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## EMPOWERING TEACHER SELF-EFFICACY ON ICT: HOW DOES TECHNOLOGY LEADERSHIP PLAY A ROLE?

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### ABSTRACT

There is no denying that the presence of ICT in the world of education has posed a great challenge to teachers in generating an effective teaching and learning process. School administrators, on the other hand, advise teachers to increase their ability and self-confidence in using ICT to improve the quality of teaching. This study focuses on the relationship between principals' technology leadership and teachers' self-efficacy on ICT. The five components of principal technology leadership are also analyzed to predict the influence on teachers' self-efficacy. The study used an instrument adapted from the National Educational Technology Standards for Administration (NETS-A) to measure principals' technology leadership. At the same time, the Teacher Sense of Efficacy Scale (TSES) was formulated with ICT elements to measure teachers' self-efficacy. The study conducted using a cross-sectional survey method with a quantitative approach. A total of 376 secondary school teachers in Malaysia were selected as study respondents using multi-level sampling methods. The results show that there is no significant difference between the age and gender of teachers on the self-efficacy of teachers on the use of ICT. The findings also found that there was a moderate positive relationship between principal technology leadership and teacher self-efficacy ( $r=0.47$ ,  $p<0.01$ ). However, principals' technology leadership only contributed a low influence of 22% variance on teachers' self-efficacy ( $r^2=0.22$ ,  $F=21.38$ ,  $p<0.05$ ). Overall, teachers' self-efficacy on ICT can be developing if the principal plays a role as a true technology leader. Principals need to reconsider the characteristics of technology leadership so that they become role models for the use of ICT in schools.

**Keywords:** Teacher Self-Efficacy, ICT, Technology Leadership, Digital Leadership, NETS-A.

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## INTRODUCTION

Teachers are individuals who play a role in channelling knowledge and skills to students to become useful people in the future. The teaching objectives of teachers not only lead to the delivery of knowledge, but they also ensure that students are formed based on noble values, have a strong identity and can live independently. Forming students is not an easy task, but teachers should have the motivation, commitment, well-being, abilities and effectiveness in implementing teaching and learning (Huang, Yin, & Lv, 2019). At the same time, the quality of teachers also maintained because the effectiveness of teacher teaching will ensure that learning objectives are achieved (Poulou, Reddy, & Dudek, 2019). Empirical studies prove that the effectiveness of teachers depends on how much they produce excellent students in various fields (Mincu, 2015; Warrah, Bing, & Yusof, 2018). With simple language, student success also influenced by the teaching excellence of teachers who wisely use the appropriateness of teaching strategies to create a stimulating learning environment.

The quality and effectiveness of teachers' teaching are primarily focused on their self-efficacy to formulate learning methods in producing students' academic excellence. High teacher self-efficacy not only lies in the best practice of teacher teaching but also depends on the conducive learning environment in the school (Choi & Lee, 2018). The original model of self-efficacy suggested that teachers should be competent in building teaching strategies, managing classrooms and engaging students in every learning activity (Tschannen-Moran & Hoy, 2001). The teacher's ability to construct these three elements will trigger a dynamic force that gives them the advantage of absorbing whatever knowledge and skills the students have. The implication is that teachers can face every challenge present while handling the learning process especially to solve problems related to the level of acceptance of student learning (Shengnan & Hallinger, 2020; Zee, Koomen, & de Jong, 2018).

The challenge of educating students is not just focusing on what the teacher has planned. This situation exists because the scope of teaching and learning of teachers is now broader across the existing curriculum and interspersed with the application of 21st-century learning (Drake & Reid, 2018). The use of information and communication technology (ICT) is increasingly absorbing into the education system to enhance student learning. Mobile technology devices such as smartphones, laptops and tablets are the latest hardware that every teacher needs to master at this time (Omar & Ismail, 2020; Oskay, 2017). Teachers who can integrate software and technological devices are said to have high self-efficacy on ICT in teaching. The question is, can teachers translate ICT so that their pedagogical methods can strengthen? There are also issues about teachers' ability to use ICT in controlling the classroom and increasing student involvement in each learning activity. The learning environment today is indeed difficult to separate from the influence of technology. Moreover, it is a new habit and norm in education (Atabek, 2020).

Based on the PISA paper planned for 2021, self-efficacy in ICT is an additional indicator that emphasizes the changing attitudes and methods of using the latest digital devices (Lorenceanu, Marec, & Mostafa, 2019). This indicator proves the effectiveness of teaching teachers using ICT results from their high level of self-efficacy. This opinion is fundamental because self-efficacy has a significant relationship with integrating technology in the school environment (Crossan, 2020; Gilkes, 2020). Even so, ICT-based pedagogy should get reliable support from various parties, including colleagues, students, and also the school administration. Relevant, every activity in the school needs to get approval from the management, especially the principal. This situation is vital because the principal is the leader in an organization and is the backbone of the journey and administrative layout and the teaching and learning process (Sun & Xia, 2018).

Due to that, school principals are the most influential individuals in encouraging teachers to improve their teaching ability, ability, and effectiveness to result in academic success for students. The principal's role is not limited to the mere instructor, but rather to lead and be a role model in every activity planned in the organization (Liu, Bellibas, & Gumus, 2020). The same phenomenon also has to do with principals' role in influencing teachers in using ICT in teaching. The question is, what are the characteristics of principals that can strengthen teachers' self-efficacy on



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the use of ICT? What is the principal's appropriate character in encouraging teachers to improve the effectiveness of teaching using ICT? Previously, one of the leadership styles that is said to empower the use of ICT is through technology leadership practices (Anderson & Dexter, 2005; Esplin, Stewart, & Thurston, 2018; Yu & Prince, 2016). Principals who practice technology leadership can enhance the integration of technology and raise school organization (Weng & Tang, 2014). The character of technology leadership is compelling for every business's success related to the use of technology.

Principals' knowledge and administration skills are critical indicators in playing a role as educational leaders in schools (Yorulmaz & Can, 2016). Principals also need to improve their self-competence in ICT before understanding their role as technology leaders (Wei, Piaw, & Kannan, 2016). Through ICT professional development programs, principals can build self-competence and further deepen technology leadership character (Raman & Thannimalai, 2019). On the other hand, are principals able to adopt technology leadership characteristics in managing school organizations towards ICT integration? Can teachers' self-efficacy on ICT also be enhanced after getting encouragement from a technology leader? This question is the primary goal of the implementation of this study. Thus, the objectives of this study are as follows:

- (a) Determine the level of principal technology leadership and teacher self-efficacy,
- (b) Examine the differences in teachers' self-efficacy based on demographic factors (gender and age),
- (c) Identify the relationship between principal technology leadership and teacher self-efficacy,
- (d) Analyze the influence of principals' technology leadership dimensions on teachers' self-efficacy.

The hypotheses of this study are as follows:

H<sub>0</sub>1: There is no significant difference in teacher self-efficacy based on gender.

H<sub>0</sub>2: There is no significant difference in teacher self-efficacy based on age.

H<sub>A</sub>3: There is a significant positive relationship between principal technology leadership and teacher self-efficacy.

H<sub>A</sub>4: There is an influence of the dimensions of principal technology leadership on teacher self-efficacy.

## LITERATURE REVIEW

### Principals Technology Leadership

Technology leadership is one of the emerging forms of leadership style in the educational environment lately. Like other leadership styles, technology leadership focuses more on organizational management and administration methods based on the use of ICT. To classify this, Esplin et al. (2018) stated that technology leadership is a leader's role in planning, giving instructions and encouraging employees to perform tasks based on technology integration. Technology leadership can inject improved competencies of employees so that they can elevate organizational achievement to a higher level (Shyr, 2017). Based on current needs, skills and knowledge of technology leadership are essential indicators for a school principal in leading the organization towards change in the Industrial Revolution 4.0 (Raman & Thannimalai, 2019).

In the world of education, Anderson and Dexter (2005) define technology leadership as the role of leaders in influencing teachers to use ICT-based educational resources to achieve learning objectives. In a simple sense, technology leaders strive to place ICT as a critical interest in driving organizations towards management excellence as well as academic achievement (Ugur & Koc, 2019; Weng & Tang, 2014). Now, the thing that emphasized is how education leaders strive to build competencies, trust and determination to understand the characters as technology leaders effectively. In this situation, education leaders should always strengthen their role by attending professional development courses, workshops or programs to improve ICT skills and knowledge (Aurangzeb, Tahir, & Khan, 2019). The necessary thing that technology leaders need to master is to find the best ingredients to



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enhance ICT knowledge, translate those skills into the organization and shape the ICT learning environment in schools (Dexter & Richardson, 2020).

Recent studies also show that technology leadership is very beneficial to teachers' self-development, organizational management, academic excellence and increased technology integration in schools. A study by Omar, Ismail and Kasim (2019) teachers will be more confident to use ICT in learning when they receive positive reinforcement and unwavering support from a technology leader. This situation excites a large number of teachers when a technology leader can motivate them to master ICT skills more deeply (Hero, 2020; Moreira, Rivero, & Alonso, 2019). Technology leaders are also able to open up space to teachers as much as possible for them to enhance further their competencies in ICT (Wei et al., 2016). This phenomenon benefits not only the school management but also teachers can use their ICT abilities to diversify teaching strategies, thereby improving student academic achievement.

### ***Teacher Self-Efficacy on ICT***

Self-efficacy is one of the crucial elements of teachers in ensuring that they can perform tasks more effectively and have a positive impact on student learning. Based on (Bandura, 1997), teacher self-efficacy termed as a belief that arises in the soul of a teacher that they can produce a job so brilliantly that it can change events in the environment. Moreover, self-efficacy can define as teacher behaviour that develops at a very high level once they have the confidence and ability to perform a given task (George, Richardson, & Watt, 2018). The fact is, this behaviour is not only produced through planned methods but also triggered by the ability of teachers to use all existing skills and knowledge (Hall & Trespalacios, 2019). Thus, it is clear that the teacher's self-efficacy is the best indicator in describing that the teacher has a high ability and determination to formulate teaching and learning strategies effectively.

Previous empirical studies have found that teacher self-efficacy not only influences effective teacher teaching practices, it even leads to significant changes to the learning environment as a whole (Choi & Lee, 2018; Li & Liu, 2020; Poulou et al., 2019). The presence of ICT in the educational arena has changed teachers' perceptions of the available abilities to generate a more effective teaching process. Coincidentally, teachers are advising to prepare for the boom of ICT integration in education. Effective use of ICT will support high student engagement and create a more dynamic learning environment (Hatlevik & Hatlevik, 2018). In this case, it becomes an obligation for teachers to form learning innovations that increasingly demanded in line with 21st-century learning.

Nowadays, teachers should have a high sensitivity to every technological development, including the use of the latest educational devices and software. There are many educational resources available, especially online that can be used by teachers to design more effective teaching. Highly effective teachers can use a constructivist approach to build learning concepts based on the use of ICT (Alt, 2018). Every activity in the classroom will be more organized when teachers have physical and mental readiness in integrating technology in teaching (Lailiyah & Cahyono, 2017). What is important is that teachers should have a positive mindset where ICT is not a burdensome thing. Thus, Schipper, Goei, de Vries, and van Veen (2018) recommend that teachers implement the following:

1. Study students' backgrounds,
2. Classify students according to needs,
3. Use different teaching strategies,
4. Giving students the freedom to choose learning outcomes,
5. Using meaningful teaching resources.



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## *Principals Technology Leadership and Teacher Self-Efficacy on ICT*

Previous studies have shown that principal leadership has a positive impact on teacher self-efficacy (Shengnan & Hallinger, 2020; Sun & Xia, 2018). Although not directly to self-efficacy in ICT, but the influence of principal leadership still leads to changes in attitudes, commitment, and also job satisfaction of teachers in implementing teaching and learning activities. School leaders have a significant role to play in shaping excellent organizations through teachers with high self-efficacy (Sakiz, Ekinci, & Saricam, 2019). The same is stated by Cansoy and Parlar (2018) that principals act as motivating agents to increase teacher confidence, create a positive attitude and have high confidence to perform any task entrusted. As the world of education is more focused on the use of ICT and the latest technology, then teachers should have a high readiness to improve the ability and capability to use the latest technology devices and software in the teaching and learning process. Therefore, principals as school leaders have a significant role to play in supporting teachers to increase their self-efficacy, confidence and ability to create innovative teaching in the classroom (Liu et al., 2020).

Some studies place principal technology leadership as a critical indicator to increase the level of self-efficacy of teachers. For example, Tiop and Talip (2020) found that the influence of principal technology leadership can not only boost the self-efficacy of teachers, but it also leads to changes in organizational management through the use of ICT. Meanwhile, Omar et al. (2019) found that teachers are motivated to use ICT when principals practice the five elements of technology leadership recommended by the National Educational Technology Standards for Administration (NETS-A). The study proves that the dimensions of technology leadership in NETS-A (International Society for Technology in Education, ISTE 2009) such as visionary leadership, digital age learning culture, excellence in professional practice, systemic improvement and digital citizenship have a positive relationship with teachers' self-efficacy in integrating ICT. When teachers' self-efficacy is at a high level, it is easy for principals to motivate them to improve their competencies in ICT, thus building teachers' readiness to integrate ICT as an innovative method in teaching (Yorulmaz & Can, 2016).

Other studies such as Atabek (2020) and Crossan (2020) conclude that teachers' self-efficacy in ICT has great potential in realizing the current education system towards the full use of technology. This statement is justified when there is an element involving technological pedagogical content knowledge (TPACK) is massively highlight. Jin and Harp (2020) stated that the elements of TPACK could not only strengthen teachers' perceptions, attitudes and self-efficacy in ICT but also teachers can implement pedagogical methods such as flipped classroom and flipped based-learning. It would be appropriate if school leaders could encourage teachers to improve their self-efficacy through mastery of TPACK and technology integration (Oskay, 2017). This phenomenon is also a catalyst for teachers to combine knowledge in the field of teaching and skills in technology to translate a more innovative teaching process to students.

### ***Conceptual Framework***

The Path-Goal Theory of Leadership inspired the original idea of this study. According to (House, 1996), this theory is used to describe the effect of leadership influence in organizing employees to perform tasks more efficiently. The theory also prioritizes the overall satisfaction of employees so that they can highlight performance at a very high level. In terms of teaching and learning, the Path-Goal Theory of Leadership is used in shaping the personality, motivation and abilities of teachers based on past experiences (Dewan & Dewan, 2010). The matter can be translated when a principal can act appropriately to motivate teachers to achieve successfully planned learning goals. Principals are individuals who have the characteristics of true leaders in support, encouragement and role models in shaping job satisfaction and teacher motivation towards teaching (Yan-Li & Hassan, 2018).

Therefore, this study adopts the conceptual framework based on the Path-Goal Theory of Leadership. ISTE (2009) suggested that the characteristics of a technology leader in education are based on five dimensions, namely visionary leadership, digital age learning culture, excellence in professional practice, systemic improvement and



digital citizenship. These five elements are significant to the change and self-development of teachers. It is recognized that teachers driven by technology leadership will be more confident to use ICT in the teaching process in the classroom (Dexter & Richardson, 2020). In fact, through the influence of technology leadership, teachers are also able to use sophisticated equipment and software through the application of mobile technology (Omar & Ismail, 2020).

Meanwhile, self-efficacy refers to the characteristics proposed by Tschannen-Moran and Hoy (2001), where the effectiveness of teachers depends on their ability to implement teaching based on teaching strategies, classroom management and student engagement. Empirical studies such as Lailiyah and Cahyono (2017), and Gilkes (2020) found that teachers' beliefs and abilities in using ICT lead to the practice of integrating technology in forming a more robust pedagogy. This situation is fascinating when teachers who have high self-efficacy on ICT can generate more dynamic teaching. However, is the involvement of technology leadership able to further boost teachers' self-efficacy on the use of ICT in the classroom? To what extent the truth will be unravelled through the implementation of this study. Thus, the conceptual framework used is, as shown in Figure 1 below.

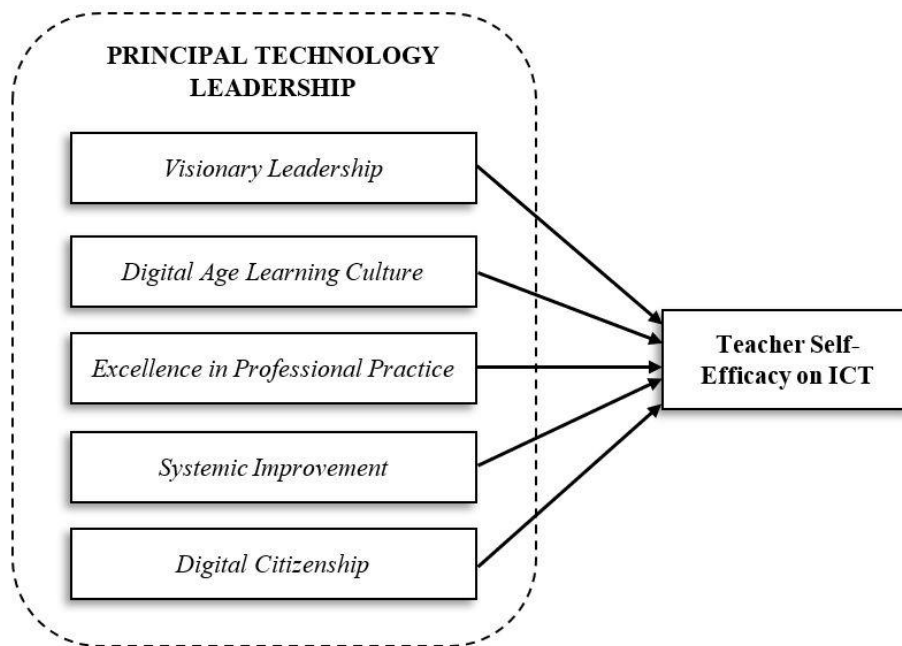


Figure 1. The conceptual framework between principal technology leadership and teacher self-efficacy on ICT

## METHODS

### Research Design, Population and Sampling

The main goal of this study is to identify the influence of principal technology leadership that has an impact on changes in teachers' self-efficacy on ICT. Therefore, the best method is through a quantitative approach by a cross-sectional survey involving designated study respondents. The quantitative approach is very suitable to be applied to determine the study respondents who have characteristics such as attitudes, behaviours and interests that are similar to the overall population (Creswell, 2014). The use of questionnaires as research instruments facilitates the process of gathering information more easily and quickly, especially involving large study areas (Cohen, Manion, & Morrison, 2018).



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The study population involves all secondary school teachers in the state of Kedah, Malaysia. Selection of study sample based on multi-level sampling proposed by Sekaran and Bougie (2016). In the first stage, random cluster sampling was used to make screening between the schools involved according to the study zone. Then, stratified random sampling was used to arrange the schools based on the study location, either urban or rural. At the final stage, systematic random sampling was used to select a study sample based on the school location. Figure 2 shows the phases of the sample selection implemented.

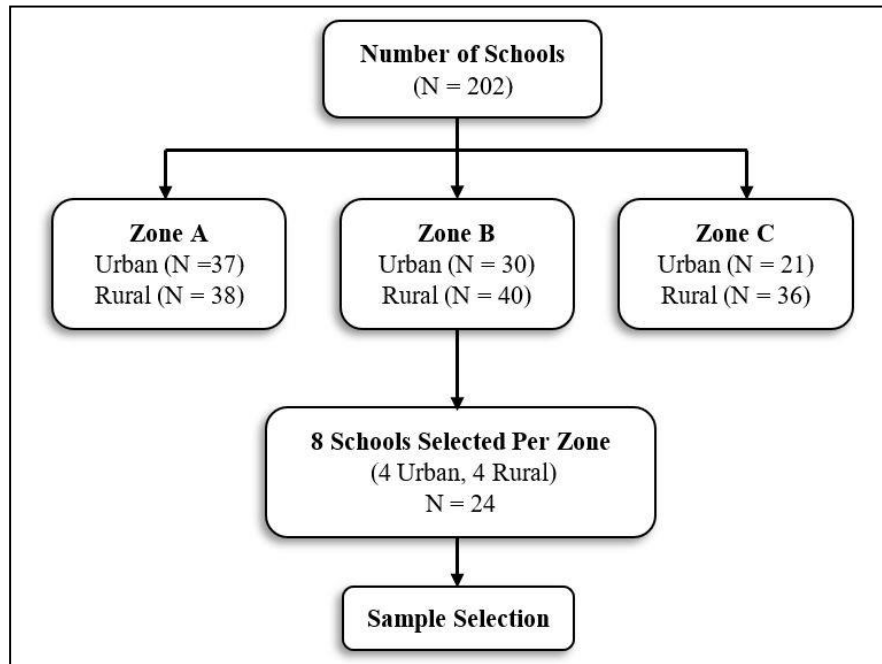


Figure 2. Phases of sample selection

A total of 376 teachers from 24 secondary schools in the state of Kedah, Malaysia were involved in the study sample. The sample size is referred based on the study sample determination table proposed by Krejcie and Morgan (1970). This study also received written permission from the Educational Planning and Research Department (EPRD), Ministry of Education Malaysia and also agreed by the Kedah State Education Department. Table 1 shows the distribution of respondents involved in this study.

Table 1  
*Respondent Information based on Demographics*

Demographic	Category	Frequency	Percentage
Gender	Male	104	27.70
	Female	272	72.30
Age	30 years old and below	16	4.30
	31 – 40 years old	123	32.70
	41 – 50 years old	154	41.00
	51 years old and above	83	22.10
School Location	Urban	196	52.10
	Rural	180	47.90



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## ***Instrumentation***

The instrument for measuring principals' technology leadership is adapted from the Technology Leadership Assessment (PTLA) presented by ISTE (2009). This global educational community strives for the process of teaching and learning using technology. The measurement of these variables is also in line with the PTLA instrument proposed by Wei (2017). Five dimensions include 32 items in total to measure the characteristics of a technology leader in school. PTLA instruments have high reliability. For example, Wei (2017) found that all PTLA dimensions have Cronbach's alpha values ranging from 0.91 to 0.94. Meanwhile, Thannimalai and Raman (2018) also used PTLA instruments and found that all dimensions on average, have a high-reliability value of 0.93.

For teacher self-efficacy, the instrument used was adapted from the Teacher Sense of Efficacy Scale (TSES) presented by Tschannen-Moran and Hoy (2001). This instrument highlights the elements of ICT to express the effectiveness of teachers on the use of ICT in teaching and learning. Previously, Zee et al. (2018) have adapted TSES in their study and found that item reliability values are around 0.86 to 0.87. Later, Sakiz et al. (2019) also adapted TSES in Turkish and found that the reliability value of the TSES instrument is between 0.83 to 0.93. In this study, TSES contained 24 items in total.

Both instruments use a 5-point numerical scale ranging from 1 (strongly disagree) to 5 (strongly agree). A pilot study was conducted to ensure that each item in the research instrument had high validity and reliability (Hair, Black, Babin, & Anderson, 2014). This reliability value is critical to signal that the instrument being tested is entirely consistent and capable of measuring variables in actual studies (Creswell, 2014). From the pilot study, it was found that all dimensions and study instruments showed high Cronbach's alpha ( $\alpha$ ) values. The summary of the reliability of this study instrument is shown in Table 2 below.

Table 2  
*Reliability of the Study Instrument*

Variable and Dimension	Item	$\alpha$	Level
Principals Technology Leadership (Overall)	32	0.94	Very Reliable
Visionary Leadership	5	0.88	Very Reliable
Digital Age Learning Culture	6	0.92	Very Reliable
Excellence in Professional Practice	7	0.91	Very Reliable
Systemic Improvement	6	0.89	Very Reliable
Digital Citizenship	8	0.93	Very Reliable
Teacher Self-Efficacy (Overall)	24	0.95	Very Reliable
Instructional Strategies	8	0.92	Very Reliable
Classroom Management	8	0.94	Very Reliable
Student Engagement	8	0.91	Very Reliable

## ***Data Analysis and Normality Test***

The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 24.0 software. Data analysis is broken down into four parts. The first part uses descriptive statistics to measure the level of each dimension and the study variables. Next, t-test and ANOVA were implemented to prove the differences in teachers' self-efficacy variables based on demographic factors such as gender and age of respondents. Then, the Pearson correlation test was used to identify the relationship between principal technology leadership and teacher self-efficacy. Multiple regression analysis is the last analysis implemented to determine which dimensions in the technology leadership of principals that affect teachers' self-efficacy on ICT. The significance level in this study is based on  $p < 0.05$ , as suggested by Creswell (2014) and Cohen et al. (2018).





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However, the normality test is something that needs to be emphasized before the tests are implemented. The importance of normality testing is to ensure that each study data has a normal distribution and more consistent in analyzing the results of the study (Hussin, Ali, & Noor, 2014). Typically, data are considered normal when skewness and kurtosis values are in the range of +1.96 to -1.96 (Hair et al., 2014). Thus, a normality analysis is performed, and the test results are displayed as in Table 3 below.

Table 3

*Data Normality Test for Study Dimensions and Variables*

Variable and Dimension	Skewness	Kurtosis	Expectation
Principals Technology Leadership (Overall)	-0.12	0.28	Normal
Visionary Leadership	-0.30	0.73	Normal
Digital Age Learning Culture	-0.21	0.29	Normal
Excellence in Professional Practice	-0.02	0.19	Normal
Systemic Improvement	0.05	-0.33	Normal
Digital Citizenship	-0.44	0.65	Normal
Teacher Self-Efficacy (Overall)	0.02	0.55	Normal
Instructional Strategies	-0.13	0.38	Normal
Classroom Management	-0.02	0.38	Normal
Student Engagement	0.06	-0.02	Normal

### **Confirmatory Factor Analysis**

Confirmatory factor analysis (CFA) performed to confirm an instrument more consistently and proven through easy to understand diagrams. In other words, each data analyzed through the structural equation modeling (SEM) phase. In this study, the data analyzed using Analysis of a Moment Structures (AMOS) software. Based on Byrne (2016), each item analyzed must have a factor loading exceeding 0.50. Nevertheless, Awang, Hui and Zainuddin (2018) suggested that using a factor loading above 0.60 is more appropriate to ensure that each item contributes to the dimension submitted.

In addition, each model tested must adhere to predefined fitness indexes. Evaluating these fitness indexes is a precondition for ensuring that a construct in each variable has high validity (Byrne, 2016; Hair et al., 2014). There are four factors suggested by Awang et al. (2018) to ensure that a construct is genuinely consistent. The four factors are Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker Lewis Index (TLI) and Chi-Square/Degrees of Freedom (Chisq/df). The following Table 4 shows the level of acceptance that must be adhered to for each index tested.

Table 4

*Fitness Indexes and the Level of Acceptance*

Category	Index	Level of Acceptance	Notes
Absolute fit	RMSEA	RMSEA < 0.10	RMSEA < 0.08 more better
Incremental fit	CFI	CFI > 0.90	CFI > 0.85 acceptable
	TLI	TLI > 0.90	TFI > 0.85 acceptable
Parsimonious fit	Chisq/df	Chisq/df < 5.0	Chisq/df < 3.0 more ideal

(Source: Awang et al., 2018)

Figure 3 shows the analysis of the CFA procedure for the principal technology leadership measurement model. It was found that this measurement model met the required fitness indexes, where RMSEA=0.076 (RMSEA<0.08), CFI=0.915 (CFI>0.90), TLI=0.908 (TLI>0.90) and Chisq/df=3.138 (Chisq/df <5.00). The situation indicates that the principal's technology leadership measurement model has reached the desired level of construct validity. In



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addition, the factor loading value for all items also exceeded 0.60. Based on Hair et al. (2014), such values give a clear indication that no items should drop. A total of 32 items were retained and confirmed to be consistent in contributing to each construct in this variable.

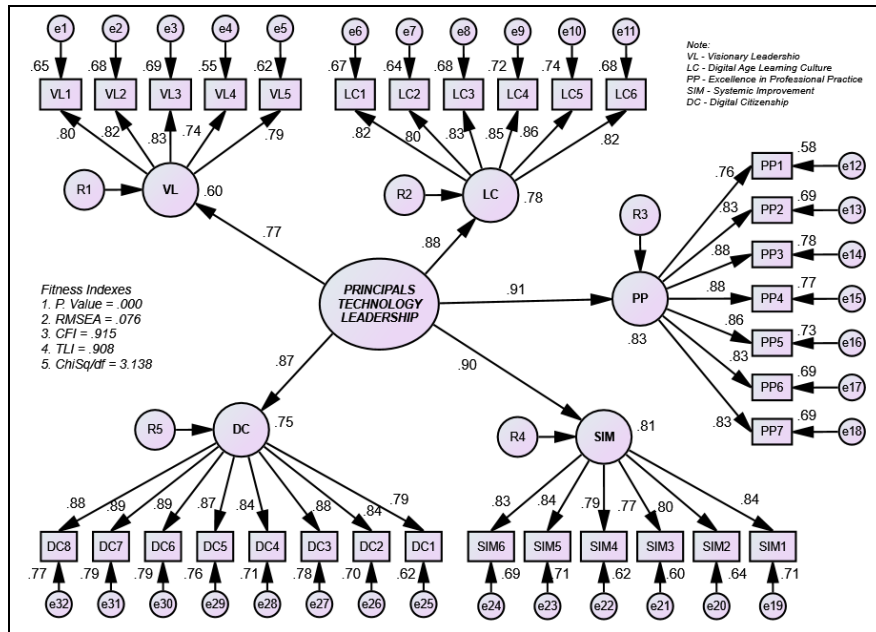


Figure 3. Measurement models for principal technology leadership

Figure 4 shows the analysis of the CFA procedure for the teacher self-efficacy measurement model. The test results found that this measurement model has complied with the required fitness indexes. This situation is evidenced by the values of fitness indexes that all meet the required level of acceptance, where the values of RMSEA=0.077 (RMSEA<0.08), CFI=0.925 (CFI>0.90), TLI=0.917 (TLI>0.90) and Chisq/df=3.204 (Chisq/df<5.00). This case indirectly illustrates that the teacher self-efficacy measurement model has reached the desired level of construct validity consistency. Each item in this model has recorded a reading above the value of 0.60, as suggested by Awang et al. (2018). Thus, all 24 items retained, and no item abortion performed.

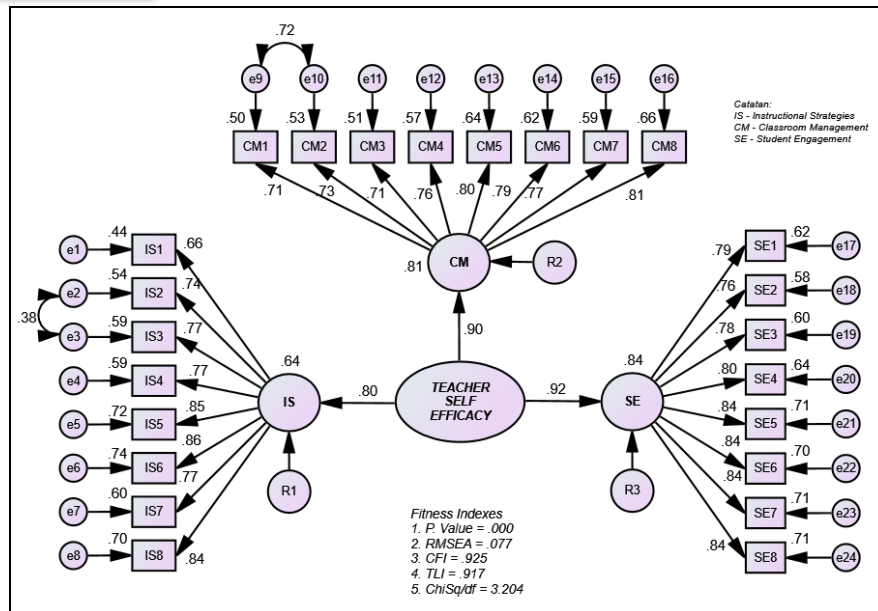


Figure 4. Measurement Models for Teachers Self-Efficacy

Based on the two measurement models, it can conclude that all the items presented have contributed to each construct formed. In the next phase, each construct has to evaluate the level of reliability through two methods: (1) convergent validity and (2) composite reliability. Convergent validity refers to the extracted average variance (AVE), which should exceed a value of 0.50 (Hair et al. 2014). Meanwhile, composite reliability refers to composite reliability (CR) value, which should exceed the value of 0.60 (Byrne, 2016).

Since each item has a factor loading exceeding a value of 0.60, the convergent validity and composite reliability of a measurement model are easier to achieve. This situation is evident when all constructs in the principal's technology leadership measurement model, as well as the teacher self -efficacy measurement model, have met convergent validity (AVE>0.50) and composite reliability (CR>0.60). In other words, each construct presented has reached the level of a more consistent measurement model. Therefore, the convergent validity analysis and composite reliability presented in Table 5 follows.

Table 5  
*Convergent Validity and Composite Reliability*

Variable and Construct	CR (> 0.60)	AVE (>0.50)
Principals Technology Leadership (Overall)	0.938	0.752
Visionary Leadership	0.897	0.635
Digital Age Learning Culture	0.930	0.689
Excellence in Professional Practice	0.943	0.705
Systemic Improvement	0.921	0.660
Digital Citizenship	0.958	0.741
Teacher Self-Efficacy (Overall)	0.907	0.765
Instructional Strategies	0.927	0.616
Classroom Management	0.916	0.579
Student Engagement	0.939	0.659



## RESULTS

### *The Level of Principal Technology Leadership and Teacher Self-Efficacy on ICT*

The mean interpretation value to measure the level of study variables refers to Darusalam and Hussin (2018) which is detailed into five parts: very high (4.21-5.00), high (3.41-4.20), medium (2.61-4.19), low (1.81-2.60), and (1.00-1.80). Based on descriptive statistics, the five dimensions of principal technology leadership show a high level, while teachers' self-efficacy variables are also at a high level. A summary of the mean values and standard deviations for the study variables is shown as in Table 6 below.

Table 6  
*Values for mean, standard deviation (SD) and level for each variable*

Variable and Dimension	Mean	SD	Level
Principals Technology Leadership (Overall)	3.80	0.49	High
Visionary Leadership	3.96	0.53	High
Digital Age Learning Culture	3.86	0.57	High
Excellence in Professional Practice	3.81	0.55	High
Systemic Improvement	3.70	0.59	High
Digital Citizenship	3.72	0.56	High
Teacher Self-Efficacy (Overall)	3.85	0.42	High
Instructional Strategies	3.76	0.48	High
Classroom Management	3.88	0.46	High
Student Engagement	3.90	0.47	High

The visionary leadership dimension showed the highest mean value ( $M=3.96$ ,  $SD=0.53$ ) compared to the other four dimensions. These findings also give the impression that a principal who has a clear vision and mission in ICT, can play a role as a visionary leader in the organization. The second highest mean value is digital age learning culture ( $M=3.86$ ,  $SD=0.57$ ). The existence of a learning culture involving the use of digital devices or software is an important indicator of the formation of technology leaders. Other dimensions also display high mean values such as excellence in professional practice ( $M=3.81$ ,  $SD=0.55$ ), digital citizenship ( $M=3.72$ ,  $SD=0.56$ ) and end with systemic improvement dimensions ( $M=3.70$ ,  $SD=0.59$ ).

Overall, the principal technology leadership variable recorded a high mean value ( $M=3.80$ ,  $SD=0.49$ ), while the teacher self-efficacy variable also displayed a high mean value ( $M=3.85$ ,  $SD=0.42$ ). The results of this analysis give the impression that principals in the state of Kedah have a high readiness to adopt the technology leadership style. Besides, teachers in the study area also have the confidence and ability to use ICT in improving the effectiveness of teaching and learning.

### *The Differences in Teacher Self-Efficacy Based on Gender and Age*

There are two tests used to analyze demographic differences in teachers' self-efficacy, namely t-test and ANOVA. This test is based on the following two hypotheses:

$H_{01}$ : There is no significant difference in teacher self-efficacy based on gender.

$H_{02}$ : There is no significant difference in teacher self-efficacy based on age.

First, a t-test was performed to test the first null hypothesis. The Levene's test recorded a value of  $p=0.10$  ( $p>0.05$ ), thus proving that these two sex groups are independent of each other and assuming homogeneity of variance is met. From this analysis, male teachers had higher mean values in self-efficacy on ICT ( $M=3.90$ ,  $SD=0.49$ ) compared



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to female teachers ( $M=3.82$ ,  $SD=0.39$ ). However, the findings show that there is no significant difference for teachers' self-efficacy based on gender factors, with the value of  $t(374)=1.67$ ,  $p=0.10$ . In other words, male and female teachers have similar self-efficacy on ICT, and gender factors are not a significant difference. This situation has resulted in the null hypothesis ( $H_01$ ) being supported when the p-value is more than 0.05. The t-test analysis is recorded in Table 7 below.

Table 7  
*T-test Analysis of Teacher Self-Efficacy based on Gender*

Gender	N	M	SD	t-value	Df
Male	104	3.90	0.49	1.67	374
Female	272	3.82	0.39		

Second, the ANOVA test was generated to test the second null hypothesis. Based on the Levene's test, a value of  $p=0.25$  ( $p>0.05$ ) was recorded, indicating that each age group was varied and met the homogeneity of variance. Table 8 shows the ANOVA analysis in which teachers aged 51 years and above had higher mean values ( $M=3.93$ ,  $SD=0.48$ ) compared to other age groups of teachers. Teachers aged 31-40 years ( $M=3.83$ ,  $SD=0.40$ ) and 41-50 years ( $M=3.83$ ,  $SD=0.39$ ) recorded the same mean value which is the second-highest. Also, the group of teachers aged 30 years and below recorded the lowest mean value ( $M=3.68$ ,  $SD=0.48$ ). The results of the ANOVA test showed that there was no significant difference in teachers' self-efficacy based on their age factor, with a value of  $F(3,372)=2.05$ ,  $p=0.11$ . Although there are differences in mean values between the age groups of teachers, the findings prove that age does not affect the differences in their self-efficacy in using ICT. Thus, it is clear that these findings cause the null hypothesis ( $H_02$ ) to be supported when the value of  $p>0.05$ .

Table 8  
*ANOVA Analysis for Teacher Self-Efficacy based on Age*

Age (years old)	N	M	SD	F	Df
30 and below	16	3.68	0.48	2.05	3, 372
31 – 40	123	3.83	0.40		
41 – 50	154	3.83	0.39		
51 and above	83	3.93	0.48		

### ***The Relationship between Principal Technology Leadership and Teacher Self-Efficacy***

Pearson's correlation is used to identify the relationship between principal technology leadership and teachers' self-efficacy of ICT. This test is implemented based on the following research hypotheses:

$H_{A3}$ : There is a significant positive relationship between principal technology leadership and teacher self-efficacy.

The value of the correlation strength interpretation in this study refers to Hussin et al. (2014) categorized into seven groups namely: 1.00 (perfect), 0.80-0.99 (very strong), 0.60-0.79 (strong), 0.40-0.59 (moderate), 0.20-0.39 (weak), 0.01-0.19 (very weak), and 0.00 (no relation). Based on the Pearson correlation test, the correlation coefficient value ( $r$ ) indicates that there is a moderate positive relationship ( $r=0.47$ ,  $p<0.01$ ) between the principal technology leadership and teachers' self-efficacy on ICT. These results give the impression that an alternative hypothesis ( $H_{A3}$ ) is acceptable. The effectiveness of teachers in using ICT in teaching is closely related to the role played by a technology leader. The relationship between these two variables is summarized in the following Table 9.



Table 9

*The relationship between principal technology leadership and teacher self-efficacy*

Variable	N	M	SD	1	2
1. Principals Technology Leadership	376	3.80	0.49	1	0.47**
2. Teacher Self-Efficacy	376	3.85	0.42		1

\*\*Correlation is significant at the 0.01 level (2-tailed)

***The Influence of Principal Technology Leadership on Teacher Self-Efficacy***

Multiple linear regression analysis was used to determine the influence of principal technology leadership on teacher self-efficacy. It is based on the following research hypotheses:

H<sub>A4</sub>: There is an influence of the dimensions of principal technology leadership on teacher self-efficacy.

Based on the ANOVA model in the analysis of multiple linear regression, it was found that the value of F is significant where  $F(5,370)=21.38$ ,  $p=0.00$  ( $p<0.05$ ). Besides, Table 10 records the results of the summary model for multiple linear regression analysis where the value of  $r^2=0.22$ . This value of  $r^2$  proves that there is a 22% variance in teachers' self-efficacy contributed by the dimensions of principal technology leadership. Although the value is low, it is enough to mean that the technology leadership of the principal is one of the predictors that evokes the effectiveness of teachers in implementing pedagogical activities when integrating ICT in the classroom. These results also support the hypothesis (H<sub>A4</sub>), and in other words, alternative hypotheses are accepted.

Table 10

*Multiple Linear Regression Analysis (Model Summary)*

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	0.47	0.22	0.21	0.37

Even so, there are only two dimensions in principal technology leadership that present a significant impact on teachers' self-efficacy. These dimensions are excellence in professional practice ( $\beta=0.21$ ,  $p<0.05$ ) and digital citizenship ( $\beta=0.16$ ,  $p<0.05$ ). The other three dimensions failed to contribute significantly to teacher self-efficacy when the  $p>0.05$  value where the visionary leadership dimension recorded values ( $\beta=0.03$ ,  $p=0.66$ ), digital age learning culture ( $\beta=0.06$ ,  $p=0.50$ ), and systemic improvement ( $\beta=0.06$ ,  $p=0.46$ ). Table 11 reports the influence of principals' technology leadership dimensions on teachers' self-efficacy in detail.

Table 11

*The Influence of Principals Technology Leadership Dimensions on Teacher Self-Efficacy*

Dimension	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta ( $\beta$ )		
(Constant)	2.36	0.16		15.11	0.00
Visionary Leadership	0.02	0.05	0.03	0.44	0.66
Digital Age Learning Culture	0.04	0.06	0.06	0.67	0.50
Excellence in Professional Practice	0.16	0.07	0.21	2.41	0.02
Systemic Improvement	0.04	0.06	0.06	0.74	0.46
Digital Citizenship	0.12	0.06	0.16	1.98	0.04

The effect of these two dimensions can also be written in the form of regression equations as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2$$

$$Y = 2.36 + 0.16(X_1) + 0.12(X_2)$$



Where,

Y = teacher self-efficacy

X<sub>1</sub> = excellence in professional practice

X<sub>2</sub> = digital citizenship

## **DISCUSSION**

### ***The Level of Principal Technology Leadership and Teacher Self-Efficacy on ICT***

The development of ICT nowadays has many benefits in improving the country's education system. Every teacher is now advised to integrate ICT as well as various digital technology devices to make their pedagogical process more effective. This situation also contributes to the increase in the level of high self-efficacy of teachers as a whole. Studies by Lailiyah and Cahyono (2017), Alt (2018) and Atabek (2020) state that the level of teacher self-efficacy is now at a high level despite having to face various challenges in arranging appropriate pedagogical methods. This situation has its truth when teachers are forced to increase their efforts to deepen and comprehend the level of understanding and ability of students in a focused manner. Teachers' knowledge of students' backgrounds will give teachers an advantage of organizing teaching strategies more meaningfully and following the level of student acceptance (Choi & Lee, 2018). The application of ICT in the teaching process will also not bring big problems if teachers can master what the needs and wants of their students.

The tricky thing for teachers is how to organize the best methods so that students have high involvement in each planned activity. A previous study by Schipper et al. (2018) found that the percentage of student engagement can increase when teachers can plan a systematic lesson study. At this stage, teachers are required to build positive behaviours to influence their self-efficacy starting from before until the end of the teaching process. The effectiveness of the teacher teaching process opens up the most incredible opportunity for teachers to manage the classroom and conducive learning environment (Poulou et al., 2019). Due to that, self-efficacy is one of the indicators and determinants of the successful integration of technology in teacher teaching (Hall & Trespacios, 2019). Thus, the application of ICT in the classroom is not a problem for teachers if their level of self-efficacy is at a high level.

Meanwhile, the technology leadership of the principal is also at a high level. This situation gives the impression that the principal is ready to play a role in fully adopting the character of the technology leader in the school organization. Earlier, Wei (2017), Thannimalai and Raman (2018) and Ugur and Koc (2019) proved that the principals in their study were prepared to adopt the features proposed by NETS-A. Indeed, a principal who successfully mastered the NETS-A indicator is said to have a high level of technology leadership (Omar & Ismail, 2020; Shyr, 2017). Technology leaders have an advantage that can be shared with all citizens in the organization. Based on the details of NETS-A (ISTE, 2009) technology leaders should have a clear ICT vision in the organization, create a digital-based learning culture and promote skills improvement through professional development programs. They also need to strive to transform schools into institutions that value optimal integration of ICT and be role models in all matters involving the use of ICT.

### ***The Differences in Teacher Self-Efficacy Based on Gender and Age***

In some respects, gender and age are significant differences in influencing a teacher's behaviour. Nevertheless, this study shows that there is no significant difference between gender and age on teachers' self-efficacy in terms of ICT use. The same phenomenon is also clearly stated by George et al. (2018) and Liu et al. (2020) where demographic factors are not a big question in enhancing teachers' self-efficacy at high performance. This case is because the positive behaviours displayed by a teacher will affect the way they work, their commitment and job performance in each task entrusted to them. The effectiveness of teachers' teaching is also the result of their high



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work motivation, earnestness, well-being and job satisfaction to produce students who excel in academics (Zee et al., 2018).

Typically, most organizations do not place gender or age factors as a benchmark for teacher teaching effectiveness. Although pedagogical methods are now embedded in the use of ICT, the original objectives of learning are the same as planned (Crossan, 2020). Every teacher should have a target that they need to educate students to become knowledgeable and skilled human beings in various fields. When ICT is implemented, indirectly, teachers should strive to mobilize teaching strategies that are appropriate to their abilities and capabilities (Gilkes, 2020). To realize this desire, management, especially principals should have a high level of awareness and not set targets that exceed the ability of teachers on a task (Cansoy & Parlar, 2018; Mincu, 2015). What is certain is that the wisdom of the administrator is required so that teachers regardless of gender or age, can work together to develop the school organization through the knowledge, skills and experience possessed among its citizens.

### ***The Relationship between Principal Technology Leadership and Teacher Self-Efficacy***

School leaders are individuals who lead teachers in mobilizing every activity planned so that the initial objectives are achieved. This statement is true when school leaders always provide the best service to teachers so that teachers can increase job satisfaction, self-efficacy and well-being at a high level (Huang et al., 2019; Sun & Xia, 2018). This study also proves that technology leadership is related to the self-efficacy of teachers, even at a moderate level. Previously, Omar et al. (2019) and Tiop and Talip (2020) also agree that teacher self-efficacy has a significant relationship with principals who practice technology leadership. Technology leaders will strive to ensure that teachers have the comfort to create a conducive learning environment. Therefore, technology leaders need to have strategic ICT planning, adequate financial allocation, provide the latest infrastructure and technical support, as well as encourage the absorption of technological aspects in the existing curriculum.

Nowadays, the demands towards 21st-century learning are a priority for every school citizen. This situation indirectly demands the ability and capability of teachers to implement teaching according to concepts that meet the needs of 21st-century learning (Drake & Reid, 2018). In this case, the principal who practices technology leadership certainly understands whatever the needs and wants of teachers to formulate appropriate teaching strategies. One of the ways is to increase the competence and self-efficacy of teachers to use the latest technology in designing teaching methods (Gilkes, 2020; Wei et al., 2016). Teachers can also improve their knowledge and skills in ICT through workshops, courses or ICT professional development programs planned by the school administration (Raman & Thannimalai, 2019). Through ICT competencies, teachers can empower self-efficacy, formulate teaching strategies using technological devices and try to use their abilities to increase student engagement in the classroom actively. Furthermore, this case can only happen if the principal can master the real character of technology leadership.

### ***The Influence of Principal Technology Leadership on Teacher Self-Efficacy***

In general, studies show that there is an influence of principals' technology leadership on teachers' self-efficacy on ICT. These findings have parallels with previous studies. For example, Weng and Tang (2014) found that technology leadership also influences the effectiveness of school administration. A study by Thannimalai and Raman (2018) found that technology leadership influences the integration of technology among teachers. Although their studies do not focus on teachers' self-efficacy, these findings provide novelty to another role of technology leadership in schools. Teachers are more confident to demonstrate the diversity of teaching strategies using ICT after receiving support from the administration. Principals should use the available power to encourage teachers to use any of the latest technology mediums that can bring positive results to student learning (Hero, 2020; Moreira et al., 2019).

Two dimensions are predictors of teacher self-efficacy, namely excellence in professional practice and digital citizenship. In a previous study, Yu and Prince (2016) also found that both dimensions influence the interest and



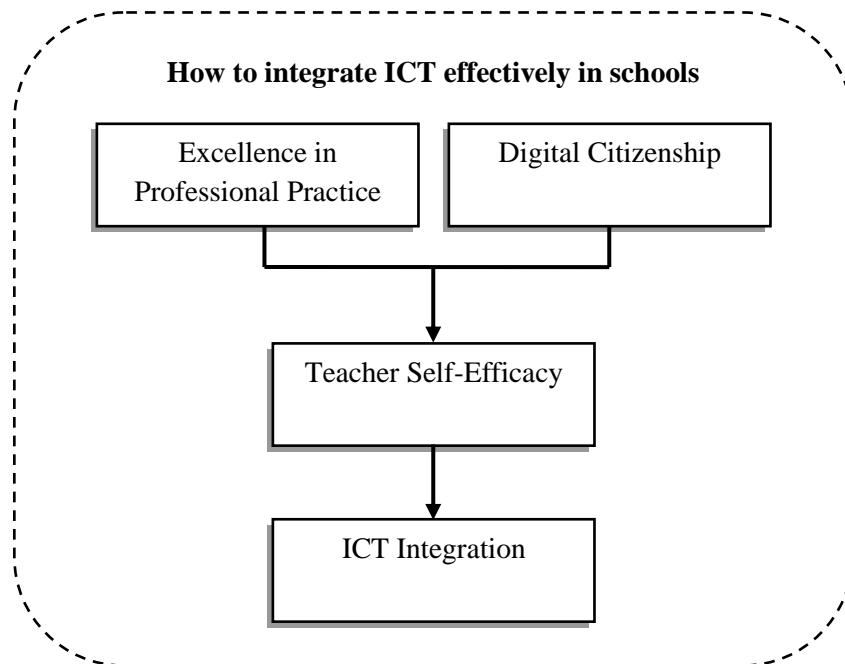


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development of technology among principals. These dimensions are also a significant marker to the formation of school culture as an ICT-based learning organization. Excellence in professional practice is the role of technology leaders to provide teachers with ICT competencies more systematically (Esplin et al., 2018). Meanwhile, principals who practice digital citizenship have a more open attitude and provide encouragement and guidance to teachers on how to use ICT safely, legally and ethically (Ugur & Koc, 2019). The practice of digital citizenship is also a trigger for the acceptance of teachers in the integration of mobile technology devices such as laptops, smartphones and even tablets (Omar & Ismail, 2020).

## CONCLUSION AND RECOMMENDATIONS

It is gratifying when studies provide positive signs that technology leadership is a contributor to teachers' self-efficacy. The empowerment of teachers' self-efficacy towards ICT is evidenced through two dimensions, namely excellence in professional practice and digital citizenship. Principals who practice these two dimensions are undoubtedly able to increase the ability and confidence of teachers to use ICT in the teaching and learning process. Effective teachers will try to improve their knowledge and skills in ICT, especially forming teaching strategies that stimulate student learning. Effective teachers are also able to use ICT to attract student involvement in every activity planned. Thus, the integration of ICT can create a more enjoyable learning environment while facilitating the task of teachers to manage the classroom. The summary of these findings can be illustrated in a model, as shown in Figure 5 below.



Even so, there are a few things to keep in mind to suggest in future studies. First, this technology leadership model still lacks three more dimensions of technology leadership, namely visionary leadership, digital age learning culture and also systemic improvement. These three characters may contribute to teachers' self-efficacy if tested on respondents of different cultures, environments, school climate, locations and different periods. This situation is exciting if this model is highlighted and proven empirically as a source of study can strengthen the self-efficacy of teachers in the future. Secondly, it is also suggested that this new model be tested more systematically using a structural equation modeling (SEM) approach. The SEM approach is the latest method that can test whether the model presented has a fitness model or vice versa, in addition to being able to identify the reliability of the model more accurately.



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## REFERENCES

- Alt, D. (2018). Science teachers' conceptions of teaching and learning, ICT efficacy, ICT professional development and ICT practices enacted in their classrooms. *Teaching and Teacher Education*, 73, 141–150. <https://doi.org/10.1016/j.tate.2018.03.020>
- Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly*, 41(1), 49–82. <https://doi.org/10.1177/0013161X04269517>
- Atabek, O. (2020). Associations between emotional states, self-efficacy for and attitude towards using educational technology. *International Journal of Progressive Education*, 16(2), 175–194. <https://doi.org/10.29329/ijpe.2020.241.12>
- Aurangzeb, W., Tahir, T., & Khan, K. (2019). An exploration of college principals' technology leadership competency assessment. *Global Social Sciences Review*, IV(II), 222–230. [https://doi.org/10.31703/gssr.2019\(IV-II\).29](https://doi.org/10.31703/gssr.2019(IV-II).29)
- Awang, Z., Hui, L. S., & Zainuddin, N. F. S. (2018). *SEM Simple Approach: Structural Equation Modeling*. Bandar Baru Bangi: MPWS Rich Resources Sdn Bhd.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company.
- Byrne, B. M. (2016). *Structural equation modeling with AMOS: basic concepts, applications and programming* (3rd ed.). Madison Avenue, New York: Taylor and Francis Group.
- Cansoy, R., & Parlar, H. (2018). Examining the relationship between school principals' instructional leadership behaviors, teacher self-efficacy, and collective teacher efficacy. *International Journal of Educational Management*, 32(4), 550–567. <https://doi.org/10.1108/IJEM-04-2017-0089>
- Choi, E., & Lee, J. (2018). EFL teachers' self-efficacy and teaching practices. *ELT Journal*, 72(2), 175–186. <https://doi.org/10.1093/elt/ccx046>
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). New York, NY: Routledge.
- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, California: SAGE Publications, Inc.
- Crossan, J. (2020). Thai teachers' self-efficacy towards educational technology integration. *Assumption University-EJournal of Interdisciplinary Research*, 5(1), 107–123.
- Darusalam, G., & Hussin, S. (2018). *Metodologi penyelidikan dalam pendidikan: Amalan dan analisis kajian* (2nd ed.). Kuala Lumpur: Penerbitan Universiti Malaya.
- Dewan, S., & Dewan, D. (2010). Distance education teacher as a leader: Learning from the Path Goal Leadership Theory. *Journal of Online Learning and Teaching*, 6(3), 673–685.
- Dexter, S., & Richardson, J. W. (2020). What does technology integration research tell us about the leadership of technology? *Journal of Research on Technology in Education*, 52(1), 17–36. <https://doi.org/10.1080/15391523.2019.1668316>
- Drake, S., & Reid, J. (2018). Integrated curriculum as an effective way to teach 21st century capabilities. *Asia Pacific Journal of Educational Research*, 1(1), 31–50. <https://doi.org/10.30777/APJER.2018.1.1.03>
- Esplin, N. L., Stewart, C., & Thurston, T. N. (2018). Technology leadership perceptions of Utah elementary school principals. *Journal of Research on Technology in Education*, 1–14. <https://doi.org/10.1080/15391523.2018.1487351>
- George, S. V., Richardson, P. W., & Watt, H. M. G. (2018). Early career teachers' self-efficacy: A longitudinal study from Australia. *Australian Journal of Education*, 62(2), 217–233. <https://doi.org/10.1177/0004944118779601>
- Gilkes, A. L. (2020). *Teachers' knowledge and self-efficacy beliefs as factors affecting technology integration practices*. Walden University.



# MALAYSIAN ONLINE JOURNAL OF EDUCATIONAL MANAGEMENT (MOJEM)

- Hair, J. J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Essex: Pearson Education Limited.
- Hall, A. B., & Trespalacios, J. (2019). Personalized professional learning and teacher self-efficacy for integrating technology in K–12 classrooms. *Journal of Digital Learning in Teacher Education*, 35(4), 221–235. <https://doi.org/10.1080/21532974.2019.1647579>
- Hatlevik, I. K. R., & Hatlevik, O. E. (2018). Examining the relationship between teachers' ICT self-efficacy for educational purposes, collegial collaboration, lack of facilitation and the use of ICT in teaching practice. *Frontiers in Psychology*, 9(June), 1–8. <https://doi.org/10.3389/fpsyg.2018.00935>
- Hero, J. L. (2020). Exploring the principal's technology leadership: its influence on teachers' technological proficiency. *International Journal of Academic Pedagogical Research*, 4(6), 4–10.
- House, R. J. (1996). Path-Goal Theory of Leadership: Lessons, legacy, and a reformulated theory. *Leadership Quarterly*, 7(3), 323–352.
- Huang, S., Yin, H., & Lv, L. (2019). Job characteristics and teacher well-being: the mediation of teacher self-monitoring and teacher self-efficacy. *Educational Psychology*, 39(3), 313–331. <https://doi.org/10.1080/01443410.2018.1543855>
- Hussin, F., Ali, J., & Noor, M. S. Z. (2014). *Kaedah penyelidikan & analisis data SPSS*. UUM Sintok, Kedah: UUM Press.
- International Society for Technology in Education. (2009). *ISTE Standards for Administrators*. Retrieved from [https://www.iste.org/docs/pdfs/20-14\\_ISTE\\_Standards-A\\_PDF.pdf](https://www.iste.org/docs/pdfs/20-14_ISTE_Standards-A_PDF.pdf)
- Jin, Y., & Harp, C. (2020). Examining preservice teachers' TPACK, attitudes, self-efficacy, and perceptions of teamwork in a stand-alone educational technology course using flipped classroom or flipped team-based learning pedagogies. *Journal of Digital Learning in Teacher Education*, 36(3), 166–184. <https://doi.org/10.1080/21532974.2020.1752335>
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 38(1), 607–610. <https://doi.org/10.1177/001316447003000308>
- Lailiyah, M., & Cahyono, B. Y. (2017). Indonesian EFL teachers' self-efficacy towards technology integration (SETI) and their use of technology in EFL teaching. *Studies in English Language Teaching*, 5(2), 344–357. <https://doi.org/10.22158/selt.v5n2p344>
- Li, L., & Liu, Y. (2020). An integrated model of principal transformational leadership and teacher leadership that is related to teacher self-efficacy and student academic performance. *Asia Pacific Journal of Education*, 1–18. <https://doi.org/10.1080/02188791.2020.1806036>
- Liu, Y., Bellibas, M. S., & Gumus, S. (2020). The effect of instructional leadership and distributed leadership on teacher self-efficacy and job satisfaction: Mediating roles of supportive school culture and teacher collaboration. *Educational Management Administration & Leadership*, 1–24. <https://doi.org/10.1177/1741143220910438>
- Lorenceanu, A., Marec, C., & Mostafa, T. (2019). *Upgrading the ICT questionnaire items in PISA 2021* (No. 202). Paris. <https://doi.org/https://dx.doi.org/10.1787/d0f94dc7-en>
- Mincu, M. E. (2015). Teacher quality and school improvement: what is the role of research? *Oxford Review of Education*, 41(2), 253–269. <https://doi.org/10.1080/03054985.2015.1023013>
- Moreira, M. A., Rivero, V. M. H., & Alonso, J. J. S. (2019). Leadership and school integration of ICT. Teachers perceptions in Spain. *Education and Information Technologies*, 24(1), 549–565. <https://doi.org/10.1007/s10639-018-9789-0>
- Omar, M. N., & Ismail, S. N. (2020). Mobile technology integration in the 2020s: The impact of technology leadership in the Malaysian context. *Universal Journal of Educational Research*, 8(5), 1874–1884. <https://doi.org/10.13189/ujer.2020.080524>
- Omar, M. N., Ismail, S. N., & Kasim, A. L. (2019). Hubungan kepemimpinan teknologi pengetua dan efikasi sendiri guru. *Jurnal Kepimpinan Pendidikan*, 6(4), 1–21.
- Oskay, O. O. (2017). An investigation of teachers' self efficacy beliefs concerning educational technology standards and technological pedagogical content knowledge. *EURASIA Journal of Mathematics, Science and Technology Education*, 13(8), 4739–4752. <https://doi.org/10.12973/eurasia.2017.00961a>



# MALAYSIAN ONLINE JOURNAL OF EDUCATIONAL MANAGEMENT (MOJEM)

- Poulou, M. S., Reddy, L. A., & Dudek, C. M. (2019). Relation of teacher self-efficacy and classroom practices: A preliminary investigation. *School Psychology International*, 40(1), 25–48. <https://doi.org/10.1177/0143034318798045>
- Raman, A., & Thannimalai, R. (2019). Importance of technology leadership for technology integration: Gender and professional development perspective. *SAGE Open*, 9(4), 1–13. <https://doi.org/10.1177/2158244019893707>
- Sakiz, H., Ekinci, A., & Saricam, H. (2019). Teachers' perceptions of their school managers' skills and their own self-efficacy levels. *International Journal of Leadership in Education*, 0(0), 1–19. <https://doi.org/10.1080/13603124.2018.1562094>
- Schipper, T., Goei, S. L., de Vries, S., & van Veen, K. (2018). Developing teachers' self-efficacy and adaptive teaching behaviour through lesson study. *International Journal of Educational Research*, 88, 109–120. <https://doi.org/10.1016/j.ijer.2018.01.011>
- Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach* (7th ed.). Chichester, West Sussex: John Wiley & Sons Ltd.
- Shengnan, L., & Hallinger, P. (2020). Unpacking the effects of culture on school leadership and teacher learning in China. *Educational Management Administration & Leadership*, 0(0), 1–20. <https://doi.org/10.1177/1741143219896042>
- Shyr, W. J. (2017). Developing the principal technology leadership competency indicators for Technical High Schools in K-12 in Taiwan. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(6), 2085–2093. <https://doi.org/10.12973/eurasia.2017.01215a>
- Sun, A., & Xia, J. (2018). Teacher-perceived distributed leadership, teacher self-efficacy and job satisfaction: A multilevel SEM approach using the 2013 TALIS data. *International Journal of Educational Research*, 92, 86–97. <https://doi.org/10.1016/j.ijer.2018.09.006>
- Thannimalai, R., & Raman, A. (2018). The Influence of principals' technology leadership and professional development on teachers' technology integration in secondary schools. *Malaysian Journal of Learning and Instruction*, 15(1), 203–228. Retrieved from <http://mjli.uum.edu.my/images/Vol15No1June2018/h-203-228.pdf>
- Tiop, T., & Talip, R. (2020). Hubungan kepimpinan teknologi pengetua dalam pengurusan kurikulum dan efikasi sendiri guru. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, 5(4), 71–83. <https://doi.org/10.47405/mjssh.v5i4.383>
- Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: capturing an elusive construct. *Teaching and Teacher Education*, 17, 783–805. [https://doi.org/https://doi.org/10.1016/S0742-051X\(01\)00036-1](https://doi.org/https://doi.org/10.1016/S0742-051X(01)00036-1)
- Ugur, N. G., & Koc, T. (2019). Leading and teaching with technology: School principals' perspective. *International Journal of Educational Leadership and Management*, 7(1), 42–71. <https://doi.org/10.17583/ijelm.2019.3758>
- Warrach, S. M., Bing, K. W., & Yusof, H. (2018). Developing and validating model of teacher quality using structural equation modeling (SEM) technique. *Malaysian Online Journal of Educational Management*, 6(3), 1–28. <https://doi.org/10.22452/mojem.vol6no3.1>
- Wei, L. M. (2017). *Principal technology leadership practices, teacher ICT competency, and teacher acceptance of School Management System (SMS) in Negeri Sembilan secondary schools*. (Doctoral Thesis), University of Malaya.
- Wei, L. M., Piaw, C. Y., & Kannan, S. (2016). Relationship between principal technology leadership practices and teacher ICT competency. *Malaysian Online Journal of Educational Technology*, 4(3), 13–36.
- 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. <https://doi.org/10.1016/j.compedu.2014.03.010>
- Yan-Li, S., & Hassan, D. (2018). Leadership behaviour on job satisfaction in Malaysian national secondary schools: Motivation and hygiene satisfaction. *Malaysian Online Journal of Educational Management*, 6(3), 48–67. <https://doi.org/10.22452/mojem.vol6no3.3>
- Yorulmaz, A., & Can, S. (2016). The technology leadership competencies of elementary and secondary school directors. *Educational Policy Analysis and Strategic Research*, 11(1), 47–61. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1127620.pdf>



# MALAYSIAN ONLINE JOURNAL OF EDUCATIONAL MANAGEMENT (MOJEM)

- Yu, C., & Prince, D. L. (2016). Aspiring school administrators' perceived ability to meet technology standards and technological needs for professional development. *Journal of Research on Technology in Education, 48*(4), 239–257. <https://doi.org/10.1080/15391523.2016.1215168>
- Zee, M., Koomen, H. M. Y., & de Jong, P. F. (2018). How different levels of conceptualization and measurement affect the relationship between teacher self-efficacy and students' academic achievement. *Contemporary Educational Psychology, 55*, 189–200. <https://doi.org/10.1016/j.cedpsych.2018.09.006>

## APPENDIX

### *Principals Technology Leadership (Instrument adapted from ISTE, 2009)*

Code	Items	Mean	$\alpha$
	Visionary Leadership		0.88
	My principal...		
VL1	spearheaded school planning towards the use of ICT.	3.89	
VL2	is involved in the ICT strategic plan.	4.05	
VL3	disseminated information about the ICT strategic plan.	4.01	
VL4	encourages teacher involvement in ICT strategic plans.	3.86	
VL5	supports the program in the ICT strategic plan.	3.98	
	Digital Age Learning Culture		0.92
	My principal...		
LC1	makes sure teachers use digital resources.	3.89	
LC2	encourages the effectiveness of ICT in learning.	4.00	
LC3	provides the concept of student-centred digital learning.	3.76	
LC4	ensures ICT practices across the curriculum.	3.84	
LC5	encourages teachers to innovate through digital resources.	3.87	
LC6	cultivates a learning community through ICT.	3.80	
	Excellence in Professional Practice		0.91
	My principal...		
PP1	provides the infrastructure for ICT development.	3.65	
PP2	nurtures teachers to adopt an ICT culture.	3.88	
PP3	is involved in the use of ICT.	3.84	
PP4	encourages effective communication through ICT.	3.82	
PP5	exemplifies effective collaboration through ICT.	3.88	
PP6	follows the latest technology usage trends.	3.88	
PP7	explored the potential of the latest technology in learning.	3.74	
	Systemic Improvement		0.89
	My principal...		
SIM1	maximizes school achievement through ICT resources.	3.68	
SIM2	leverages data to improve staff performance.	3.72	
SIM3	leverages data to improve student achievement.	3.71	
SIM4	invited outside experts to share ICT skills.	3.72	
SIM5	builds ICT's strategic partnerships with others organization.	3.73	
SIM6	provides ICT infrastructure for the school's operation.	3.65	
	Digital Citizenship		0.93
	My principal...		
DC1	made sure all students had access to ICT facilities.	3.59	
DC2	encourages the safe, legal and ethical use of ICT.	3.78	
DC3	exemplifies the safe, legal and ethical use of ICT.	3.77	
DC4	developed a safe, legitimate and ethical ICT policy	3.72	



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DC5	fosters social interaction through ICT.	3.73
DC6	emulates social interaction through ICT.	3.74
DC7	emulates cultural understanding through ICT.	3.74
DC8	leverages the development of global issues through ICT.	3.70

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*Teachers self-efficacy of ICT (Instrument adapted from Tschannen-Moran and Hoy, 2001)*

Code	Items	Mean	$\alpha$
	Instructional Strategies		0.93
	Through ICT, I can...		
IS1	diversify assessment strategies.	3.55	
IS2	explain student confusion.	3.76	
IS3	ask clear questions.	3.84	
IS4	diversify teaching strategies.	3.70	
IS5	answer multi-level questions from students.	3.79	
IS6	customize teaching based on students' understanding.	3.85	
IS7	measuring understanding related to student learning.	3.79	
IS8	tailoring challenges according to student level.	3.79	
	Classroom Management		0.92
	Through ICT, I can...		
CM1	controlling student discipline.	3.96	
CM2	influencing students to follow classroom rules.	3.98	
CM3	calming students who make noise.	3.89	
CM4	creating student discussion groups.	3.90	
CM5	addressing the problem of students who are left behind.	3.79	
CM6	addressing students who disrupt learning.	3.82	
CM7	predict student behaviour.	3.85	
CM8	creating a smooth learning routine.	3.88	
	Student Engagement		0.94
	Through ICT, I can...		
SE1	encourage students to carry out learning activities.	3.95	
SE2	foster students to appreciate learning.	3.91	
SE3	motivating students to increase engagement.	3.89	
SE4	ensure students diligently perform each activity.	3.98	
SE5	improve students' understanding through various activities.	3.89	
SE6	helping students think critically.	3.82	
SE7	evoke student creativity.	3.84	
SE8	delve into the problem of student acceptance level.	3.88	