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Technology Leadership in Malaysian Schools:

The Way Forward to Education 4.0 – ICT Utilization and Digital Transformation

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ABSTRACT

Education 4.0 is the answer to the global needs for the advanced integration of humans and technology. Leading school's technology utilization can be the way forward to support Education 4.0 realization. This study aims to investigate the effects and roles of principals' technology leadership towards teachers' ICT utilization and students' academic performance in secondary schools in Selangor, Malaysia. This empirical study uses a set of questionnaires to gather information from respondents who are in the teaching profession. A total of 310 questionnaires were completed and analyzed. The findings have shown significant positive impacts between the effects of the technology leadership roles of principals on teachers' effective ICT utilization and students' academic performance. The integration of ICT and technological tools in schools has a great challenge towards the new era of the Education 4.0 system. This suggests that principals who embrace technology will effectively lead their schools to acquire educational resources to enhance student engagement and learning.

KEYWORDS

Digital Transformation, Education 4.0, ICT Utilization, Malaysia, Principals, Teachers, Technology, Technology Leadership

INTRODUCTION

In an era that focuses on smart technology, artificial intelligence and robotics, educational institutions must produce a highly skilled and capable workforce who can take advantage of the tools available in this technologically transformed world. Accordingly, education 4.0 needs to cater to the needs of Industrial Revolution (IR) 4.0 by introducing students to the potential of digital technology, open-sourced content and personalized data. By aligning teaching and learning methods with the skills needed in the future, education institutions need to produce students who are well-equip with the 21st century skills and knowledge to face the challenges of fourth industrial revolution. One of the strategies can be taken is accelerated remote learning, which is the idea that students learn theoretical knowledge remotely using digital means, whilst ensuring any practical skills are still learnt face-to-

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face. This is a more flexible way of learning that requires accountability, good time management, and skills that need to be relied on due to the rise in the freelance economy (Anealka Aziz, 2018).

In implementing ICT into schools, the main responsibilities of the principal, is to ensure that the best method to stimulate the learners' to learning process are done through effective ICT infrastructure and staffs exposure to it (Gurr, 2000). A school principal is the main agent in bringing successful digital transformation in schools (Hall & Hord, 2001). Researchers also justified that an important element in a smooth technological change in school, is obviously the school principal (Hallinger & Heck, 1996). Furthermore, the attitude exhibited by the principals while in the process of the technology implementation or innovation towards it differs and the consequences to it may lead to greater execution success. Principals are often regarded as the backbone of a school to provide the interventions that either increases the potential for it to be a success of a change or it to be failure (Dexter, 2008). A principal's technology leadership role is essential so that the school's teaching and learning systems can be in place to make the process more efficient (Gurr, 2000), including the recruitment of the school's staffs to manage and govern the ICT implementation.

Technology leadership is the combination of strategy and general leadership techniques. However it is more focused on technology, particularly those which has a connection to access towards tools (Killen, 2005). Technology updating and the realization that the professional expansion and application of technology is always changing according to the needs of the generation. Metcalf (2012) states that school leaders are facing challenging task of applying current digital transformation in order to make the learning process more effective. A school leader must combine various responsibilities to ensure those technology resources are available and safe for the use of students and teachers alike. Simultaneously, school leaders must become a role model to encourage the use of ICT in the teaching and learning process and also organizational management in this 21st century (MOE, 2013). How to effectively lead the teaching and learning process in order to facilitate students to learn theoretical knowledge by using digital means, is the main challenge for the school technology leadership (Wachira & Keengwe, 2011).

The Malaysian education system is facing some challenges in regards to current digital transformation. Continuously, there is a pressure for schools to be equipped and prepared towards the 21st century education system . Although, the government has continuously given adequate attention and support for the digitalized education system (Ministry of Education, 2012), the key focus is how school leaders are moving forward and where they are make the most progress. The connection between principals' technology leadership and the effectiveness of ICT implementation in schools has been reported in previous researches (Brooks-Young, 2000; Gibson, 2002; Gurr, 2000). According to Gibson (2002), one of the most important issues in the success of school technology integration includes the effectiveness of principals' technology leadership that can directly influence in fully utilization of ICT by teachers. The efforts from school leaders to answer these questions, will help the younger generation to go through a quality and updated education system (Leong, 2010; Lu, 2013; Wahdain & Ahmad, 2014).

The competitive Malaysian education system to global needs to be transformed in the line with the development of the industrial revolution 4.0. the development of advanced technology like robotics, Internet of Things (IoT), and big data analytics are expected to change the landscape of Malaysian education system. Education 4.0 creates various opportunities for teachers to engage in new teaching and learning technology tools and it improved the teachers' knowledge on ICT more in depth (Lawrence, Lim & Abdullah, 2019). Moreover, principals need to know how technology can improve students' achievement, how to make data driven decisions, how much technology staff and technological support are required and carry out the technology policies. Therefore, there is a need to investigate the various aspects of technology leadership roles in schools. In a nutshell, technology management stresses the achievement of management efficiency by ensuring the right information can be obtained at the right time. This research specifically aims to identify the technology leadership roles of principals towards effective ICT utilization in schools as well as to identify the relationship

between the effects of technology leadership roles towards teachers' effective ICT utilization and students' academic performance.

LITRATURE REVIEW

Principal Technology Leadership With NETS-A

Technology Leadership in this study encompasses the knowledge and skills that included what every K-12 administrator need to know and be able to do with technology regardless of any other jobs given. There are few behaviors being used to assist school principals in increasing their technology leadership and providing guidelines to support their expertise that are contained in the NETS-A, proposed by the International Society of Technology in Education (ISTE) IN 2002 (Creighton, 2003).

The NETS-A standards are categorized into six sections; (a) Vision, Planning and Management, (b) Learning and Teaching (c) Staff Development and Training, (d) Technological and Infrastructure Support, (e) Evaluation and Research (f) Interpersonal and communication Skills. Flanagan and Jacobsen (2003) suggested that technology leadership of principals is more effective with the integration of NETS-A as standard criteria as it can influence and empower the technology plans with the school community. In order to guide principals in accomplishing their daily school technology plans required on a daily basis, the NETS-A standards plays an important role (Flanagan and Jacobsen (2003). Without standards, school administrators, schools of education, and state agencies are limited in their ability to provide the needed proficiency in school activities (International Society of Technology in Education [ISTE], 2002).

a. Vision, Planning and Management

In this standard 1, school leaders are need to facilitate, plan and direct the school's vision and mission towards the technology use and widely to integrate it (Brooks-Young, 2002). A successful technology leadership for technology mainly starts from the vision and planning the leader does for the school community (Byrom & Bingham, 2001). According to Flanagan and Jacobsen (2003), impactful technology integration starts from the strong foundation outlined by the visionary and knowledgeable leader being the technology leader.

b. Learning and Teaching

An expectation of a follower on their leaders are they are knowledgeable and proficient of how to integrate any new skills or methodology being integrated in the organization. Thus, NETS-A reported this concern it is in Standard 2, Learning and Teaching. The responsibility being held by the leader is to provide an environment that will be able to foster a collaboration, supportive learning community among the school staffs and trigger them to be creative and involve in technology related activities (ISTE, 2002).

c. Staff Development and Training

The NETS-A Standard 3 encourages leaders to be supportive to the school community to integrate ICT and to model ways to effectively use technology (ISTE, 2002). Research shows that technology leaders must be able to encourage and create an atmosphere in the school or organization to develop the desired interest of the teachers to support the ICT policy (Kearsley & Lynch, 1994). Technology leaders should know how to support their schools' staff so that their technology level and skills can be enhanced (Leithwood, 1994).

d. Technological and Infrastructure Support

This standard 4 encourages the leaders to use technology to help increase and achieve the school's goals. The appropriate use of tools and support for ICT integration by the school need to be analyzed and pump into the system (Kearsley & Lynch, 1994). Besides that, the school leaders must ensure that the technology used is not only to support the teachers but also to encourage a good flow of usage between the administrators as well (MacNeil & Dalafield, 1998).

e. Evaluation and Research

Standard 5 specifies the terms that takes in account that the technology being used in the school system is being evaluated and revised timely (ISTE, 2002). The technology used in the school system such as the chosen software, applications, equipment, networks and support services of all types must be monitored and given an evaluation for certain time period after it is being integrated (Costello, 1997).

f. Interpersonal and Communication Skills

Finally, Standard 6 states that educational leaders should work hand-in-hand with other staff to ensure equal access, safety of users and compliance with social and ethical practices related to technology use (ISTE, 2002). In support of ISTE, Pereus (2001) also mentioned that principals must be able to boost the motivation of teachers and encourage them to try the modern ICT for a different experience of teaching.

Teacher Effective ICT Utilization

Wanjala, Elizabeth, and Mukwa (2011) found that teachers are willing to use ICTs in their teaching and learning process. They are able to manage the classroom and integrate technology into the subjects taught and link suitably to the activities designed for learners. They also pointed out that even if strategies used by teachers are with ICT are new, they are willing to do a trial and error to rectify the issue and then integrate the right method to teach. However, some teachers especially the senior ones might fear or in other words may not be confident in using ICT in their teaching (Rosnaini & Ismail, 2010). Their study on ICT training experience among teachers revealed that older teachers normally need more guidance and support to utilize ICT in their duty. Even with a formal ICT training sometimes they might not be able to expose and explore the usage of ICT for their own integration purposes (Visvanathan, 2010).

Teachers' attitude and behavior does influence the extent they may apply ICT in their teaching and learning. The integration of ICT in the curriculum has been affected by teachers' attitude and behavior (Iran, 2005). The prior studies have reported that teachers nowadays do have a positive attitude towards computers and ICT (Iwona & Sztendur, 2010; Mingaine, 2013; Kurga, 2014). The school principal should be able to offer technical support when needed (Honan 2008). The school administrators can intensify the efforts to organize or send teachers to attend workshops or training in house or outside school. By doing this, it may help them to upgrade themselves in terms of ICT utilization in the classroom and also solve their dilemma in technology integration in their class (Almekhlafi & Almeqdadi, 2010). In addition, the school must form a support partnership that can help and motivate teachers to share effective technology practices and experiences (Ertmer & Otternbreit-Leftwich, 2010).

Student Academic Performance

The utilization of ICT and technological tools in students' routine daily learning activities in their classroom. The prior studies have been reported that principal technology leadership has a positive

influence on student achievement improvement (Greaves et al., 2010). In this new era of Industrial Revolution 4.0 with the integration of advanced technology in education field, school principals should play their important roles to provide a sustainable, dynamic digital age learning cultures for all students. Teachers' professional development is useful to empower them to improve students learning via new technology and digital resources, as well as technological tools (Thannimalai & Raman, 2018). Moreover, students attitude and attention on learning may keep them in positive and optimistic beliefs in learning, which affect their academic performance (Hsieh, Yen & Kuan, 2014). Efficient technology leadership can positively facilitate students learning (Flanagan & Jacobson, 2003) and performance. Thus, this study is attempt to determine the impact of principal technology leadership role on students academic performance. Simultaneously, teachers' effective ICT utilization is also investigated its influence on students' academic performance. The relationship among these three constructs have been further analyzed in this study.

Proposed Research Model

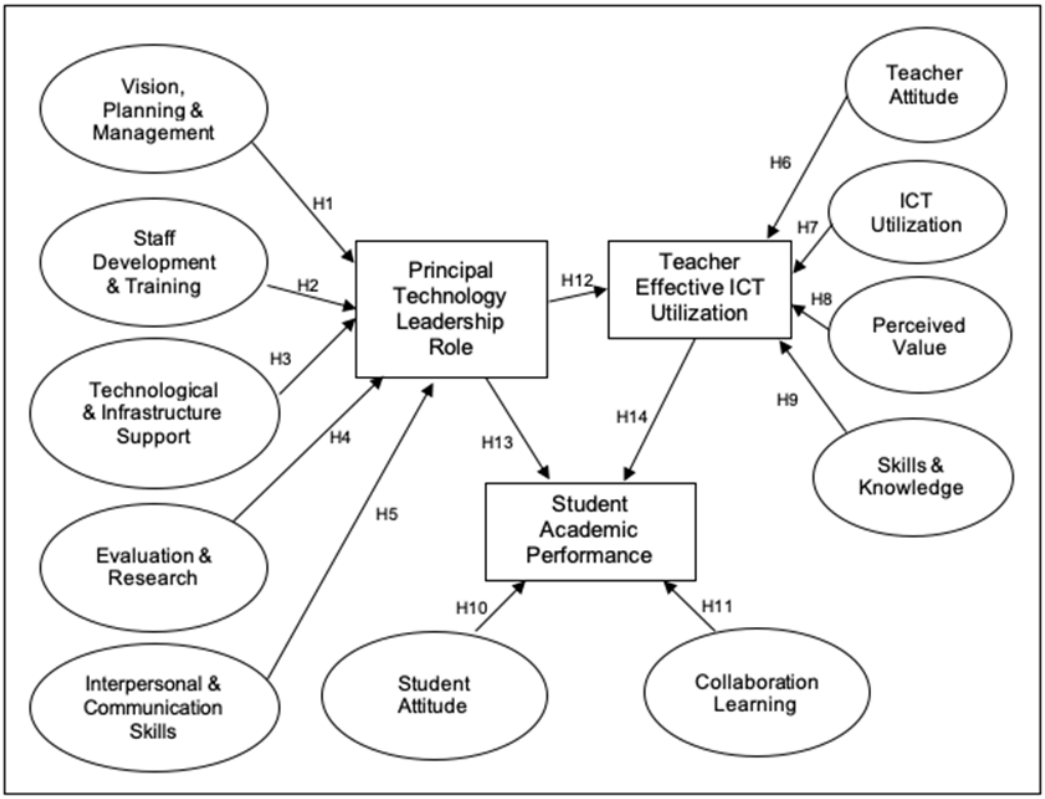
Based on the aforementioned literature reviews, there are some studies have been done on the relationship between principal technology leadership and professional development on teacher technology integration (Thannimalai & Raman, 2018), principal technology leadership and teacher ICT competency (Leong, Chua & Kannan, 2016), principal technology leadership, teaching innovation, and student academic optimism (Hsieh, Yen & Kuan, 2014). These studies have reported there are significant positive findings among principal technology leadership, ICT competency or teaching innovation integration, as well as students' academic optimism. This study is attempted to further investigate the impact or relationship of principal technology leadership roles via NETS-A, teacher effective ICT utilization and students' academic performance in aligning with the utilization of technology tools in facing the challenges of Education 4.0 in Malaysia. Figure 1 has proposed the research model and 14 hypothesis are listed after the model.

Since the prior studies have revealed the positive roles of technology leadership on teacher ICT ability and teaching technology tool integration, the present study has highlighted the impacts or influences of five principal technology leadership roles via NETS-A on teacher effective ICT utilization and student academic performance. The following list are the hypothesis for the study based on the proposed research model as presented in Figure 1.

H1: Vision, planning and management has a significant positive impact on principal technology leadership role.
H2: Staff development and training has a significant positive impact on principal technology leadership role.
H3: Technological and infrastructure support has a significant positive impact on principal technology leadership role.
H4: Evaluation and research has a significant positive impact on principal technology leadership role.
H5: Interpersonal communication skills has a significant positive impact on principal technology leadership role.
H6: Teacher attitude has a significant positive impact on teacher effective ICT utilization.
H7: ICT utilization has a significant positive impact on teacher effective ICT utilization.
H8: Perceived value has a significant positive impact on teacher effective ICT utilization.
H9: Skills and knowledge has a significant positive impact on teacher effective ICT utilization.
H10: Student attitude has a significant positive impact on student academic performance.
H11: Collaboration learning has a significant positive impact on student academic performance.
H12: Principal technology leadership role has a significant positive impact on teacher effective ICT utilization.
H13: Principal technology leadership role has a significant positive impact on student academic performance.

H14: Teacher effective ICT utilization has a significant positive impact on student academic performance.

Figure 1. Proposed research model.



METHOD

Population and Sampling

The population selected to participate in this study consisted of all teachers from selected secondary schools in Selangor district. Prior approval was granted by the school administration of all schools before selecting the schools. The schools were selected by analyzing the status or title owned by the schools such as 'High Performance School', 'Cluster School' and 'Smart School' in Selangor district. The purpose of this was to identify those schools in the district that were currently utilizing ICT rather than schools that were utilizing little or minimum usage of ICT.

All the chosen schools' principals granted the researcher permission to include their teachers in this study. In some of the schools the principals volunteered to distribute the survey instrument themselves. The researcher delivered and collected the instruments at the designated times requested by the principals. The targeted population for this study consisted of secondary schools in Selangor, Malaysia. There 27,106 teachers within 277 schools located in Selangor. The minimum number of respondents needed for this study is at the significance level $p = .05$ is 250 teachers (Krejcie & Morgan, 1970). A total of 320 questionnaires were distributed to the respondents and a total of 310 questionnaires collected were analyzed.

Instrumentation

Instrument of this research was a survey questionnaire. This questionnaire was partly self-developed by researchers according to the experience as a secondary school teacher and observation of school practices. However, most of the questions were extracted from previous studies (Ajjan & Hartshorne, 2008), which have done the similar research. Nevertheless, it was developed based on literature reviews that were in line with this study. The questionnaire consisted of 48 items, which are categorized in three sections. It was distributed and respondents were asked to indicate their responses to the extent which they agree with the statement using a 4 point Likert Scale namely Strong Disagree (1), Disagree (2), Agree (3), and Strongly Agree (4).

The questionnaire was divided into 4 sections. Section A consisted of demographic information of the respondents. Then Section B consisted of 20 items divided into 5 sub roles regarding technology leadership of principals. There were 18 items related to teachers' effective ICT utilization in secondary schools in Section C and another 10 items in Section D regarding students' academic performance. The total number of items in the questionnaire is 54 items including 48 testing variables or Likert's scale variables and 6 items related to demographic variables.

Data Collection and Analysis Process

This study used a quantitative analysis. After developing the questionnaire, the researcher sent it over to selected schools for respondents to answer. 320 questionnaires were distributed to the teachers of few selected schools in Selangor. Number of questionnaires distributed to the teachers was according to the size of school. Accordingly, school which has more teachers were distributed more questionnaires. All questionnaires were passed by hand through each school's principal or head of department. The questionnaires were collected gradually within two weeks by researcher. 315 were received after two weeks, but there were only 310 complete questionnaires chosen to be analyzed.

Smart Partial Least Squares (SmartPLS) version 3.3.2 was used to analyze the data collected from questionnaire. Descriptive analysis – frequency and percentage were used to analyze the demographic information of the respondents. Partial Least Squares-Structural Equation Modelling (PLS-SEM) has been utilized to test the inferential statistics of the research hypothesis based on the proposed research model. PLS-SEM application has been applied in several fields of study, including management information system and social sciences (Hair et al., 2016). Smart PLS is also used to analyze multiple variables in the complex models, and assess measurement and structural models respectively (Hair et al., 2016).

The demographic information which collected from the questionnaires, consisted of gender, age, Teaching Experience, academic qualifications, Duration of work in the current school and Length of experience (years) with ICT in teaching from secondary schools in Selangor. Table 1 has shown the demographic analysis findings for the respondents of the study.

FINDINGS

Path Analysis

The measurement model and structural model were examined to evaluate the model in terms of reliability and validity. Internal consistency refer to the level of all tested factors are different and each items are evaluating an equivalent concept (Hair et al., 2016). Hence, the composite reliability (CR) value must more than 0.70, factor loadings 66higher than 0.70, and average variance extracted (AVE) should be equal to or more than 0.50 (Hair et al., 2013, 2016). Simultaneously, Cronbach's Alpha is measured to determine the internal consistency of the items in the questionnaire. Table 2 has explained the findings of convergent validity for the three scales (principal technology leadership role, teacher effective ICT utilization, and student academic performance) that used for this study. All loading factor, CR, AVE, and Cronbach's Alpha values of all tested constructs and items are in

Table 1. Demographic information and profile of the respondents (N = 310)

Demographic Information	Level	Frequency	Percentage (%)
Gender	Male	160	51.6
	Female	150	48.4
Age group	< 25 years	2	0.6
	26 – 35 years	220	71
	36 – 45 years	84	27.1
	> 46 years	4	1.3
Teaching Experience	< 5 years	22	7.1
	6 – 10 years	205	66.1
	11 – 20 years	57	18.4
	> 20 years	26	8.4
Academic qualification	Diploma or Certificate	36	11.6
	Bachelor Degree	152	49
	Master Degree	118	38.1
	Doctorate	4	1.3
Duration of work	1 – 3 years	71	22.9
	4 – 6 years	152	49
	> 6 years	87	28.1
Length of experience with ICT in teaching	1 – 3 years	93	30
	4 – 6 years	166	53.5
	> 6 years	51	16.5

the appropriate range and above the threshold values as stated above, which confirmed the reliability of the measurement model. Item EC3 under interpersonal and communication skills construct has shown loading factor at .677, which is closed to .70, threshold value for loading factor. Thus, item EC3 is accepted to measure interpersonal and communication skills construct.

Discriminant validity is conducted to ensure the construct is unique and not explaining same phenomena that characterized by other constructs in the model (Hair et al., 2016). A construct is considered to have sufficient discriminant validity when the AVE is higher than the squared correlation among the constructs (Fornell & Larcker, 1981). Table 3 has shown the discriminant validity for all constructs or variables that tested in the model. Each construct's AVE is higher than each of the squared correlation between constructs. The PLS was applied to measure the research hypothesis according to the proposed model as shown in Figure 1. Figure 2 has shown the measurement model with path coefficient.

Table 4 has listed the results of the hypothesis testing by using bootstrapping method. The relationship between all the variables in the proposed path model is measured and the findings are shown in Table 4. All the hypothesis (H1-H14) are significantly accepted via this PLS-SEM analysis. Figure 3 also illustrates the structural model for the analysis. All the path coefficients in the inner and outer model are statistically significant. For the model fit measures, this model is just fit with the SRMR value (.08), which is closely meet the threshold value (< .08) (Hu & Bentler, 1999), is considered a good fit.

Table 2. Findings of convergent validity of the study

Construct	Items	Loading Factor	Cronbach's Alpha	CR	AVE
Principal Technology Leadership Role					
Vision, planning and management	LV1	.719	.748	.841	.571
	LV2	.791			
	LV3	.802			
	LV4	.705			
Staff development and training	ST1	.823	.771	.854	.594
	ST2	.785			
	ST3	.729			
	ST4	.742			
Technological and infrastructure support	TI1	.740	.767	.851	.588
	TI2	.787			
	TI3	.783			
	TI4	.756			
Evaluation and research	ER1	.813	.800	.870	.625
	ER2	.778			
	ER3	.767			
	ER4	.804			
Interpersonal and communication skills	EC1	.742	.709	.820	.534
	EC2	.742			
	EC3	.677			
	EC4	.758			
Teacher Effective ICT Utilization					
Teacher attitude	TA1	.806	.826	.878	.591
	TA2	.766			
	TA3	.830			
	TA4	.701			
ICT utilization	TU1	.741	.761	.848	.583
	TU2	.796			
	TU3	.770			
	TU4	.745			
Perceived value	TV1	.845	.846	.897	.686
	TV2	.846			
	TV3	.849			
	TV4	.769			
Skills and knowledge	TS1	.769	.814	.871	.574
	TS2	.784			
	TS3	.744			
	TS4	.756			
	TS5	.733			
Student Academic Performance					

continued on next page

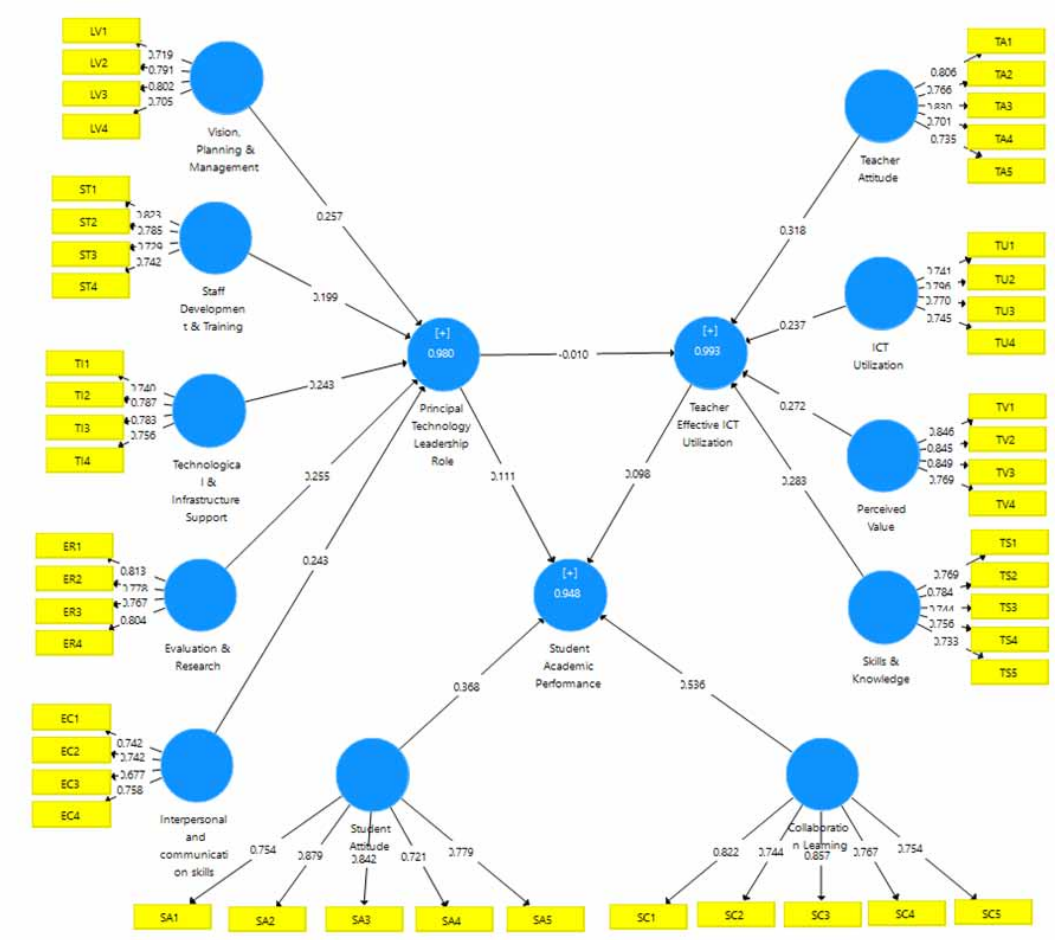
Table 2. Continued

Construct	Items	Loading Factor	Cronbach's Alpha	CR	AVE
Student Attitude	SA1	.754	.855	.896	.635
	SA2	.879			
	SA3	.842			
	SA4	.721			
	SA5	.779			
Collaboration Learning	SC1	.822	.848	.892	.624
	SC2	.744			
	SC3	.857			
	SC4	.767			
	SC5	.754			

Table 3. Discriminant validity model

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Collaboration learning	.790													
2.Evaluation and research	.549	.791												
3.ICT utilization	.593	.474	.763											
4.Interpersonal and communication skills	.616	.533	.533	.730										
5.Perceived value	.603	.448	.742	.495	.828									
6.Principal technology leadership role	.643	.814	.580	.778	.507	1.00								
7.Skills and knowledge	.585	.447	.726	.443	.739	.453	.757							
8.Staff development and training	.472	.594	.390	.568	.361	.835	.298	.771						
9.Student academic performance	.907	.604	.702	.649	.719	.712	.681	.491	1.00					
10.Student attitude	.640	.455	.636	.506	.639	.549	.580	.299	.838	.797				
11.Teacher attitude	.556	.434	.799	.416	.787	.488	.720	.372	.638	.573	.769			
12.Teacher effective ICT utilization	.653	.494	.892	.514	.902	.548	.880	.384	.754	.667	.920	1.00		
13.Technological and infrastructure support	.488	.677	.445	.668	.352	.858	.283	.641	.558	.419	.299	.365	.767	
14.Vision, planning and management	.556	.573	.483	.487	.376	.814	.332	.746	.600	.434	.436	.443	.594	.755

Figure 2. PLS-SEM Measurement model.



As shown in Table 4, Hypothesis 1 (H1), Hypothesis 2 (H2), Hypothesis 3 (H3), Hypothesis 4 (H4), and Hypothesis 5 (H5) were significantly accepted and supported. In other words, vision, planning and management, staff development and training, technological and infrastructure support, evaluation and research as well as interpersonal and communication skills have significant positive impact on principal technology leadership role (ß = .199 - .257, $p < .001$). Among these five roles, vision, planning and management has the highest effect on principal technology leadership role (ß = .257, $p < .001$). Whereas for teacher effective ICT utilization construct, all four factors and hypothesis (H6, H7, H8, and H9) were significantly accepted and supported from the analysis. This means that teacher attitude, ICT utilization, perceived value, as well as skills and knowledge have significant positive impacts on teacher effective ICT utilization (ß = .237 - .318, $p < .001$). Teacher attitude has the highest effect on teacher effective ICT utilization (ß = .318, $p < .001$). However, collaboration learning has shown higher significant positive impact on student academic performance (ß = .536, $p < .0010$) if compared to student attitude. Hypothesis 10 (H10) and Hypothesis 11 (H11) are significantly accepted from the analysis, student attitude and collaboration learning have significant positive impacts on student academic performance.

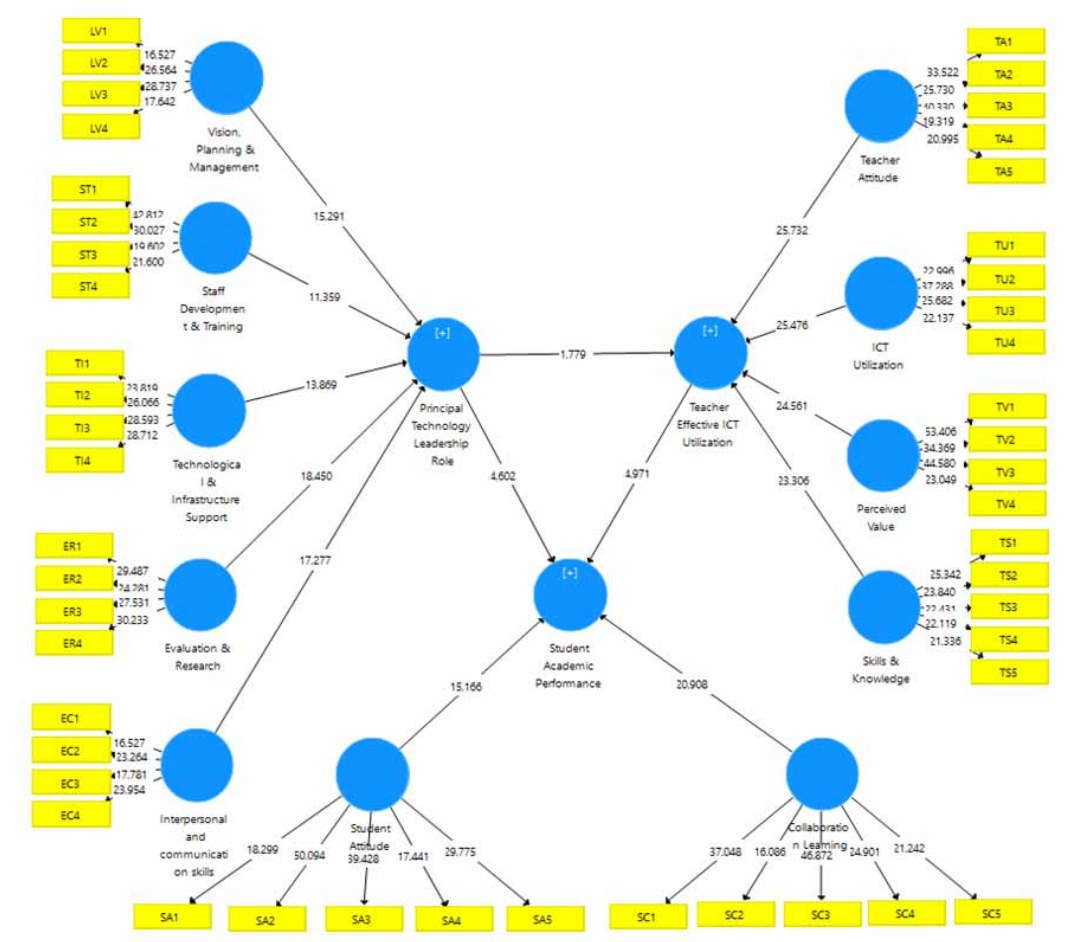
This study also revealed that principal technology leadership role has significant positive influence on student academic performance (ß = .111, $p < .001$) if compared to teacher effective

Table 4. Findings of the research hypothesis by using bootstrapping

Number of Hypothesis	Relationship	Path Coefficient Original (ß)	SD	T value	P value	Results
H1	Vision, planning and management ® Principal Technology Leadership Role	.257	.017	15.29	.000***	Supported
H2	Staff development and training ® Principal Technology Leadership Role	.199	.017	11.36	.000***	Supported
H3	Technological and infrastructure support ® Principal Technology Leadership Role	.243	.018	13.87	.000***	Supported
H4	Evaluation and research ® Principal Technology Leadership Role	.255	.014	18.45	.000***	Supported
H5	Interpersonal and communication skills ® Principal Technology Leadership Role	.243	.014	17.28	.000***	Supported
H6	Teacher attitude ® Teacher effective ICT utilization	.318	.012	25.73	.000***	Supported
H7	ICT utilization ® Teacher effective ICT utilization	.237	.009	25.48	.000***	Supported
H8	Perceived value ® Teacher effective ICT utilization	.272	.011	24.56	.000***	Supported
H9	Skills and knowledge ® Teacher effective ICT utilization	.283	.012	23.31	.000***	Supported
H10	Student attitude ® student academic performance	.368	.024	15.17	.000***	Supported
H11	Collaboration learning ® student academic performance	.536	.026	20.91	.000***	Supported
H12	Principal Technology leadership Role ® teacher effective ICT utilization	-.010	.006	1.78	.038*	Supported
H13	Principal Technology leadership Role ® student academic performance	.111	.024	4.60	.000***	Supported
H14	Teacher effective ICT utilization ® student academic performance	.098	.020	4.97	.000***	Supported

Note. *p < .05; ***p < .001

Figure 3. PLS-SEM structural model



ICT utilization (ß = .098, p < .001). Another interesting finding is teacher effective ICT utilization has weak significant positive influence on student academic performance (ß = -.010, p < .05). The findings also suggest hypothesis 12 (H12) is supported that principal technology leadership role has significantly impact on teacher effective ICT utilization. Hypothesis 13 (H13) has demonstrated a significant positive association between principal technology leadership role and student academic performance. Lastly, Hypothesis 14 (H14) has demonstrated that a positive significant impact between teacher effective ICT utilization and student academic performance supporting H14.

DISCUSSION

Issues related to the effects of technology leadership roles of principals on teachers' effective ICT utilization and students' academic performance is being paid close attention to in the field of education, especially for the new era of Education 4.0 with many technological tools in teaching. The principals' technology leadership roles (vision, planning and management, staff development and training, technological and infrastructure support, evaluation and research, interpersonal and communication skills) have contributed significantly impact on teachers' ICT utilization and students' academic

performance. The finding of this study shows that different roles played by the principals in the ICT integration gave positive impact to both teachers and students.

The roles of principals outlined in this study (refer to Figure 3) as a technology leadership did give a boost and motivation to teachers to utilize ICT in their teaching and learning process. This is in line with Ritchie (1996) for example state that the lack of exposure and administration support would badly influence the integration of ICT in the teaching and learning process by teachers. He on the other hand, also states that principals who trained themselves in using and being more capable in using ICT usually plays a vital role in technology integration in schools (Ritchie, 1996).

This study also suggests that, a school principal's role is that influential in transforming any new innovation in a school. This finding is identical with Anderson and Dexter's (2005) research which concluded that if a school principal need to become a technology leader in their schools, they need use technology themselves, develop technology strategies and provide funds and training for new technology in schools. The results support to this study as is shown that there is a significant positive relationship between the effects of technology leadership roles of principal on teachers' effective ICT utilization. These findings suggest that principals should intensify and maintain their effort and involvement in integrating ICT for their school and become an effective technology leader in order to increase teacher's ICT utilization and students' academic performance (Chang, 2012).

The results from previous studies show that the effects of principals' technology leadership roles play an important role for teachers to carry out their teaching and learning process. Their constant support and efforts in monitoring teachers' utilization may develop a positive acceptance of ICT in carrying out their daily responsibility as teachers (Sharratt, 1999). As the usage of ICT has been increasingly incorporated into schools, this study got a positive acceptance on it. The study's results is alike as Shah (2014) who observed that management especially school principals need to support to improve the teachers' teaching strategies and students' academic performance in school. However, the principals can motivate teachers to have a positive attitude toward the acceptance of ICT utilization in order to properly and effectively integrate it into their routine works. The results of this study indicated that teachers in Selangor secondary schools demonstrated very positive attitude toward the acceptance and use of ICT.

Lastly, these teacher respondents found that it also gave a great impact on their students' academic performance. The effects of technology leadership roles of principals are confirmed as one of the effect that influences teachers ICT utilization and students academic performance in secondary schools in Selangor. This finding was supported by the empirical study findings conducted by Tan (2010), and Leong (2010) who found that principals' technology leadership roles significantly influences teachers' ICT utilization.

IMPLICATIONS

Principals are definitely the main agent for teachers' ICT utilization and students academic achievement in the teaching and learning process. The tone and planning the principals' set do affect the entire school system. Therefore, principals who effectively implement technology demonstrates a great vision, mission and goals, thereby creating 21st century classrooms that helps create a comfortable and up to date environment for teachers and enhance learning for students in the new era of Education 4.0. This study can serve educators, especially administrators, by highlighting principals' roles as a technology leader in the effectiveness of technology integration for instruction.

The roles and responsibilities principals are adhering to be multi-tasking. Principals now not only do work related to management duties o their school; they also are responsible for fulfilling the needs of the teachers and students in the school. To make sure whatever plan related to new tools or transformation taking place in the school goes on smoothly, the principals must do a detailed planning, support and budgeting. Teachers hereby only being the agents of implements, depend on

their principal's technology leadership in the utilization of technology. Effective principals search for proven strategies in order to successfully carry out the roles that bound their duties.

Principals do have their strategies and resources that are used to help in the venture provided Ministry of Education. When principals began to integrate technology, like Augmented Reality (AR) or Virtual Reality (VR) and robotic tools were placed in the classroom for teachers to learn how to operate and incorporate the technology device in the teaching and learning process. As more support and encouragement was given, technology was used effectively in the classroom.

CONCLUSION

This research clearly shows there is a relationship between the effects of technology leadership roles of principals on teachers' ICT utilization and students' academic performance in secondary schools in Selangor. The roles of technology leadership of a principal are crucial in the ever-changing education system. Principals must model practices, which they expect teachers and students to replicate in order for ICT transformation to take place in the school for facing the challenge of Education 4.0. Thus, school administrators, particularly principals, do not have a choice in accepting and equipping technology needs of the present day. The world is consider now borderless in terms of information exchange means that schools will have to unquestioningly accept the technological application and integration of ICT tools.

School principals who are the technology leaders must explore and expose themselves more to bring in more of ICT use in their schools. They must be ensuring the ICT mission, vision, value and beliefs of their school are in par with the opportunities provided to teacher and students. Technology leadership roles of principals are a vital factor that affects the effective use of ICT in classrooms. When integrated properly, technology becomes an accelerator tool and makes learning more interactive and creative for the students. Therefore, principals must maximize their talents and ideas to not only prepare students for the 21st century but to enhance teachers' teaching and learning skills within the educational arena as being prescribed the government of Malaysia.

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