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Investigation of Principals' Technology Leadership Profiles in the context of Schools' Learning Organization Culture and ICT Infrastructure: F@tih Project Schools vs. the Others

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Abstract

Although there is a growing body of literature about the integration of information and communication technologies (ICT) into K-12 schools and the ways how individually school principals can lead and support these initiatives, little is known about to what extent principals' technology leadership (TL) practices are predictable by school's organization culture and present ICT infrastructure. Hence, in this exploratory study, we set out to classify Turkish principals by their TL practices into discrete TL profiles, taking individual, cultural and infrastructural factors into consideration. The five standards of International Society for Technology in Education (ISTE-2009) were taken as the measures of TL practices. Some main components of the learning organization (LO) culture such as team learning, shared vision and systems thinking disciplines were regarded as the measures of school culture. Principal's age and gender demographics, computer and internet usage frequency, school's F@tih project status and teachers' perception of LO culture were used as predictor variables. The current study surveyed 1105 teachers and 58 principals from 69 K-12 public schools located in Istanbul city. Latent class analysis (LCA) was used to assign principals to distinct TL profiles. Afterwards, logistic regression analysis was undertaken to determine significant predictors of the outcome TL profiles. The results revealed that Turkish principals assume two different profile of TL practices, leveled as high and low profiles. Almost 55% of the principals were delineated in the high-profile structure due to their strong interest to perform ISTE standards, whereas 45% of the principals were classified in the low-profile structure because of their relatively poor interest in the standards. The most striking result to emerge from this research is that Turkish principals are most likely to perform high-profile TL practices when having: a) run a F@tih project school; b) used internet technology more frequently, c) managed a school in which teachers perceive a higher level of team learning LO culture, changing odds ratios from 4 up to 26 times higher.

Keywords

Technology leadership
ISTE standards
Fatih project
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School culture
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Introduction

Turkish Ministry of National Education (MNE) have been in a constant struggle for providing Turkish schools with modern information and communication technologies (ICT) since the early 80's (Tezci, 2011). Nevertheless, such early efforts focused on mainly ICT teaching issue rather than extending ICT-supported learning environment. However, at the beginning of the new millennium, foreign-invested "World Bank Basic Education I and II" project placed the most remarkable milestone in Turkey's ICT integration history by granting 300 millions dollars worth of ICT classrooms with computers and neccesary equipments (World Bank, 2002).

Ultimately, in 2010, MNE has introduced Turkey's largest technology investment project with a great enthusiasm, namely "Movement to Increase Opportunities and Technology Project", also known as "F@tih Project" by its Turkish acronym ("Fatih Project", 2012). Total budget of this project has reached around 1.8 billion USD (Uluyol, 2013). Though the project was initiated in 4 pilot schools at the outset, its scope was extended over 17 provinces and 52 schools in 2012. According to project's master plan, nearly 620.000 classrooms should have been equipped with interactive smart boards, digital projectors and laptop until the end of 2015 ("Fatih Project", 2012). However, due to some unforeseen contractual problems in tender offers, only 10% of the project has been completed until today and hence it was prolonged for three years until the end of 2018 (Ministry of National Education [MNE], 2015).

Beyond its enormous financial and indisputable technical capacity, F@tih project was nevertheless criticized by some Turkish scholars on grounds of poor technology leadership (Gök & Yıldırım, 2015; Hoşgörür, 2013; Vatanartiran & Karadeniz, 2015), deficient human resource management (Günbayı & Yörük, 2014), overlooking the present resistance of traditional school culture (Vatanartiran & Karedeniz, 2015), inadequate professional development facilities (Hoşgörür, 2013) and lack of follow-up technical support (Akkoyunlu & Baskan, 2015; Banoğlu, Madenoğlu, Uysal, & Dede, 2014). Vatanartiran and Karadeniz (2015) categorized these factors under three main themes such as executive, infrastructural and instructional issues. In this paper, we placed a particular focus on the executive (e.g. school culture) and infrastructural (e.g. school's ICT capacity) themes in order to scrutinize principals' TL practices.

Technology Leadership and Learning Organization Culture

The execution of TL practices is not subject to any fixed leadership position occupied by a sole school actor, but rather a school characteristic and change management process embedded in the whole school context (Davies, 2010; Keller, 2005). Nonetheless, many studies support that school principals continue to play a key role in leading ICT integration processes in K-12 schools (Anderson & Dexter, 2005; McLeod, 2008; Yee, 2000). Studies have shown that principal's leadership practices (Anderson & Dexter, 2005; Tan, 2010; Yuen, Law, & Wong, 2003), ICT using experience (Gurr, 2000; Schiller, 2003; Polizzi, 2011) and training level of technology (Dawson & Rakes, 2003; Polizzi, 2011) contribute to the success of ICT integration in K-12 schools. Having a clear and unequivocal set of TL standards is of utmost importance to principal leadership whereby diverse educational and professional communities could agree on common and effective TL practices to promote ICT integration (Richardson, Bathon, Flora, & Lewis, 2012).

In this sense, International Society for Technology in Education (ISTE) suggested five sets of standards on what school principals should know and practice about educational technologies (International Society for Technology in Education [ISTE], 2009; Richardson & McLeod, 2011). ISTE is a non-profit professional networking organization whose TL standards adopted or adapted by 80% of the states in USA (Kanematsu & Barry, 2016; Schrum, Galizio, & Ledesma, 2011). Not only international research but also Turkish ones paid a considerable attention to ISTE standards and hence these standards gained a high popularity in Turkish TL research (Cakir, 2012; Hacıfazlıoğlu, Karadeniz, & Dalgıç, 2010, 2011; Sincar, 2013). Investigating the F@tih project schools and ISTE standards therein, Güven (2015) indicated that school principals in F@tih project are inclined to self-report their TL

practices in moderate and high levels, whereas teachers perceive principals' TL practices in lower level (Şahin & Demir, 2015). ISTE (2009) standards are composed of:

1) Visionary leadership,
2) Digital-age learning culture,
3) Excellence in professional practices,
4) Systemic improvement and
5) Digital citizenship standards.

Of these standards, "visionary leadership" inspires a shared technology vision, ICT planning and budgeting in schools. Developing a detailed technology plan consistent with objectives of the school and district level strategic plans is also detailed in this standard. The "digital-age learning culture" offers principals to be model of school community as ICT-oriented instructional leaders. The "excellence in professional development" focus on ICT-related professional growth by providing teachers with the needed time and resource. The "systemic improvement" is related to principal's networking and data-driven decision making activities while recruiting technology literate new staff or evaluating teacher-student performance. The "digital citizenship" set and develop education policy of ethical, equal and fair ICT use in schools (Richardson & McLeod, 2011).

When the underpinnings of leadership practices are examined, three main factors come to the fore in the leadership literature: leader's personal traits, behaviors and school's organizational context (Daugherty, Mentzer, Lybrook, & Little-Wiles, 2013). Traditionally, technology leaders have been profiled on their leadership traits and behaviors as tech-savvy and role-model principals with operational know-how knowledge of computers and relevant software applications (Cooley & Reitz, 1997; Crouse, 1997; Roberts, 1997). Recently, however, such a "heroic" TL understanding has gradually lost its popularity in the leadership literature. (Gurr, 2004; Tan, 2010). Instead, recent research have paid far more attention to contextual factors such as school culture and school improvement conditions (Tondeur, Devos, van Houtte, van Braak, & Valcke, 2009; Vanderlinde, van Braak, & Dexter, 2012). For instance, Flanagan and Jacobsen (2003) have addressed five core features of TL practices: student engagement, shared technology vision, equal and fair access to ICT, teachers' professional development and ubiquitous infrastructural networks. Likewise, Dexter (2008) identified three sets of TL practices in relation with social, cultural and infrastructural school contexts as follows: a) generating a shared technology vision in collaboration with teachers b) stimulating a professional learning environment among teachers and c) maintaining educational ICT equipments.

This shifting focus on the contextual variables inspired a great interest in the learning organization (LO) culture. Senge et al. (2000) have founded the term LO culture on "five disciplines" (i.e. "tools"; Senge, 1990) whereby all educational stakeholders could express their aspirations and new ideas by "shared vision" and "team learning" culture; build awareness on schools' systemic stucture and their personal thinking ways by "mental models" and "systems thinking" culture; develop their professional capacity by "personal mastery" culture. Dexter (2008) have particularly set apart the pivotal role of team learning, shared vision and system thinking cultures in improving TL practices. Some other researchers considered the existence of LO understanding neccesary to refine a proper school culture supporting ICT integration process (Anderson & Dexter, 2005) and strengthen technology-oriented cultural change in schools (Flanagan & Jacobsen, 2003). Numerous empirical study found that LO culture encourages teachers to adopt ICT tools in their teaching activities (Divaharan & Lim, 2010), to promote fruitful collegial collaboration (Dexter, 2011) and to foster a strong commitment

to school's technology vision (Yuen et al., 2003). Even it was laid down as a condition of an innovative school culture building technology-rich learning environment in schools (Law, Yuen, & Fox, 2011).

Purpose of the Study

Despite the abundance of available theoretical and empirical literature, however, not much is known about the extent to which: a) principal demographics b) technology-oriented principal behaviors, c) the LO school culture and d) ICT infrastructure could predict principal's TL practices. Therefore, there is a need to take into consideration all these individual, school-related cultural and infrastructural variables in relation with principals' TL practices. In order to fulfill such a research gap, the current study set out to profile principals' TL practices in relation with their individual demographics (i.e. age and gender), technology-oriented behaviors (i.e. frequency of computer and internet usage), school's LO culture (i.e. "team learning", "shared vision" and "systems thinking's" cultures; see. Dexter, 2008) and infrastructural conditions (i.e. involvement in the F@atih project). Rather than handling individual ISTE standards as dependent variables, we tracked the overall characteristics of TL by sorting out principals into sub-groups with similar TL practices (see. Samancıoğlu, Bağlıbel, Kalman, & Sincar, 2015). Such a clustering approach allowed us to interpret Turkish principals' TL dispositions from a more holistic and visualized point of view. To that end, we addressed two research questions in this paper:

1) In which profiles can Turkish principals' TL practices be clustered?
2) To what extent are principals' demographic features, computer and internet usage frequency, schools' LO culture and ICT infrastructure able to predict these TL profiles?

Method

Research Population

The current study surveyed 1163 participants, 1105 teachers and 58 principals from 69 public schools located in the Maltepe province of Istanbul city. Of the schools, 42% were primary schools (n=29), 32% were middle schools (n=22) and 26% were secondary schools (n=18). Almost in the same percentages, 41% of the teachers were sampled from the primary school level (n=456), 33% from the middle school level (n=363) and 26% from the secondary school level (n=286). About 38% of the Turkish school principals surveyed were primary school principals (n=22), 36% were middle school principals (n=21) and 31% were F@tih project secondary school principals (n=18).

As for gender demographics, the large majority of the principal participants (90%) were male principals (n=52), whereas about two thirds of the teacher participants (70%) were female teachers (n=745). These statistics are consistent with the general concern about the gender inequality in the distribution of school principals and teachers, as reported that 84% of principals are male but 64% of teachers are female in Turkish schools ("Women in Turkey", 2016). The average principal age was 48 years old (SD=8.83; Minimum=31; Maximum=62) and the average teacher age was 40 years old (SD=8.80; Minimum=22; Maximum=69).

Procedures

Given the nested data structure with teachers clustered in schools, the sampling frame involved the multistage data collection procedures (Crano & Brewer, 2008). According to two-stage sampling design, the first stage focused on the selection of the teacher units (i.e. schools). After obtaining the prior research permission from the Maltepe governorate, a total of 75 schools in the province were easily accessible to administer teacher and principal questionnaires in those schools. Of these schools, 69 ones accepted to participate in the study with 92% response rate.

The second stage was to sample teacher participants. Thus, a ratio of 40% is used for each school to avoid oversampling teachers in small-size schools and under sampling them in large-size ones. As a rule of thumb, a sampling ratio over 30% is required for the research population of around 1.000 participants (Durrheim & Painter, 2006). Accordingly, a total of 1285 teacher and 69 principal questionnaires were administered in the participating 69 schools. After the elimination of missing and invalid data, 86% and 81% response rates were respectively achieved for teachers (n=1105) and principals (n=58).

Research Instruments

The principal questionnaire consisted of two parts. In the first part, principal demographics of age and gender were collected through an open-ended form. Besides, principals' computer and internet usage behaviors were measured by ordinal frequency metrics on a 5-point item, whose options range from 1 (weekly 0-2 hours) to 5 (weekly 12 hours and more). At the end of the first part, principals were asked to make his/her mark through a binary option about whether their school is a F@taih project school or not.

The second part of the questionnaire included 32 items of the Technology Leadership Scale (TLS) developed by Banoğlu (2012). Scale items measure principals' TL practices by five sub-scales based on ISTE standards (i.e. visionary leadership, digital-age learning culture, systemic improvement, excellence in professional development and digital citizenship). Principals' responses are rated on a 5-point likert-type measurement instrument ranging from 1 (never) to 5 (always). Sample items from these subscales are -for instance- "I consider important the presence of a school technology plan aligned witht he school strategic plan." (visionary leadership); "I make sure teachers design technology-enriched and efficient lesson plans." (digital-age learning culture); "I ensure teacher involvement in professional development activities just as planned in the school technology and strategic plans." (excellence in professional practice); "I endeavor to collect qualitative and quantitative data with a view to assessing ICT using level in the school." (systemic-improvement); "I raise teacher awareness for ethical and lawful ICT usage that may be violated by students in their student homework and research." (digital citizenship).

The TLS demonstrated sound psychometric properties with respect to validity and reliability in the original scale development study (Banoğlu, 2012). According to the related report, the use of exploratory factor analysis (EFA) was conducted through varimax rotation since this rotation technique permits estimated factor loadings to become less correlated among factors but more homogeneous within each factor structure (Field, 2009; Tabachnick & Fidell, 2007b). Cronbach's α values pertaining to the sub-scales are found to be .93 for the visionary leadership standard, .91 for the excellence in professional development standard, .88 for the digital citizenship standard, .93 for the digital-age learning culture standard and .79 for the systemic improvement standard of TL. Having checked the normality of data, EFA results yielded a five-factor solution with factor loading ranging from .52 to .84

and those explained almost 65% of the total variance (KMO=.90; p<.001). After EFA procedures, the confirmatory factor analysis (CFA) was conducted to confirm construct validity of the five-factor solution. Following the recommendation of diversity about goodness-of-fit indices (Bollen & Long, 1993; Brown, 2015), three diverse model-fit indices were selected to endorse TLS's construct validity. These indices are the normed chi-square index (CMIN/df) for parsiminuous fitting, the comparative fitting index (CFI) for incremental fitting and the root mean square error of approximation (RMSEA) for absolute fitting. A general guideline for the interpretation is that a CMIN/df ratio of 5 or less, CFI value of .95 or more, and RMSEA value of .06 or less points out an acceptable model-data fit in social sciences (Hu & Bentler, 1999; Marsh & Hocevar, 1985). As a result, CFA produced satisfactory estimates, even though CFI value was slightly lower than the suggested cut-off point (CMIN/df=1.42; CFI=.91; RMSEA= .06).

The teacher questionnaire is also formed in two parts. The first part involved teacher demographics such as gender and age. The second part included 19 items of the Learning School Scale (LSS) developed by Çetin and Subaş (2014). Based on Dexter's (2008) assumption about ICT integration and associated three LO cultures (i.e. team learning, shared vision and systems thinking), teacher participants were asked to response to the relevant sub-scales on a 4-point Likert-type measurement instrument ranging from strongly disagree (1) to strongly agree (4). Sample items from these sub-scales are "There is a goal congruence among school teams." (team learning); "Our school vision includes well-defined success criteria." (shared vision); "Organizational problems arise from the previous actions we have already taken." (systems thinking).

For its psychometric properties, the LSS explained 59% of the total variance with changing factor loadings in the value range of .51 and .81 (KMO=.86; p<.001). Besides, LSS's Cronbach's α coefficients were found to be .93 (team learning), .91 (shared vision) and .71 (systems thinking) that evidence an acceptable internal consistency for sub-scales. To endorse content validity of the scale once again, the scale items were subjected to principal component analysis using oblim in rotation technique since it allows extracted factors to be correlated with others (Field, 2009). Based on these analyses, we eliminated 4 out of 19 items from the sub-scales because those either double-loaded or cross-loaded on different factors. Next, we conducted CFA with the resultant 15-item model. Finally, it was evidenced that LSS items fit the observed data with satisfactory fit indices (CMIN/df= 4.09; CFI=.95; RMSEA=.05).

Data Analysis

Preliminary analyses were performed to assess the assumption of linearity, normality and heteroscedasticity of the data distribution. The linearity assumption was visiually examined for standardized residuals of continuous variables by a scatter plot in which no curved line occurred as evidence of the linearity (Tabachnick & Fidell, 2007b). The heteroscedasticity assumption was checked by plotting residuals of predicted and each predictor variable separetely. It was seen that scattering points did not formed a funnel shape that represents a typical pattern of heteroscedasticity (Fidel, 2009). Normality of continuous predictor and outcome variables were evaluated through skewness-kurtosis and z values. Although skewness and kurtosis estimates were all above the suggested threshold value of 2 in absolute terms (George & Mallery, 2010), we detected two outliers based on the z-values exceeding the critical value of 2.58 at 99% confidence interval (Field, 2009). Thus, the data of two participants were excluded from the main analyses. Preliminary analyses were all carried out using SPSS 23.0 software.

For the main analyses, latent class analysis (LCA) was performed to establish TL profiles (i.e. sub-groups) by a probablistic approach. Because the LCA is a multivariate clustering method to identify unobserved structures with a certain likelihood ratio (Samuelsen & Raczynski, 2013). In this study, the aim of using LCA was to track the overall layout of TL practices by sorting out principals into alike sub-groups. Later on, individual and school-level variables were added into the LCA model as independent variables by logistic regression analysis. In cases that include dichotomuous variables both in the dependent (i.e. TL profiles) and independent (i.e. gender and F@tih project status) variables, the logistic regression models is recommended to predict the probability that a binary value would change in the log odds of the dependent variable (Hair,Black, Babin, Anderson, & Tatham, 2006).

While conducting the main analyses, Mplus 7.23 statistical software was employed to calculate maximum likelihood with robust standard errors. To guard against the possiblity of local maximawhich indicate sample bias for the generated iterative model estimates (Hagenaars & McCutcheon, 2002), each model was estimated by 200 random sets of start values with 20 final stage optimization, unlike the default options of Mplus ("Mplus version history", 2012).

Results

Descriptive findings presented in Table 1 show that teacher perception of the "systems thinking" school culture obtained the highest mean on the 4-point scale (M=2.99; SD=.54), whereas their perception of the "team learning" school culture was situated at the lowest school mean (M=2.76; SD=.57). A similiar examination of principal data indicates that principals pay the most attention to their "digital citizenship" TL practices (M=4.42; SD=.51), however, they care relatively less about their "systemic improvement" TL practices in schools (M=3.74; SD=.79). Table 1 indicates all descriptive and correlation estimates.

Table 1. Descriptive and Corelation Findings

	M	SD	(1)	(2)	(3)	(4)[a]	(5)[a]	(6)[a]	(7)	(8)	(9)	(10)
(1) Age	48.27	8.83										
(2) Internet usage	3.51	1.36	-.28*									
(3) Computer usage	3.98	1.16	-.21	.56**								
(4)[a]Team learning (LO)	2.76	.57	.25	.01	-.17							
(5)[a]Shared vision	2.81	.65	.09	.01	-.14	.88**						
(6)[a]Systems thinking (ÖÖ)	2.99	.54	.07	.07	-.10	.51**	.54**					
(7) Visionary leadership (TL)	4.07	.64	-.06	.16	-.10	-.07	-.13	-.11				
(8) Digital-age learn. cult. (TL)	4.15	.67	-.04	.21	.30*	.13	.12	-.04	.62**			
(9) Professional practice (TL)	4.04	.71	-.02	.18	.12	-.01	-.07	-.04	.86**	.68**		
(10) Systemic improv. (TL)	3.74	.79	.16	.26*	.10	.15	.07	.07	.68**	.69**	.75**	
(11) Digital citizenship (TL)	4.42	.51	.17	.27*	.25	.30*	.24	.01	.55**	.68**	.57**	.64**

[a]Aggregated teacher perception

*p: p<.05

** p: p<.01

The correlation estimates reveal that the older the principals, the less frequently they use computer technology in their work (r=-.28; p<.05). There is a medium level relation between computer and internet usage frequencies of Turkish principals (r=.56; p<.01). Principals' computer usage frequency is moderately related to their "digital-age learning culture" TL practices (r=.30; p<.05). Unlike the computer usage behavior, principals' internet usage frequency is associated with their "systemic improvement" (r=.26; p<.05) and "digitial citizenship" TL practices (r=.27; p<.05).

Based on aggregated teacher perceptions, it was evidenced that all LO cultures are related to each other as expected. Furthermore, "shared vision" and "team learning" LO cultures were found to be strongly associated in schools (r=.88; p<.01). What is of interest to us is that teachers' perception of "team learning" culture about their schools has a cross-sectional and even moderate level relation with principals' "digital citizenship" TL practices (r=.30; p<.05). In other words, the more principals pay attention to their "digital citizenship" TL practices, the more teachers perceive "team learning" school culture in their workplace and vice versa.

Among the five standards of TL practice, the strongest relationship was found between principals' "visionary leadership" and "digital-age learning culture" TL practices (r=.86; p<.001). Another high correlation was observed between their "excellence in professional development" and "systemic improvement" TL practices (r=.75; p<.01). All other standards of TL practice were found to be moderately associated with each other.

Latent Class Analysis

To identify the number and structure of diverse TL profiles assumed by Turkish school principals (see. research question-1), latent class analysis was conducted to assign principals to classes based on their TL practices and using a probabilistic approach. For that purpose, we calculated -log likelihood (-LL), Akaike information criteria (AIC), Bayesian information criteria (BIC), class entropy (Ent.) and Lo-Mendell-Rubin (LMR) comparative fit index for an iterative set of LCA models (Heck & Thomas, 2015). Table 2 shows alternative class structures alongside their respective indices.

Table 2. Latent Class Solutions and Fit Indices

Profil modelleri	-Log likelihood (-LL)	% Decrease in -LL	AIC	BIC	Ent.	LMR (k-1) test	p
One-class profile	248.78	-	517.57	537.82	1.00	-	-
Two-class profile	162.25	34.80	356.50	388.90	.96	166.19	.001
Three-class profile	144.32	11.05	332.65	377.21	.94	34.42	.22

Seeing that three-class model did not produce a significant decrease in the value of LMR (p=.22), the two-class model was interpreted to depict TL profiles in this study (-LL= 162.25; AIC= 356.50; BIC= 388.90; Entropy= .96; LMR= 166.19, p<.001). Figure 1 illustrates the determined two-class model with their five class indicators, i.e. ISTE standards.

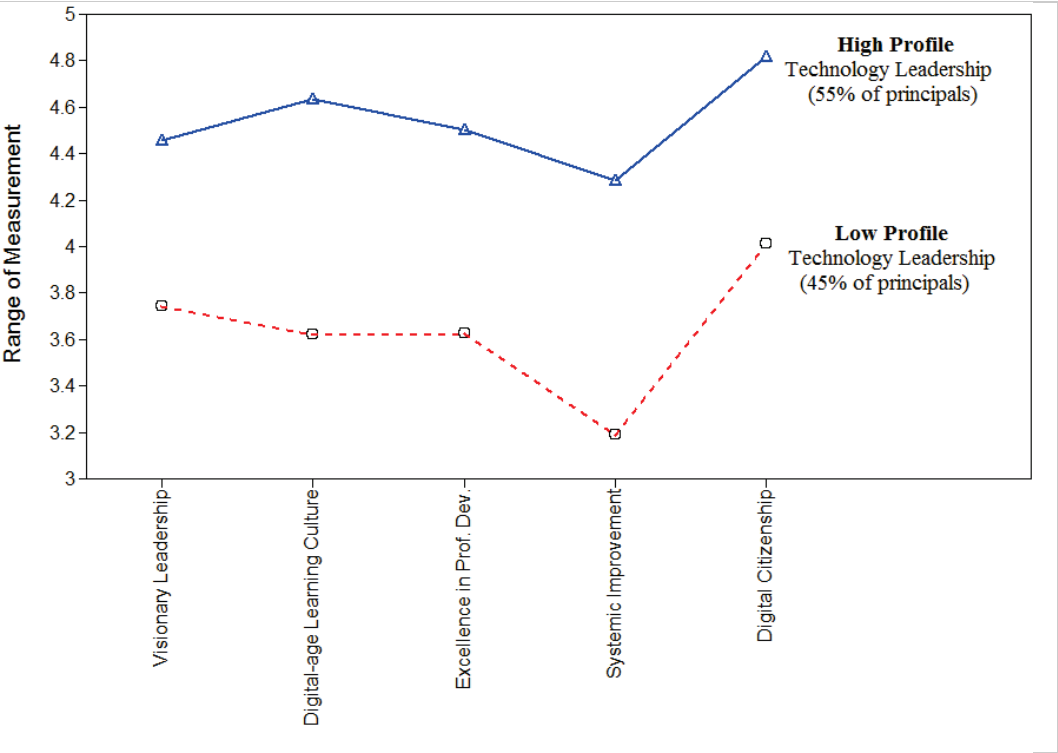

Figure 1. Technology Leadership Profiles

As illustrated in the Figure 1, the two-class model resulted in two diverse TL profiles. As having seen their apparent level difference, we named these graphics as high and low profiles. The high-profile latent class structure included 55% of the principals who pay clearly high attention to their TL practices. According to dispersion of ISTE standards, the "digital citizenship" standard regarding the execution of ethical and fair TL practices receives a great attention from the principals clustered in the high-profile structure (M=4.82; SE=.05). However, the "systemic improvement" standard based on principals' data-driven decision making and strategic partnership TL practices attracted relatively less attention of the related principals (M=4.28; SE=.08). As for the low-profile structure, 45% of the principals seemed relatively indifferent to execute the five ISTE standards of TL practice, an exception is that the "digital citizenship" standard have positioned a little bit above the others (M=3.94; SE=.06).

Logistic Regression Analysis

To examine the second research question, principals' TL profiles (0= low-profile; 1= high-profile) were regressed on their age, gender, weekly frequency of computer-internet usage informations, aggregated teacher perception of "team learning", "shared vision", "systems thinking" LO cultures and school's F@tih project status variables. The low-profile structure was determined as the reference class of logistic regression analysis. Thus, positive and significant regression coefficients nominate some predictor variables of principal's TL practices that enhance the assignment probability of a principal to the high-profile (see. Table 3).

Table 3. Technology leadership profiles regressed on the predictors

Predictors	High-profile TL (Outcome Variable)		
	B (SE)	*Odds Ratio (OR)*	*CI 95%*
Gender	- .10 (.35)	.91	.51-1.61
Age	.19 (.44)	1.21	.59-2.49
Computer usage	.46 (.42)	1.59	.80-3.16
Internet usage	1.26 (.56)*	3.53	1.41-8.80
Team learning (LO)	2.15 (.92)*	8.60	1.90-38.92
Shared vision (LO)	- .67 (.89)	.51	.12-2.22
Systems thinking (LO)	- .93 (.54)	.39	.16-.95
F@tih project schools vs others	3.25 (1.26)*	25.89	3.25-206.18

*p: p<.05

The results indicate that the probability that a principal would be classified in the high-profile is about four times higher than the one that principal is assigned to the low-profile if he/she would use internet technology more frequently (OR=3.53; 95% CI=1.41-8.80). To put it simply, we found that principal's internet usage frequency is able to predict one's TL profiles very likely. Besides, it was evidenced that principals are likewise nine times more likely to execute the high-profile TL practices in a school setting if teachers perceive a higher level of "team learning" culture in that setting (OR=8.60; 95% CI= 1.90- 38.92). Much more strongly, the results show that principals who manage F@tih project schools are almost twenty-six times more likely to carry out high-profile TL practices, compared to non-project schools' principals (OR=25.89; 95% CI= 3.25-206.18). Briefly, ICT infrastructure was found to be the most probable predictor of TL profiles assumed by Turkish principals. Schools' present LO culture of "team learning" was another influential factor on principal's TL profile. Thirdly, we found that the higher internet usage frequency drive up the probability of a principal to perform the higher level of TL practices.

Discussion, Conclusion and Suggestions

In the last couple of decades, national education systems invested a considerable amount of financial resource in establishing a widespread, equal and high-speed access to educational technologies in K-12 public schools (Blount, 2008; Dale, 2005; Kozma, 2005; Organization of Economic Cooperation and Development [OECD], 2006, 2010). Based on these public investments, national authorities launched a broad range of educational reform movements on ICT integration in many countries across the world such as Apple Classrooms for Tomorrow Project in USA; Information Society Program in Finland; School IT Project in Mauritius; Smart School Project in Malaysian; Educational Reform for Knowledge Economy in Jordan and F@tih project in Turkey ("Fatih Project", 2012; Jhurree, 2005; Kankaanranta & Linnakyla, 2004).Beyond the monetary and technical magnitude of those projects, Anderson and Dexter (2005) noticed that principals' TL practices and technology-oriented behaviors play a more important role in ICT integration processes than the provision of cutting-edge technological tools into schools.

It is obvious that infrastructral facilities are not unique determinants to take into account but also individual and cultural variables are other infleuntial factors on principal's TL practices (Tondeur et al., 2009; Vanderlinde et al., 2012). In this sense, it is known that there are considerable variations between principals in terms of their ICT use (Schiller, 2003), but yet their personal competence and frequency of ICT use improve their support to teachers for ICT integration in schools (Polizzi, 2011). Taking into account the cultural context, a positive school culture fostering team working, visionary approach and holistic perspective was stipulated to ensure the success of TL practices (Dexter, 2008, 2011; Tearle, 2004; Vanderlinde, van Braak, & Dexter, 2012).

Drawing on all these individual, contextual and infrastructural factors together, this study adds to the literature from two main perspectives. First, the present study achieved to classify Turkish principals' TL practices into two distinct profiles that identify how and to what extent school principals engage in ISTE standards of technology. Of these profiles, the high-profile TL structure covered 55% of principals with satisfactory interest to perform ISTE standards in schools; whereas, 45% of principals were ploted in the low-profile TL structure since those showed a rather low interest in the same standards. These results are quite consistent with those of Samancıoğlu et al. (2015) study, in that Turkish principals were profiled as high-profile (66%) and low-profile (34%) technology leaders based on teacher views. However, unlike the current study, Samancıoğlu et al. (2015) had investigated TL profiles without taking principal and school related factors into account. Diversely, our work challanged the issue from a more holistic point of view that involved all related factors.

The most striking result to emerge from this study suggests that principals of the technology-enriched F@tih project schools have a rather strong tendency to perform high-profile TL practices. In other words, the F@tih project investment made a contribution to existing managerial capacity of schools alongside their infrastructural assets. This result supports Anderson and Dexter's (2005, p. 56) TL model which delineates the interrealted relationship between infrastructure and TL in schools. It gains additional strength for the principals who use internet technology more frequently in their daily tasks and in the schools with a teaching staff who experiences the "team learning" LO culture. Likewise, Banoğlu (2012) showed that the higher level of TL practice predicts the higher frequency of internet usage with a statistical accuracy rate of 68%. The present study confirms a similar relationship, but from a reverse angle, that the higher frequency of internet usage predicts the higher level of TL practice for school principals. Unlike Banoglu's results, the present study did not indicate any predictive relationship between the computer usage and principal's TL practices. In parallel with our study, numerous other studies have drawn on the integrity of cultural and structural school characteristics as regard to TL practices performed in schools (Flanagan & Jacobsen, 2003; Tondeur et al., 2009; Vanderlinde, van Braak, & Dexter, 2012). Although the complementary of collegial cooperation and team-based leadership practices were already observed in the previous case studies (e.g. Dexter, 2011; Cuban, Kirkpatrick, & Peck, 2001), the findings in this study provided quantitative evidences to the literature.

Based on the present results, we concluded three implications for educational policy makers and practitioners as the following:

a) Gathering principals runing F@tih project schools and the others in the context specific TL meetings and workshops may improve experience sharing and dissemination of good leadership practices among principals.
b) In order to promote principals' TL practices, a broader internet usage among principals should be stimulated on virtual tools such as e-mails, social media groups and educational portals by official education policies.
c) Expanding technology-related professional learning networks among teachers may support principals to manage ICT integration process in a more effective way.

Despite having to do with exploratory nature of the clustering approach employed in the first research question (i.e. TL profiles), results derived from the second research question offer explanatory insights into the integrity of individual, cultural and structural factors on principals' TL practices. However, it is worthy to note that TL practices are not confined to positional leadership power of a principal (Davies, 2010). Therefore, further research can concentrate on teacher-level TL practices with a more inclusive focus. Another drawback concerning internal validity of the study is that F@tih project was restricted with secondary schools as of the date of 2015, therefore the results ignore the mediating effect of school-level variable on the prediction of principals' TL practices in the F@tih project schools. At last, the findings in this paper were limited with few principal demographics and three LO components of school culture. It would therefore of interest to involve many other cultural and structural school characteristics in further research.

Besides, there are various strengths and weaknesses in this study. Some primary strengths can be listed as applied multilevel analyses and combining multiple data source coming from teachers and principals into a comprehensive research model. The most important weakness of the study was the relatively small school-level sample size of 58 school principals, compared to 1105 teachers aggregated in those schools.

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