rule of thumb is that an AVE value of .50 and higher indicates adequate convergent validity at the construct level (Fornell & Larcker, 1981; Hair et al., 2010). AVE values in Table 2 exceed this criterion for each construct, ranging from .52 to .82. In order to gauge discriminant validity, the AVE value for a construct was compared with the squared bivariate correlations between that construct and all other constructs in the model. All AVE values in Table 2 are larger than their corresponding squared inter-construct correlations in Table 1. This means that each construct in the model has more in common with its observed items than with other constructs' and thus demonstrates discriminant validity (Fornell & Larcker, 1981). Taken as a whole, these results provide evidence to accept the measurement model as valid and reliable and subsequently to proceed with testing the structural model.

***Structural Model Testing***

The research model in Figure 1 which treats SC as an exogenous variable and TL, SS, and TI as endogenous variables was tested using the SEM analysis. The model demonstrated good fit to the sample data with the goodness-of-fit indices being the same as with the measurement model ($\chi^2$=405.17, df=146, p<.01, $\chi^2$/df=2.78, SRMR=.049, RMSEA=.069, CFI=.96, TLI=.95). Table 3 presents standardized path estimates and corresponding t-values. Four out of six hypotheses were supported by the data. The exogenous variable, SC, had a significant and positive influence on SS (β=.28, p<.01) and TL (β=.63, p<.01) supporting $H_4$ and $H_5$ respectively. However, it did not have a significantly influence on TI (β=-.04, p>.05) and hence the data did not support $H_6$. Among the endogenous variables, TL had a significant and positive influence on SS (β=.56, p<.01) supporting $H_3$ but did not have a significant influence on TI (β=.09, p>.05) and thus $H_2$ was not supported. Finally, the other endogenous variable, SS, had a significant and positive influence on TI (β=.26, p<.05) supporting $H_1$.

**Table 3.** Results of the SEM Analysis for the Structural Model

| Hypothesis | Path | Standardized path estimate | t-value | Result |
|---|---|---|---|---|
| $H_1$ | SS → TI | .26 | 2.56* | Supported |
| $H_2$ | TL → TI | .09 | .96 | Not supported |
| $H_3$ | TL → SS | .56 | 9.57** | Supported |
| $H_4$ | SC → SS | .28 | 5.04** | Supported |
| $H_5$ | SC → TL | .63 | 12.02** | Supported |
| $H_6$ | SC → TI | -.04 | -.46 | Not supported |

*p<.05, **p<.01

In SEM analyses, it is also important to assess how an outcome (i.e., endogenous variable) is impacted by its determinants (can be exogenous and endogenous variables) because it may be directly and/or indirectly influenced in the model. Direct effect represents a one-way link between two variables whereas indirect effect corresponds to a pathway from one variable to another one through one or more mediator variables. The total effect is the sum of the direct and indirect effect on the outcome. Table 4 demonstrates standardized direct, indirect, and total effects in the structural model. SC had a direct effect of .63 on TL with an explanation of 40% of its variance. SC and TL had the direct effects of .28 and .56 respectively on SS with accounting for 59% of its variance. Moreover, SC had an indirect effect of .36 through TL on SS and thus it was the dominant determinant of SS with a total effect of .64. In other words, TL provides partial mediation (explanation of some relationship) between SC and SS. Regarding those determinants explaining 9% of the variance in TI, SC and TL had no significant direct effect but SS had a direct effect of .26. However, both variables had indirect effects of .22 and .15 respectively on TI through SS. Therefore, SS provides full mediation between SC and TI and TL and TI, suggesting its importance in increasing TI.

**Table 4.** Standardized Direct, Indirect, and Total Effects of Structural Model

| Outcome | $R^2$ | Determinant | Direct effect | Indirect effect | Total effect |
|---|---|---|---|---|---|
| TL | .40 | SC | .63 | - | .63 |
| SS | .59 | SC | .28 | .36 | .64 |
| | | TL | .56 | - | .56 |
| TI | .09 | SC | -.04 | .22 | .18 |
| | | TL | .09 | .15 | .24 |
| | | SS | .26 | - | .26 |

## Discussion, Conclusion and Suggestions

The results of the study showed that SS had a significant direct and the largest total effect on TI. This is consistent with previous research indicating that administrative support, peer collaboration, or technical help was influential factors (Aşkar & Usluel, 2003; Davis et al., 2009; Inan & Lowther, 2010). As expected, the direction of the effect was positive. Therefore, it is reasonable to infer that teachers are more likely to use technology in their instructions when they get technical and instructional assistance with regards to the problems they face with or they are encouraged and appreciated for their successful use of technology. One reason for this finding might be the perception of ease of use. Knowing that support is available when necessary, teachers may perceive technology to be easy to use and thus make more attempts for the use of technology without much hesitation. If hardware or software tools fail a few times, teachers may become discouraged and decide not to use them anymore. Therefore, it is important to keep technology in good working condition in the schools. Another reason may be the belief of self-efficacy. For instance, prior research suggests that support mechanisms have a positive effect on computer self-efficacy (Shiue, 2007). Teachers sometimes need guidance or recommendations about how to use a specific or new technology in their classrooms. If they know that they can get administrative backing and peer cooperation in such cases, their perception of self-confidence and self-efficacy will get better and thus they will become more comfortable for taking risks in learning and using new technologies.

In contrast to hypothesized model in this study, TL had no significant direct effect on TI. However, it had a significant indirect effect on TI through SS. In other words, SS played a mediator role between TL and TI. The lack of direct was not expected because TL was shown to be an influential factor in schools' technology outcomes in previous research studies (Anderson & Dexter, 2005; Chang & Hsu, 2009; Marulcu, 2010). Nevertheless, there were also a few studies indicating that TL was not considerably associated with teachers' attitudes towards technology (Celep & Tülübaş, 2014) and TI (Watts, 2009). One possible explanation for this is that teachers might be influenced by other factors more than or rather than institutional mandate from school managers. These factors may include professional duties, personal interests, perceived usefulness, competition, and achievement press from parents. Another reason for this finding might be linked to Turkish educational context. For example, Celep and Tülübaş (2014) states that the centralized management system of the schools in Turkey assigns more responsibility of providing technology and promoting its usage to Ministry of Education than school principles. Hence, the initiatives taken by the ministry (e.g. FATIH project) may be more effective than school principals' leadership on TI. TL is not limited to school manager but rather is a wider managerial competency including the cooperation of others such as teachers. Banoğlu (2011) found that school managers who have IT coordinator teachers in their schools demonstrated higher TL competencies than those without IT coordinators. Thus, school managers ought to work together with IT coordinators in order to benefit from their knowledge and skills, provide teachers with necessary technical and pedagogical support, and make technology supported teaching as a cultural norm of their schools. On the other hand, the mediation role of SS could reduce the effect of TL on TI. This possibility should be examined in future studies. The presence of indirect effect suggests that TL first influences SS which in turn influence TI. This highlights the importance of SS in order for TL to be influential on TE. That is to say, if school managers provide teachers with more overall and technical support, effective communication, and professional development, teacher will then integrate technology more widely. They need to be role models, resource providers and facilitators rather than just rulers and controllers. At this point, professional development programs related to TE for school managers should be increased because previous research revealed that school managers who completed such programs reported higher levels of TL than others who did not have any in-service education (Yorulmaz & Can, 2016).

Similar to TL, SC did not directly affect TI, but indirectly affected it through the mediation of TL and SS. Put differently, SC influences both TL and SS which in turn influence TI. This suggests that establishment of a positive working environment in the school is important for effective leadership and adequate support. If school personnel share common mission and vision and have positive relationships, they will then spare enough time, collaborate with each other, and support themselves with regards to integrating technology. It is well evidenced that each school has a set of norms and values that guides instructional beliefs and practices including which methods, tools and materials are acceptable to use (Ertmer & Ottenbreit-Leftwich, 2010). For example, Windschitl and Sahl (2002) found that teachers' computer integration into classroom instruction was strongly influenced by the belief systems about what constituted good teaching in their institutional culture. In school environments with strong cohesion about TI, not only school managers but also teachers have to behave and work in a way that represents schools' shared values and beliefs about TI (i.e., cultural pressure). For example, school managers try to improve their own leadership competencies and provide as much support as possible if technology use is prioritized in the school. TI should be a school-wide effort reflected in school values and policies. As Zhao and Frank (2003) states, integrating technology is less likely to be accomplished if it separates from the existing values, beliefs, and practices of the teachers and administrators in the school.

In conclusion, this study demonstrates that school culture indirectly influences technology integration through the mediation of technology leadership and support services. Positive school climate may result in effective leadership behaviors and adequate support and encouragement for technology integration. Therefore, the study suggests that educational policymakers and administrators ensure to create a supportive and positive school environment and culture with shared vision if they want to increase the use of educational technology. As is the case with most studies, the present has several limitations as well. Firstly, it is a correlational study which examines theoretical relationships among the variables. Hence, the findings do not indicate cause-effect relationships. Experimental or longitudinal studies are needed for exploring casual relations. Secondly, the proposed model explained a small amount of variance (9%) in technology integration because it includes only three constructs related to socio-cultural characteristics. Future studies should include more school-level variables. Thirdly, school managers' technology leadership competencies were measured through the perception of participating teachers. Future studies may directly assess this construct from the school managers. Finally, the model was tested with the data gathered from convenience sample of high school teachers from a specific city in a culturally district country, Turkey. Thus, the generalizability of the results to other school settings and cultures is limited. Similar studies can be conducted to test the proposed model in different cultures and teacher populations.

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