Education and Science tedmem

Vol 42 (2017) No 189 73-84

# Developing a Grounded Model for Educational Technology Leadership Practices

Yan Piaw Chua [1], Yee Pei Chua [2]

## Abstract

Educational technology leadership is defined as "technology-leadership integration" of influence that consists of a both the expertise in using ICT and the expertise in leading and managing the educational institution. This study investigated technology leadership practices among users of secondary schools' e-learning platform. Semi-structured interviews with school leaders, teachers, students and parents were conducted to gather information of educational technology leadership practices. Through domain analysis, a technology leadership model emerged from the data. The model was further validated with a quantitative survey study involving 209 school leaders. The findings established a grounded model for technology leadership practices in schools.

## Keywords

Educational technology leadership
Technology-leadership integration
E-learning platform
Secondary school
Grounded model

## Article Info

Received: 06.15.2016
Accepted: 11.28.2016
Online Published: 02.21.2017

DOI: 10.15390/EB.2017.6705

## Introduction

In the digital era, the use of information technologies such as the internet with personal computers, smart phones and mobile phone applications in monitoring school activities and networking among school communities has increased. Schools are equipped with e-learning platform to comprehend face-to-face teaching and learning processes (Alvarez, Martín, Fernandez-Castro, & Urretavizcaya, 2013). As schools rely more on technology, school leaders need to change their role as technology leaders - leaders who can lead and manage staffs through technology in e-learning platform; who are technology-skilled and able to integrate technology in leadership. The new technology leadership requires the leader to achieve leadership objectives in a computer-mediated manner with virtual teams that are dispersed over space and time (Fonstad, 2013).

However, the problem that faces the application of technology leadership in schools is sometimes not the failure of the e-learning platform or computer facilities but the attitude and behavior of leaders, the organizational culture, the readiness of leaders and staffs, and their unwillingness to adapt and change (Hung, 2016; Jameson, 2013). To address these issues, this study is conducted to understand technology leadership practices in a school e-learning platform. It proposes a technology leadership model in understanding the underlying mechanisms that account for school technology leadership quality.

[1] University of Malaya, Institute of Educational Leadership, Malaysia, chuayp@um.edu.my
[2] Universiti Putra Malaysia, Faculty of Computer Science and Information Technology, Malaysia, yeepei94@hotmail.com

***Literature Review***

Technology leadership is defined as "virtual relationships of influence" whereby this new highly adaptive field of knowledge affects multiple daily interactions across professional education and training, spontaneously involving people who use social networking facilities regularly both at home and at work (Jameson, 2013). It is also defined as "technology-leadership integration" of influence that consists of a both the expertise in using ICT and the expertise in leading and managing the educational institution (Flanagan & Jacobsen, 2003). Technology leadership skills consist of two dimensions - the ICT skills and the leadership skills. The ICT skills include "deep knowledge" of the application and maintenance of ICT (e.g., functional; technical; product-related; and customer experience-related); the leadership skills represent expertise in developing the organization, i.e., competence in leadership and management (e.g., envisioning; building and aligning relationships across boundaries; sense making; inventing) (Fonstad, 2013). The strength of technology leadership is depended on how well technology and leadership skills are integrated. The Adaptive Structuration Theory has been employed to explain how technology and leadership impact and depend on each other in e-organizations and that the technology-leadership integration is heavily dependent on technology-knowledge, technology-skills and technology leadership quality (Purvanova & Bono, 2009). However, although technology leadership is needed at all levels of e-learning and teaching, the implementation of technology leadership in schools, on the whole, has not been accompanied by specific technology leadership training (Jameson, 2013), and the common failure of the implementation of e-learning and teaching is typically due to scarce technology leadership (Hanna, 2009).

A search for research related to technology leadership finds only a small number of documents and most are at the early stage of conceptualization. Examples of areas of technology leadership studies are: the potential of implementing technology leadership in schools (Alenezi, 2016), skills of the technology leader (Garcia, 2015), globalization and innovation in educational technology (Bowen et al., 2013), technology leadership styles (Hadjithoma-Garstka, 2011), roles of technology leaders (Tan, 2010), technology competency (Afshari, Bakar, Wong, Samah, & Fooi, 2009), the support and training for the effective delivery of e-learning (McPherson & Nunes, 2008), technology leadership challenges and opportunities (Barwick & Back, 2007).

Scholars have the same opinion that technology leadership research in education is scarce. For example, reviewing seventy-seven journal articles regarding technology leadership, DasGupta (2011, pp. 30) summarizes that "there does not appear to be any serious disagreement amongst scholars on technology leadership; However, there is agreement that this is a new field and that more research needs to be conducted." Jameson (2013, pp. 901) also reports that, "technology leadership research in education has barely emerged into public recognition as a research concept within the recognisable surface of scholarly endeavour, judging by its still thin citation counts, on the whole research studies in technology leadership appear to be surprisingly limited within the databases available"

Because technology leadership research in education is scarce, several scholars (van Welsum & Lanvin, 2012) have expressed their concern over the "what" and the "how" on the application of technology leadership in schools, specifically the questions of "what are the factors that determine the quality of technology leadership practices in schools?" and "how is the quality of technology leadership practices in schools enhanced?"

To address the missing link and gap, this study investigates school technology leadership practices in a school e-learning platform. Specifically, the objectives of this study are to develop a grounded model of technology leadership practices in schools and to further validate the model.

## Method

### *Establishing a Grounded Model of Technology Leadership Practices in Schools*

To establish a grounded model of technology leadership practices in schools, first, semi-structured interviews with a group of users of a school e-learning platform - 20 school leaders, teachers, students and parents were conducted to gather the themes of technology leadership practices in schools. Second, the model was further validated with a quantitative survey study involving 209 school leaders.

The interpretative research method was adopted to achieve the first objective, that is, the collection of a rich set of data from a variety of sources of a small number of participants in detail and in depth (Chua, 2016). It involves the creation of a model that fully and directly emerges from the data, not from the researcher (Conrad, 1995). The grounded theory research design is appropriate for this study because it gives due consideration to the theoretical requirements and the interpretative method (Glaser & Strauss, 1967). With the grounded theory design, the interview data were systematically analyzed and interpreted to generate a model or theory regarding a phenomenon that is grounded from its data (Strauss & Corbin, 1990).

In grounded theory research, the outputs can be adapted, implemented, and reassessed according to the researcher's need (Creswell, 2005). One of the main criteria to determine the validity of the outputs is the ability of the theory generated to be adapted for application in various contexts (Strauss & Corbin, 1990). For this, in the present study we refer to the emerging theoretical framework in which the original interview data are categorized with open coding and re-examined for further evidence. Then we use axial coding, which is the process of developing main themes, to trace the relationships between themes and to enhance the validity and reliability of the study (Creswell, 2005).

### *Participants of the Study*

Sampling in grounded theory research is generally used to select respondents with the potential to provide the researcher with the information required to generate a theory/model implicit in the corpus data. School leaders (n=5), teachers (n=5), students (n=5) and parents (n=5) were selected as the main respondents because they were directly involved in the implementation of the e-learning platform in schools.

All of the interview respondents were active users of the school e-learning platform, the VLE FROG, a nationwide e-teaching and learning program performed by the Malaysian Ministry of Education. This e-learning platform has 11 million users in all schools nationwide in Malaysia, including 6 million students, 4.5 million parents and 500,000 teachers, spread across 10,000 schools, over 329,847 square kilometres (Xchanging, 2014). The VLE allows users to be organized into groups and roles; to present resources, activities and interactions within a course structure; to provide for the different stages of assessment; to report on the participation rate; and to have some level of integration with other institutional systems (Martin, 2007).

### *Research Instrument*

Two interview inventories were constructed for the collection of in-depth qualitative data from the four groups of respondents. (1) The *Teacher, Student and Parent* Inventory contains four items concerned with their commitment to and satisfaction with the effective implementation of the e-learning platform in schools; (2) The *School leaders Inventory* with four items concerning their technology leadership roles and involvement in implementing the e-learning platform in schools. The inventories include items on problems with planning and implementation, the support given for the implementation of the e-learning platform and recommendations to enhance the effectiveness of technology leadership practices in leading and monitoring the e-learning platform in schools.

### *Data Collection and Analysis*

In qualitative data analysis, data collection and analysis are always performed simultaneously (Strauss, 1987). The transcribed interview data was analyzed using the Atlas.ti software (Ringmayr, 2012), which is used for recording and coding the data. Grounded theory research uses a systematic method of data collection and analysis with the aim of constructing an in-depth understanding of social and psychological phenomena (Chenitz & Swanson, 1986). Atlas.ti is an ideal tool for analyzing data in connection with grounded theory research. To achieve this aim, data analysis involves two types of coding: open coding and axial coding. Open coding involves checking and rechecking data that have been collected and transcribed and in which relevant codes are given to statements that are both meaningful and important, while axial coding is a synthesis of open coding as the codes for categories are connected to each other.

To make the link between codes, a domain analysis technique, the Spradley's (1980) *Semantic Relationship Questions Technique* was employed. The types of question asked include "*How is this statement linked to other statements?*", "*Are there similarities to other statements*?", "*Is it the outcome of a strategy?*", "*Is it the cause of the implementation?*" and "*Is it the outcome of a process?*" This technique enables the researcher to arrange and place an idea with data with the same theme in a domain. The categories of a sub-theme are identified using nine universal semantic relationships, for examples, strict inclusion (X is a kind of Y); cause-effect (X is an outcome of Y); rationale (X is a reason for doing Y) and sequence (X is a step or stage in Y). By coding each statement and paragraph in the data, themes are emerged and their relationships are identified.

## Results

From the domain analysis, eight core themes emerged from the data, namely, *readiness, practices, strategies, support, culture, needs, hindrances* and *technology leadership quality*. The story line and analytic story for the grounded model was stated by taking technology leadership quality as the main theme and tracing its relationship to the other themes.

### *Story Line*

The research data show that technology leadership is needed in schools because schools are equipped with e-learning platform to facilitate teaching and learning processes and to help teachers overcome the deficiency of face-to-face practices. The readiness of the leaders in terms of technology-knowledge, technology-skills, computer-mediated communication competences and positive school culture with strong support for the technology leaders affect technology leadership practices and strategies in the schools. On the other hand, negative attitude and low commitment among users, the failure of the e-learning platform and insufficient training are hindrances that reduce rate of usage of the e-learning platform.

Besides that, effective strategies are essential for implementing high quality technology leadership in schools. Effective strategies include developing a compelling mission and vision for networking, providing computer-mediated communication competence training, enhancing lifelong learning, building close and positive relationships among users and fostering the maximum use of the e-learning platform. To improve technology leadership practices, schools must create conducive infra-structures for e-teaching and learning, stimulate e-collaboration between users and external parties (e.g. education departments and parents), reward self-e-learning initiatives, and create a better e-workplace and pathways for networking among users.

### *Analytic Story*

The output generated from axial coding shows that technology leadership quality is important for the implementation of the e-learning platform in school. Good strategies, e-learning culture and support will ensure the quality of technology leadership in schools. However, the main challenges of technology leadership are the context of preparedness (readiness) and the school/personal context (hindrances). The relationships among the variables extracted from the qualitative data are shown in the grounded model of technology leadership (Figure 1).

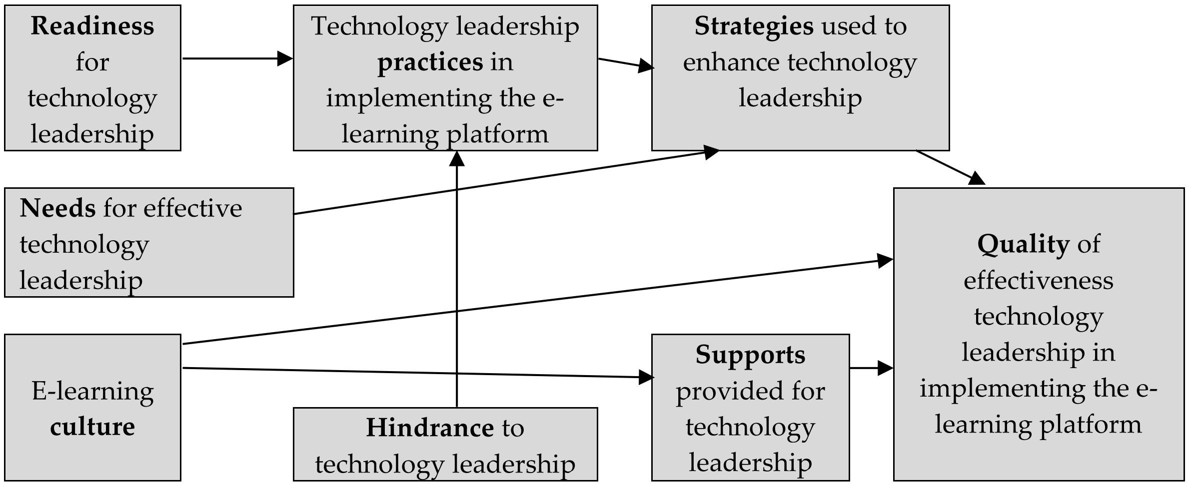


**Figure 1.** The Grounded Model of Technology Leadership in Schools

### Validating the Grounded Model

#### *Participants*

Quantitative survey data were collected from 209 school leaders at secondary schools. They played the role of leaders in leading, managing and monitoring the use of the e-learning platform in schools. The participants were school principals (n = 52, 24.88%) and senior assistants (n = 157, 75.12%). Among them, 74 are males (35.41%) and 135 are females (64.59%). The participant's average age is 46.9. In terms of ethnicity, 180 of them are Malay (86.12%), 17 are Malaysian Chinese (8.13%) and 12 are Malaysian Indian (5.75%). The majority of the respondents (n = 142) have at least 5 years of experience as school leader (67.94%) and 67 of them have less than 5 years of experience (32.06%). In terms of education, nearly half of them (n = 98, 46.89%) possess master degree, 109 with bachelor degree (52.15%) and two of them are doctoral degree holders (0.96%).

#### *Survey Questionnaire*

The survey questionnaire used in this study consisted of two sections that correspond to the demographic details and eight main variables in the technology leadership model generated from the emerging data of interview. There were a total of 40 items. The items were created based on the data of each theme generated from the semi-structured interviews. For example, the first item of needs is "*Technology leadership is needed because of more investment in ICT in school*". The items used a categorical scale of measurement ranging from 1 to 5, the Likert type scale with "1" indicating "strongly disagree" and 5 indicating "strongly agree". The item statements were validated by a panel of three educational expects from a local university.

#### *Data Analysis*

For testing the validity and reliability of the model, PLS-SEM analysis was performed in two stages. First, the validity (construct validity and discriminant validity) and reliability (composite reliability and Cronbach's alpha internal consistency reliability) of the variables (the eight themes) were examined to ensure that the items validly and reliably represented the concepts of the eight variables in the model. Finally the relationships among the variables were identified and reported.

## Results

#### *Preliminary Analysis of Data: Validity and Reliability of the Variables*

PLS-SEM is a non-parametric model testing analysis that does not require that the data of the items involved in the analysis are normally distributed. However, the validity and reliability of the variables in the model should be established prior to examination of the relationship among the variables. This is to ensure that the eight variables are validly and reliably represented by their indicators, which are the instrument items. In PLS-SEM analysis, the eight variables are latent variables that are reflectively represented by their indicators. The convergent validity of a variable is achieved when the loadings of the items for each variable are (i) significant, with (ii) the loading of each individual item being greater than .50, and (iii) the average variance extracted (AVE) for the variable being greater than .50 (Hair, Hult, Ringle, & Sarstedt, 2016). The outputs of the validity and reliability analysis of the eight variables are presented in Table 1. The results show that the eight variables achieved their construct validity. In addition, the variables were reliable because reliability of a variable is achieved when both values of Cronbach's alpha and composite reliabilities are greater than .70 (Hair et al., 2016).

**Table 1.** Validity and Reliability of Variables in the Model

| Latent variables | Indicator | Convergent validity | | Reliability | |
|---|---|---|---|---|---|
| | | Loading | AVE | Composite Reliability | Cronbach's Alpha Reliability |
| Culture | C1 | .9253*** | .8612 | .9413 | .9462 |
| | C2 | .9482*** | | | |
| | C3 | .9331*** | | | |
| | C4 | .9050*** | | | |
| Hindrances | H1 | .9231*** | .8533 | .9488 | .9425 |
| | H2 | .9520*** | | | |
| | H3 | .9331*** | | | |
| | H4 | .8855*** | | | |
| Need | N1 | .8374*** | .7408 | .9423 | .9404 |
| | N2 | .9021*** | | | |
| | N3 | .8810*** | | | |
| | N4 | .8848*** | | | |
| | N5 | .8945*** | | | |
| | N6 | .8638*** | | | |
| | N7 | .7521*** | | | |
| Practices | P1 | .8923*** | .7705 | .9427 | .9158 |
| | P2 | .8861*** | | | |
| | P3 | .8336*** | | | |
| | P4 | .8802*** | | | |
| | P5 | .8936*** | | | |
| | P6 | .8795*** | | | |
| Technology leadership quality | Q1 | .9137*** | .7986 | .9307 | .9413 |
| | Q2 | .8590*** | | | |
| | Q3 | .9029*** | | | |
| | Q4 | .8981*** | | | |
| Readiness | R1 | .9096*** | .6959 | .9171 | .8832 |
| | R2 | .8760*** | | | |
| | R3 | .8906*** | | | |
| | R4 | .9086*** | | | |
| | R5 | .5158*** | | | |
| Strategies | S1 | .7659*** | .6718 | .9246 | .9182 |
| | S2 | .8474*** | | | |
| | S3 | .8708*** | | | |
| | S4 | .8260*** | | | |
| | S5 | .8570*** | | | |
| | S6 | .7657*** | | | |
| | S7 | .7980*** | | | |
| Support | S1 | .9152*** | .8037 | .9408 | .9508 |
| | S2 | .9237*** | | | |
| | S3 | .9212*** | | | |
| | S4 | .8785*** | | | |
| | S5 | .9065*** | | | |
| | S6 | .8302*** | | | |

*** significant at $p < .001$.

The discriminant validity of a construct is achieved when inter-correlations among the variables in the model are smaller than .90. The implication is that the variables are independent to one another and no overlapping of concepts is found. Multi-collinearity causes overlapping of concepts among the variables in a model. This problem exists in model testing due to extremely strong inter-correlations ($r \geq .90$) between variables in the model (Byrne, 2010). The results in Table 2 show that the inter-correlation coefficients among all of the variables were less than .90. The variables are free of multi-collinearity problems, and therefore the discriminant validity of the variables for the model is achieved.

**Table 2.** Inter-correlations among the Variables in the Model

| Latent variables correlation | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Culture | 1.0000 | | | | | | | |
| 2. Hindrances | -.8188 | 1.0000 | | | | | | |
| 3. Needs | .8257 | -.8023 | 1.0000 | | | | | |
| 4. Practices | .7851 | -.7585 | .8338 | 1.0000 | | | | |
| 5. Technology leadership quality | .7703 | -.7350 | .7354 | .7237 | 1.0000 | | | |
| 6. Readiness | .8148 | -.8021 | .7678 | .7436 | .7816 | 1.0000 | | |
| 7. Strategies | .6485 | -.6640 | .6987 | .7438 | .6729 | .6737 | 1.0000 | |
| 8. Support | .8136 | -.7378 | .7714 | .7564 | .8589 | .7726 | .6801 | 1.0000 |

***The Final Model***

The PLS-SEM analysis using SMART PLS was performed to establish the relationship among the variables in the model. SMART PLS is one of the latest software applications that enable researchers to accurately and effectively model and analyze inter-relationships among latent variables that have multiple indicators (Hair et al., 2016). Specifically, with the SMART PLS, multiple equations of the correlational and causal relationships in a model are computed simultaneously. It enables researchers to support their theories by extending the standard multivariate analytical methodology, which includes regression, factor analysis and analysis of variance.

The final model depicted in Figure 2 consists of the technology leadership quality variable with its seven core factors. Technology leadership quality is directly influenced by three core factors, namely, culture, support and strategies; and it is indirectly influenced by readiness, practices, needs and hindrances. The data in Table 3 indicate that the factors contribute 76.2% of technology leadership quality ($R^2 = .762$).

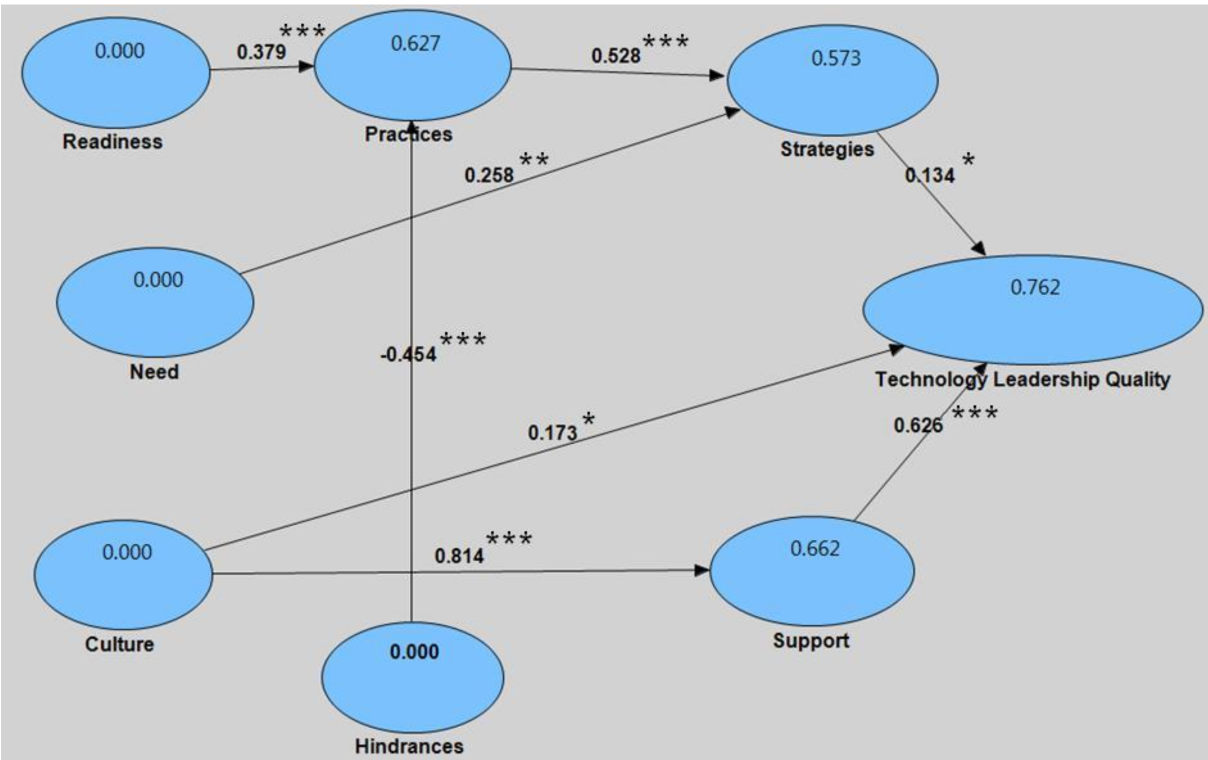


**Figure 2**. The Model of Technology Leadership Quality

**Table 3.** T-Statistics, Standardized Regression Weights ($\beta$) and $R^2$ of the Relationships among the Variables in the Model

| Regression | | | T-statistics (Bootstrapping value) | Standardized regression weights ($\beta$) | $R^2$ |
|---|---|---|---|---|---|
| Independent variable | | Dependent variable | | | |
| Culture | ---> | Technology leadership quality | 2.012* | .173 | .762 |
| Strategies | ---> | Technology leadership quality | 2.042* | .134 | |
| Support | ---> | Technology leadership quality | 5.814*** | .626 | |
| Practices | ---> | Strategies | 4.722*** | .528 | .573 |
| Needs | ---> | Strategies | 2.337* | .258 | |
| Readiness | ---> | Practices | 3.276** | .379 | .627 |
| Hindrance | ---> | Practices | 3.904*** | -.454 | |
| Culture | ---> | Support | 16.292*** | .814 | .662 |

* Significant at $p < .05$; ** Significant at $p < .01$; *** Significant at $p < .001$;

Among the three direct factors of technology leadership quality, support is the main factor ($\beta$ = .626, $p < .001$), followed by culture ($\beta$ = .173, $p < .05$) and strategies ($\beta$ = .134, $p < .05$). A one-unit input of positive culture chance would cause a .626-unit increase in technology leadership quality. The implication is that, with full support, a conducive culture and the right strategies, technology leadership quality would be maximized to 76.2% ($R^2$ = .762).

A total of 57.3% of the strategies used by the technology leaders are significantly influenced by practices ($\beta$ = .528, $p < .001$) and need ($\beta$ = .258, $p < .01$). Therefore, to improve strategies, technology leaders need to maximize practices and fulfill the needs of the users of the school e-learning platform.

In addition, a total of 66.2% of the support provided by technology leaders is due to the culture (β = .814, $p < .001$), whereas the main factors of technology leadership practices are readiness (β = .379, $p < .001$) and hindrances (β = -.454, $p < .001$) of the leaders.

The sub-models of the technology leadership quality model are presented in Table 4. These sub-models are the basics of the technology leadership model.

**Table 4**. Sub-models of the Technology Leadership Grounded Model

| Sub-model | Regression model | $R^2$ | Effect |
|---|---|---|---|
| 1. | Technology leadership quality = .628 Support + .175 Culture + .136 Strategies | *.762* | *Strong* |
| 2. | Strategies = .529 Practices + .258 Needs | *.573* | *Moderate* |
| 3. | Practices = .379 Readiness - .455 Hindrances | *.627* | *Moderate* |
| 4. | Support = .814 Culture | *.662* | *Strong* |

Effect size for $R^2$: weak effect = .04; moderate effect = .25; strong effect = .64 (source: Ferguson, 2009).

## Discussion

Creswell (2005) stated that a theory or model in grounded theory research generated from the research data is an abstract explanation or understanding of a process concerning variables in some topic hidden in the research data. The finding of the qualitative data analysis in this study leads to the formation of the technology leadership quality model, which can be used as a reference for technology leadership practices in implementing the school e-learning platform. However, the model that is generated from the data does not have a wide scope of applications (Chua, Tie, & Zuraidah, 2013; Glaser & Strauss, 1967). Hence, the model produced from this study does not aim to produce standards to be used in all schools or to compare with existing standards in the implementation in schools. Nevertheless, it can be used as a reference by schools involved in the implementation of the e-learning platform in enhancing technology leadership quality.

The following four criteria emerged from the current study can be used in defining the model of technology leadership quality in schools. First, school leaders and followers should be given full support in implementing the e-learning platform. In terms of support, school leaders need to create an e-teaching and learning workplace and provide a relevant infra-structure; create conducive pathways for networking among users; give psychological support for networking among users; make networking an incentive and a basic for the performance rating of staff. Besides that, school leaders need to create a conducive technology leadership culture to maximize technology leadership practices. The strategies for encouraging a research culture include creating an appetite among users; designing user-friendly curricula to enhance the rate of usage; fostering multi-disciplinary approaches to networking among users; promoting a better and greater use of e-teaching and learning. In addition, school leaders should practice well-designed strategies, including reshaping objectives and curricula in line with e-teaching and learning; organizing technology-competence training among teachers, students and parents; building long-term relationships among all users across boundaries and monitoring progress; stimulating change for positive mindsets towards e-teaching and learning and network thinking; developing a compelling mission and vision for networking; and managing the maximum use of ICT services (process, design, networking among users) (refer to sub-model 1 in Table 4).

Second, the strategies taken by school leaders must be appropriate, with good practices that include adapting new models to increase effectiveness; maximizing value from ICT spending by the institution; enhancing the use of ICT in teaching and learning; leading a proper way of using ICT in schools; leading as role models for e-communication and encouraging active participation; and setting proper institutional goals for implementing e-teaching and learning in the school. Besides that, the strategies must be in line with the needs, that is the demand for and investment in ICT; online instructional guides and coaching; developing more uses of ICT; for global cooperation; leading for changes and enhancing the cooperation of the school with external parties, i.e., education officers, parents, staff and students (refer to sub-model 2 in Table 4).

Third, the practices of technology leadership in implementing an e-learning platform should be in line with the readiness. The users must be ready for implementation before the practices can be maximized. Readiness on the part of school leaders and followers includes their attitude towards technology leadership; leadership skills, e-teaching and learning knowledge and skills; networking knowledge and skills; and computer-mediated competencies. On the other hand, to maximize the output quality of the strategies, leaders need to minimize or remove the four main technology leadership hindrances, which include the failure of technology; a negative attitude and low commitment among users; insufficient ICT knowledge and skills; and insufficient ICT training (refer to sub-model 3 in Table 4).

Fourth, to cultivate a technology leadership culture in the school, schools need to provide full support to their community. This support includes providing psychological support and implementing a positive reward system for e-learning; providing a relevant infra-structure and workplace; and creating conducive pathways for networking (refer to sub-model 4 in Table 4).

The grounded model of technology leadership quality of this study is supported by several researchers who state that technology leaders must provide strong support for the implementation of the e-learning platform (Fonstad, 2013); be able to maintain a conducive culture within the users (Albidewi, 2014); emphasize on the needs and readiness of users (Hung, 2016); be able to practice effective technology leadership and implement strategies that are relevant to the ever-evolving nature of technology (Garcia, 2015). In implementing e-learning and teaching in schools, leaders should always be aware and attempt to reduce the hindrances to maximize practices and strategies (Alwidi & Cooper, 2015; Lilian, 2014; Weng & Tang, 2014) to achieve a high level of technology leadership quality in schools.

## Conclusion

This study generates a model for the implementation of technology leadership in school e-learning platform. Researchers can use this information to identify unanswered issues or questions in the literature and define future research directions concerning technology leadership. The study helps educators better understand the concept of effective technology leadership and the factors that are related to it.

The strength of this study is that it suggests an approach to further validating the grounded model to improve the generalizability of the model. However, the findings of this study are limited to the characteristics of the school sample and the e-learning platform, further research in technology leadership can be conducted in other locations and fields of studies to provide a greater picture of technology leadership practices.

## Funding

This work was supported by the University of Malaya Research Grant, Institute of Research Management & Monitoring, University of Malaya [Grant no: UMRG-RG345-15AFR].

## References

Afshari, M., Bakar, K. A., Wong, S. L., Samah, B. A., & Fooi, F. S. (2009). Factors affecting teachers' use of information and communication technology. *International Journal of Instruction, 2*(1), 76-104.

Albidewi, I. (2014). Technology leadership system: A futuristic vision. *International Journal of Business and Management Review, 2*(2), 91-101.

Alenezi, A. (2016). Technology leadership in Saudi schools. *Education and Information Technologies, 21*, 1-12. doi:10.1007/s10639-016-9477

Alvarez, A., Martín, M., Fernandez-Castro, I., & Urretavizcaya, M. (2013). Blending traditional teaching methods with learning environments: Experience, cyclical evaluation process and impact with MAgAdI. *Computers & Education*, *68*, 129-140.

Alwidi, I. T., & Cooper, M. (2015). Using management procedure gaps to enhance e-learning implementation in Arica. *Computers & Education*, *90*, 64-79.

Barwick, D., & Back, K. (2007). High tech's double edge: creating organizationally appropriate responses to emerging technologies, *On the Horizon*, *15*(1), 28-36.

Bowen, E. E., Bertoline, G. R., Athinarayanan, R., Cox, R. F., Burbank, K.A., Buskirk, D. R., & Kucukonal, H. (2013). Global technology leadership: A case for innovative education. *Praxis, Procedia Social and Behavioral Sciences*, *75*(3), 163-171.

Byrne, B. M. (2010). *Structural equation modeling with SMART PLS: basic concepts, applications, and programming (2nd ed.)*. N.Y.: Routledge, Taylor and Francis Group.

Chenitz, W. C., & Swanson, J. M. (1986). *From practice to grounded theory*. Menlo Park, CA: Addison-Wesley.

Chua, Y. P. (2016). *Mastering research methods* (2nd ed.). Shah Alam: McGraw-Hill Education.

Chua, Y. P., Tie, F. H., & Zuraidah, M. D. (2013). Creating an education research acculturation theory for research implementation in school. *Education and Urban Society, 45*(4), 506-513. doi: 10.1177/0013124511413124

Conrad, C. F. (1995). A grounded theory of academic change. In B. G. Glaser (Ed.), *Grounded theory 1984-1994* (pp. 699-718). Mill Valley, CA: Sociology Press.

Creswell, J. W. (2005). *Educational research: planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson.

DasGupta, P. (2011). Literature review: technology leadership. *Emerging Leadership Journeys*, *4*(1), 1- 36.

Ferguson, C. J. (2009). An effect size primer: a guide for clinicians and researchers. *Professional Psychology: Research and Practice*, *40*(5), 532-538.

Flanagan, L., & Jacobsen, M. (2003). Technology leadership for the twenty-first century principal. *Journal of Educational Administration*, *41*(2), 124-142.

Fonstad, N. (2013). E-Leadership skills. In *e-skills vision: e-skills for competitiveness and innovation vision, roadmap and foresight scenarios: Final report* (pp. 67-103). Germany: The European Commission.

Garcia, I. (2015). Emergent leadership: Is technology leadership importance in the quality of virtual education? *RIED: Revista Iberoamericana de educación a Distancia, 18*(1), 25-44.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory*. Chicago, IL: Aldine.

Hadjithoma-Garstka, C. (2011). The role of the principal's leadership style in the implementation of ICT policy. *British Journal of Educational Technology*, *42*(2), 311-326.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2016). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.). Thousand Oaks: Sage.

Hanna, N. K. (2009). *E-Transformation: Enabling new development strategies*. Bathesda, MD: Springer Science & Business Media.

Hung. M. L. (2016). Teacher readiness for online learning: Scale development and teacher perceptions. *Computers & Education*, *94*, 120-133.

Jameson, J. (2013). Technology leadership in higher education: The fifth "age" of educational technology research. *British Journal of Educational Technology*, *44*(6), 889-915. doi: 10.1111/bjet.12103

Lilian *S. C. (2014).* Virtual teams: Opportunities and challenges for technology leaders. *Procedia Social and Behavioral Sciences*, *110*, 1251-1261.

Martin, W. (2007). *Virtual learning environments: using, choosing and developing your VLE*. London: Routledge.

McPherson, M. A., & Nunes, J. M. (2008). Critical issues for e-learning delivery: what may seem obvious is not always put into practice. *Journal of Computer Assisted Learning*, *24*(5), 433-45.

Purvanova, R. K., & Bono, J. E. (2009). Transformational leadership in context: face-to-face and virtual teams. *The Leadership Quarterly*, *20*, 343-357.

Ringmayr, T. G. (2012). *Atlas.ti 7 quick tour: revision 27*. Berlin: ATLAS.ti Scientific Software Development. Retrieved from http://atlasti.com/wp-content/uploads/2014/05/QuickTour_a7_en_07.pdf

Spradley, J. P. (1980). *Participant observation*. Orlando, FL: Harcourt Brace Jovanovich College Publishers.

Strauss, A. (1987). *Qualitative analysis for social scientists*. Cambridge, UK: Cambridge University Press.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park: SAGE.

Tan, S. C. (2010). School technology leadership: lessons from empirical research. In: C.H. Steel, M.J. Keppell, P. Gerbic, & S.Housego (Ed.), *Curriculum, technology and transformation for an unknown future. Proceedings of the 2010 Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) 2010 Conference* (pp. 896-906). Sydney, Australia.

van Welsum, D., & Lanvin, B. (2012), *Technology leadership skills: vision report, prepared for the European Commission*, DG Enterprise and Industry. Retrieved from http://eskillsvision.eu/fileadmin/eSkillsVision/documents/Vision%20report.pdf

Weng, C. H., & Tang, Y. (2014).The relationship between technology leadership strategies and effectiveness of school administration: an empirical study. *Computers & Education*, *76*, 91-107. doi:10.1016/j.compedu.2014.03.010

Xchanging. (2014). Case study, Ministry of Education, Malaysia. Retrieved from https://www.xchanging.com/sites/default/files/XCH_CaseStudy_1BestariNet_May2014_0%20UPDATED.pdf