

Technology Leadership in Education and Digital Integration In Educational Management

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Abstract:- Technology leadership is the key to digital integration in the field of education. However, there are various constraints preventing comprehensive technology integration in education today. The purpose of this report is to examine, analyze, and compare two studies focusing on technology leadership of educational leaders and digital integration in education, particularly in the context of schools in Malaysia. The analysis and comparison of the studies specifically focus on the concept of the Technology Leadership Model using the NETS-A standards and how a hypothesis model is constructed based on NETS-A adjusted to the education system in this country. Findings from both selected articles indicate that the level of technology leadership of educational leaders is high, but there are still various issues related to technology leadership in Malaysia that need attention, such as leaders not practicing virtual leadership, teachers as leaders not being proficient in optimizing technology use, and current limitations in technology usage equipment. Implications for each discussed issue are examined from policy, training, administration, and educational leadership aspects to ensure that the proposed steps taken have a positive impact on all educational entities and institutions. The results of this report show that technology leadership plays a crucial role in digital integration in schools in line with the functions and roles of leaders as the primary drivers of schools.

Keywords:- Component; Technology Leadership, Educational Leaders, Digital Integration, Educational Management, NETS-A Standards.

I. INTRODUCTION

The world's education system is currently exploring the principles of the fourth industrial revolution (IR 4.0); a principle that requires preparedness to face comprehensive advancements in digital, robotics, communication, economics, and lifestyles. IR 4.0 witnesses the Internet of Things (IoT) or more commonly known as IoT, encompassing various aspects of contemporary life, making digital competence a necessity that needs to be integrated into the education system from an early stage (Mullen, 2019). Therefore, the function of leadership in education as well as teachers' skills in teaching and learning need to evolve in line with progress to remain relevant (Schwab, 2018). This step is crucial to produce high-quality human capital for this industrial era (Thannimalai and Raman, 2018). This aspiration is also aligned with the

Sustainable Development Goals (SDGs) under SDG4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Leadership in education becomes the primary key that needs to be emphasized due to their role in integrating technology in schools. The Ministry of Education Malaysia (MOE) emphasizes the importance of school leaders through the Malaysian Education Development Plan (PPPM) 2013-2025 in Chapter 5, as well as the role of ICT in pedagogical implementation and curriculum through Wave 3. Dynamic educational leaders who are always brave and ready to embrace change in this era of technology and modernization need to be present in schools (Yusof, Faiz, and Ibrahim, 2019). Educational leaders at the school level; Principals and Headmasters have a significant responsibility to ensure that the administrative and teaching staff under their leadership are always prepared. This is where the need for technology leadership arises, where Principals and Headmasters execute their leadership concept through current technological facilities. This technology leadership integrates the use of digital technology into leadership styles that serve as intermediaries for every decision made, problem-solving conducted, and task distribution within the organization; different from conventional and traditional leadership before (Lee, 2010).

II. TECHNOLOGY LEADERSHIP MODEL

Current technology has indeed explored and enhanced traditional leadership concepts through the integration of technology into this leadership concept. The term technology leadership, which encompasses two fields, namely leadership and teaching technology, is also known by other researchers as educational technology leadership (Kearsley and Lynch, 1994), ICT leadership (Afshari, Bakar, Luan, and Siraj, 2012), digital leadership (Arokiasamy, Abdullah, and Ismail, 2014), and the more straightforward term with the addition of 'e', e-leadership (Jameson, 2013).

Past studies have shown that several perspectives such as employee attitudes, behaviors, feelings, and thinking styles within an organization are greatly influenced by the leadership style practiced by that organization (Cetin et al., 2012). For example, when we look at teachers' perceptions in schools, empirical studies show findings that the success of a school depends heavily on the management of principals and headmasters who are effective (Aniza and Zaidatol Akmaliah, 2013; Horng and Loeb, 2010; Hoy and Miskel, 2013; Mohd

Yusri and Aziz, 2014; Yusof and Ibrahim, 2016; Zaidatul Akmaliah and Soaib, 2011; Angelle et al., 2011). The leadership of principals and teaching competence are major contributors to the excellence of the school (James and Balasdran, 2013) to ensure quality education for students, thus having a significant impact on educational management.

There are various forms of technology leadership models developed by contemporary researchers. Among the models frequently seen is the Anderson and Dexter Technology Leadership Model introduced in 2005. This model emphasizes demographic factors, types of schools, infrastructure, and financial status, but based on the differences in factors for each institution, technology leadership is positioned as the link between infrastructure factors and technology integration (Anderson and Dexter, 2005). Figure 1 illustrates the concept of this model comprehensively.

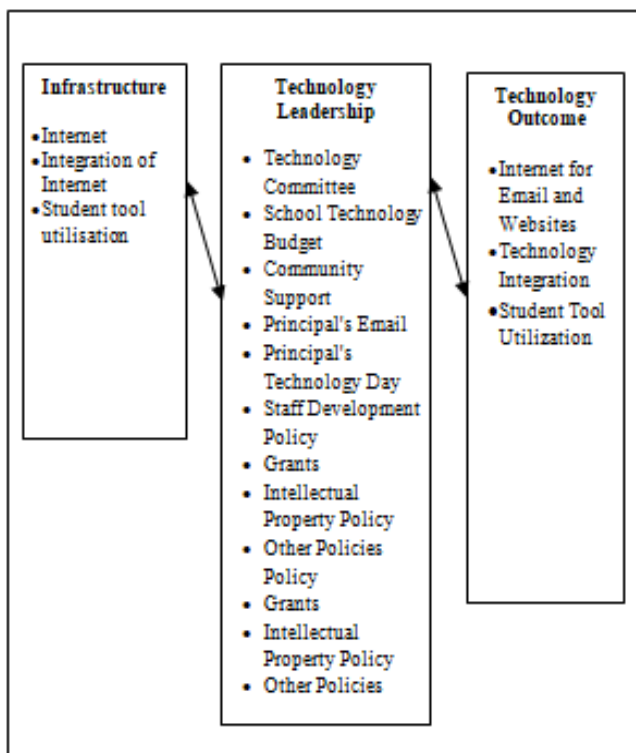


Fig. 1. The Anderson and Dexter Technology Leadership Model 2005

Based on Figure 1, the nine components of this technology leadership influence both infrastructure provision and technology outcomes bidirectionally. Raamani and Arumugam (2018) briefly explain that for every improvement in infrastructure elements, technology leadership commitment will also increase, thereby yielding positive outcomes for technology results.

One popular framework for technology leadership is the National Educational Technology Standard for Administrators (NETS-A) issued by the International Society for Technology in Education (ISTE). NETS-A has five easily classifiable components: visionary leadership, digital age learning culture, excellence in professional practice, systemic improvement, and digital citizenship (ISTE, 2009). All emphasized aspects

in the framework provide an overview of how a technology leader plays a role in the field of education. Through the NETS-A model, researchers can examine various related aspects such as teacher technology integration, teacher self-efficacy, and school ICT achievement. NETS-A also serves as guidelines that school principals can use to understand their role as technology leaders and apply technology integration in the school's educational processes (Sincar, 2013). This framework concept can be depicted as shown in Figure 2;

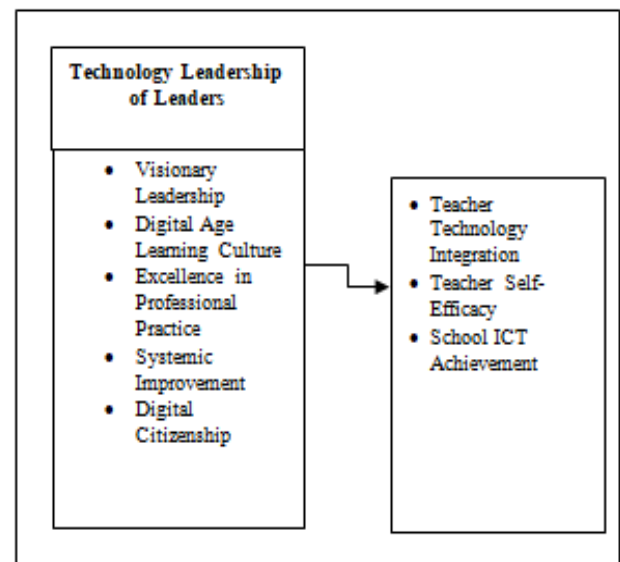


Fig. 2. NETS-A Framework Model

Educational leadership focused on e-leadership or technology leadership can demonstrate differences between current ICT usage and implementation practices with studies conducted to examine leadership domains (Avolio et al., 2014; DasGupta, 2011; Jameson, 2013; Lovelace, 2015). Numerous past studies indicate that technological and economic advancements are shaping a new context for leadership in schools (Avolio and Kahai, 2003; Gurr, 2004; Savolainen, 2013), and this has a significant influence on principals in ensuring their digital competencies and those of their teachers are at the appropriate level.

III. OBJECTIVES

The purpose of this concept paper is to examine and analyze two studies on technology leadership and its impact on technology integration in schools. The selected studies are "Principals' Technology Leadership and its Effect on Teachers' Technology Integration in 21st Century Classrooms" and "Digital Leadership Among School Leaders in Malaysia."

IV. PROBLEM STATEMENTS

Given that effective leadership is a crucial element in producing holistic educational leaders, the primary agenda in striving for excellent education goals is the development of ideal leadership such as virtual leadership; aligning with current needs (Hallinger, 2011; Harris et al., 2019). However, a significant problem with virtual education is that many

leaders and educators in the education field are still not competent in using technology (Apsorn, Sisan, & Tunkunanan, 2019). Based on Article 1, the stated problem is related to the function of technology leaders and the use and integration of digital materials in the teaching and learning process (TLP). The Malaysian Ministry of Education (MOE) has allocated over RM600 million for the implementation of ICT in educational initiatives, such as 1BestariNet. However, according to the Third Series of the National Audit Report 2013 (Ministry of Finance, 2014), one of the weaknesses found is the very low usage of the Virtual Learning Environment (VLE) by teachers, ranging from 0.57% to 4.69%, which proves that technology integration in classrooms is still at a worrying level, especially when technology leadership of educational leaders is not fully utilized to ensure that teachers as leaders can fully utilize technology and digital devices. Therefore, realizing the importance of technology leadership among school principals to address this issue, this paper examines the level of technology leadership using the NETS - A framework construct to assess teacher technology integration in schools. The objectives of Article 1 are;

- To identify the level of technology leadership of principals in secondary schools;
- To identify the level of teacher technology integration in secondary schools; and
- To determine whether the constructs of principal technology leadership (visionary leadership, digital age learning culture, excellence in professional practice, systemic improvement, and digital citizenship) influence teacher technology integration in secondary schools.

Article 2 focuses on how literature reviews in the context of Malaysian educational leaders indicate that many school leaders have low (Kannan, 2013) and moderate (Kannan, Sharma, & Zuraidah, 2012) levels of knowledge and skills in technology leadership. Technology leadership in the context of the selected study is defined as the integration of digital technology such as mobile devices, communication applications, and web applications in the leadership practices of school leaders in using technology in schools, making the concept of digital leadership broader. This is not only about the use of computers or technology in performing leadership functions in schools but also providing a wide digital network such as online forums, blogs or digital bulletin boards, online file sharing, and video conferencing to enhance leadership and teaching and learning practices (Yusof, 2013). However, relatively, there is still no digital leadership model specifically developed in the context of educational leadership environments in Malaysia. Therefore, this article serves as an initial study aimed at developing a model for measuring digital leadership among school leaders by identifying their dimensions, functions, and behaviors. However, the hypothesis model used still refers to the NETS - A construct.

Both articles explain the importance of technology leadership functions and the need to identify the level of technology leadership in schools. A clear difference that can be seen is the measurement methods used. Article 1 uses a standard measurement standard, namely NETS - A, while Article 2 constructs a hypothesis model based on previous

research models with two main dimensions, namely communication and school climate, to be adapted to the study context in Malaysia. Both theories are related, although the hypothesis model used focuses only on more specific constructs. Based on the problem statement of Article 2, the two selected dimensions are communication and school climate. All indicators under the dimensions of communication and school climate are also explained in NETS - A through the visionary leadership and digital age learning culture standards. This shows the relationship for examining the findings of this study. The problem statements for both articles stem from the same situation, which is the low usage and integration of technology in schools.

V. RESEARCH FINDINGS

The findings for Article 1 are divided into three sections: principal demographics, principal's level of technology leadership in schools, and the level of teacher technology integration in secondary schools. The demographic findings show that 61.7% of teachers are male, 95.7% of teachers are over 45 years old, and 72.3% have between 2 to 10 years of experience. The level of principal technology leadership in schools shows high readings with a minimum of 4.05, and the level of teacher technology integration is also quite high with a minimum reading of 3.62. Subsequently, the confirmation of constructs and indicators used was made using the PLS Algorithm, and it showed that the construct reliability values based on Cronbach's Alpha exceeded the recommended value of 0.70, while the convergent validity was 0.5, indicating that the validity discrimination conditions were achieved for this study. The model framework used for Article 1 is as follows:

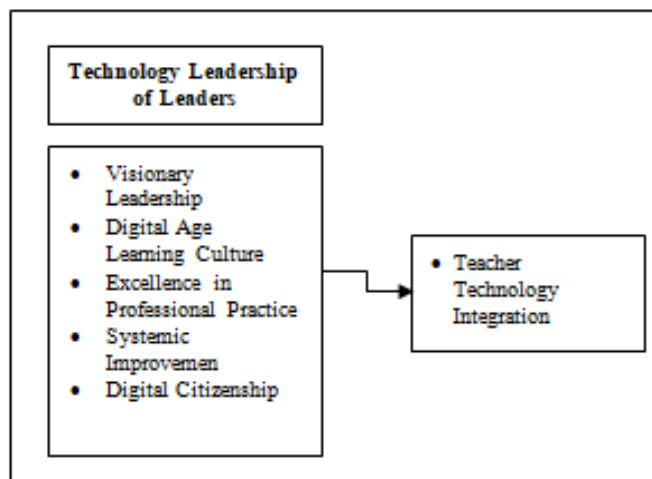


Fig. 3. Article 1 Hypothesis Model

Figure 3 provides an overview of how constructs in technology leadership are tested to obtain information regarding teacher technology integration. When looking at Article 2, the research findings show that the digital leadership variables are normally distributed and interdependent on each other. To ensure the validation of constructs and indicators proposed in the digital leadership model, a factor validation analysis was conducted, and all indicators in this hypothesis model were accepted as constructs in digital leadership. Then, the validation of

constructs and indicators proposed in the digital leadership model was followed by factor validation analysis to show that the study conducted on 352 respondents has successfully developed a measurement model for digital leadership for use in educational settings in Malaysia.

The results of the factor validation analysis indicate that two dimensions and nine constructs out of the 10 proposed constructs and 42 digital leadership behaviors of school leaders have been identified for use in this digital leadership model. The constructs are as follows: i. virtual meetings and conferences, ii. virtual discussions, iii. virtual information sharing, iv. online file sharing, v. virtual communication, vi. supervision of virtual teaching and learning, vii. virtual student performance monitoring, viii. virtual development programs and professionalism, and ix. virtual school goal promotion. The hypothesis model used by Article 2 is as follows:

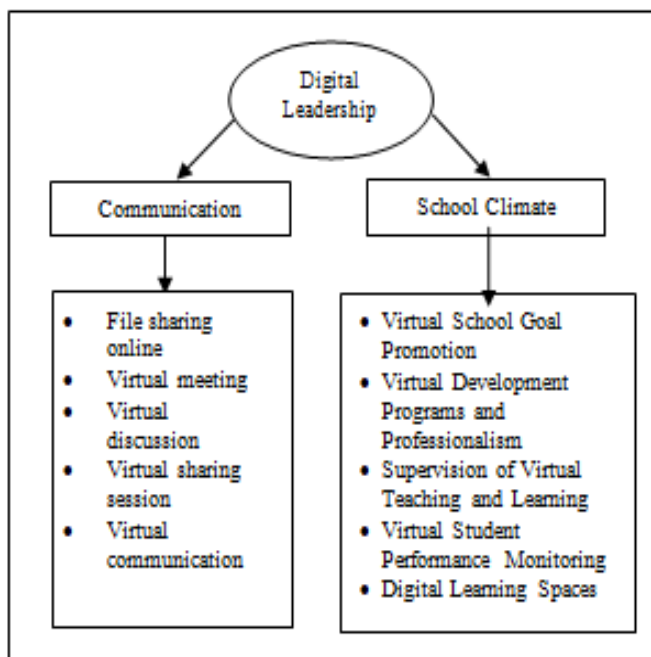


Fig. 4. Article 2 Hypothesis Model

Based on the research findings of both articles, it can be concluded that the level of technology or digital leadership of a leader can be seen through the integration of technology in their schools. For example, the findings of Article 1 emphasize the aspect of digital learning culture, which is also tested in Article 2 through the school climate dimension, namely supervision of virtual teaching and learning, virtual student performance monitoring, and digital learning spaces. This is a positive finding, indicating that a digital leadership model developed specifically in the context of educational leadership in Malaysia can be effectively utilized. Demographic factors such as gender, age, teaching experience, and study location are among the aspects that need to be highlighted in future research to see if they play a role in the differences in research findings, especially in examining differences between schools led by male and female principals.

VI. EDUCATIONAL TECHNOLOGY LEADERSHIP AND ISSUES IN MALAYSIA

Although the findings of both selected articles indicate that the level of educational technology leadership in schools is high, there are still various issues related to technology leadership in Malaysia at present that need attention. Both articles touch on the importance of providing school leaders who are competent in technology and ICT integration, including suggestions for conducting principal preparation programs focused on technology. This indicates the existence of leaders who do not integrate technology in their institutions, let alone practice technology leadership. Article 1 also mentions the competency of teachers in using technology optimally because teachers need to be innovative, especially when introducing and promoting IoT in classrooms. Schools also need to be prepared, as stated in article 2, to build high ICT skills and competencies for IR 4.0. All the issues addressed in both articles are further discussed below:

A. Educational Leaders do not Practice Virtual Leadership

The practice of virtual leadership by school leaders is found to be incomplete, especially when there are still leaders who do not encourage extensive technology use in schools. The situation becomes more acute when school leaders do not make the implementation of technology-based teaching and learning in virtual spaces a culture in schools. This results in various problems between teachers and students, especially when they are forced to maximize online teaching and learning sessions like the current pandemic situation.

The pandemic situation has created new challenges for administrators and teachers when faced with remote working issues. Problems arise when they need to work but are not in the same place or physically separated from leaders, especially for school principals who have never cultivated supervision and online teaching and learning before. The main problem that arises is ineffective communication when principals or headmasters fail to communicate effectively with teachers under their responsibility. This problem has been occurring for a long time because it is natural for school leaders to be busy and often involved in meetings and commitments outside of school, causing their focus to stray from the curriculum and teaching in school. This problem can be overcome with the use of technology, which can actually optimize communication among all parties.

B. Teachers are not Proficient in Optimising Technology Use

The increase in ICT use in schools provides opportunities for students to view the teaching and learning process from various different perspectives, thereby motivating them to continue learning. Therefore, continuous efforts are being made to improve teachers' ICT skills in Malaysia, but ICT integration in schools has not yet reached a satisfactory level. Teachers' digital competence is still worrying because teachers are expected to have high knowledge in this field, especially when they need to conduct 21st-century classes and teaching. One of the main reasons for the lack of ICT use is explained by Hennessy, Ruthven, and Brindley (2015) to be due to lack of confidence and support

from educational leaders and schools regarding technology. A study conducted by UNESCO in 2012 also found that ICT use by teachers in schools mostly only involves using Microsoft Word applications for teaching, and if this is true, it is indeed very worrying.

Next is the challenge for teachers to capture students' focus during online learning processes. This issue may seem simple but actually has a significant impact on the process of preparing materials and planning by teachers. Students will also benefit more from this integration. For example, past studies have shown that through the use of blogs, students find it easier to improve their writing skills, are motivated to write, and make their writing more dynamic through digital interactions on social media. The situation becomes more acute in the current situation when, according to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the COVID-19 pandemic has affected 1.5 billion students from more than 165 countries worldwide, making online learning the primary medium for education now. Online learning requires teachers to search for and use various available resources to make the teaching and learning process more interactive and interesting.

C. Limitations in Technology and the Use of Facilities

The problem becomes more acute when currently, many teachers and students still do not have good internet access, especially for those living in rural areas. According to SKMM (2020), internet usage in urban areas is 75.6%, while in rural areas, it is 24.4% for the year 2020. The difference of 51.2% in internet usage rates between urban and rural areas is very significant. The lack of Internet infrastructure in rural areas can be a major obstacle to virtual leadership.

The issue of convenience and comfort during learning is also significant. Technological equipment, internet, furniture and equipment, lighting, learning spaces, and air quality are components that affect the quality of classroom environments. There are still parents who cannot provide computer facilities, internet, and suitable learning environments for their children to undergo online learning, thereby affecting their learning performance. Online learning implemented by schools needs to take into account the suitability and capabilities of students, and this is where school leaders need to play a role in being aware of the conditions of students in their schools and finding alternatives to solve these problems.

VII. IMPLICATIONS OF TECHNOLOGICAL LEADERSHIP IN EDUCATIONAL MANAGEMENT

Based on the issues stated, it is clear that there are still many challenges to be addressed in ensuring progress in the field of education in Malaysia. There are many implications that can be seen through this technological leadership. The implications will be discussed according to the following aspects:

A. Policy

The Ministry of Education Malaysia (MOE) has implemented technology-based projects to digitize education management in line with the ICT Transformation Plan 2019-

2023 and the Digital Education Policy (DEP). The goal of this plan, also known as the ICT Transformation Plan (ITP), is to enhance the ministry's operational effectiveness to a higher level by emphasizing an ideal future ICT environment and operations that complement the MOE. Additionally, the Malaysia Education Development Plan (PPPM) 2013-2025 also emphasizes the aspect of equitable access to internationally benchmarked quality education and leveraging information and communication technology (ICT) to enhance the quality of education in the country. However, clear online learning policies, including a curriculum suitable for online learning, need to be established to enable all parties to play their roles in achieving these goals.

Currently, technological leadership plays a key role in creating fundamentally risk management plans at the ministry level to the school level to ensure that all students receive education in line with the aspirations of Education For All. Education For All is an initiative by MOE to close the education gap and develop holistic and balanced human capital from various aspects. Inspired by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) through Education For All (EFA), this global mandate aims to ensure the educational needs of all individuals are met. Education For All emphasizes three main objectives: value-based education, improving the quality of the entire system, and autonomy and accountability for schools and universities, in line with the aspirations of the PPPM 2013 - 2025 to improve literacy and numeracy rates, teaching quality, teacher skills, and school leadership quality.

MOE also needs to make the integration of technology and ICT a mandatory policy in all schools based on the needs and capabilities of the schools. The government needs to ensure that every school is equipped with the latest technology and equipment to produce students who can face the challenges of the IRF.0. This is a step forward in education, in addition to preparing for any future issues. The pandemic situation, which requires online learning using Internet access and various devices such as computers, tablets, etc., actually increases the level of ICT use in education (König et al., 2020; Rahayu Ahamad Bahtiar et al., 2020). However, according to the Study of Student Readiness in Online Learning, 36.9% of students are still left out of online learning (MOE, 2020), which is a serious issue that needs to be addressed promptly.

B. Training

Technology leaders who are considerate of others need to be sensitive and understand when monitoring and directly involving in managing change. Among the critical aspects is the technology knowledge and expertise gap. Educational leaders need to deal with teachers from different generations (baby boomers, Generation X, Y, and Z) who have various levels of technological competencies (Rahayu et al., 2020). In implementing change strategies, leaders need to play a role in planning organizational goals and activities, including in the field of training and professionalism. This step is important considering that teachers use this online learning as a support to conventional learning conducted in classrooms at school.

MOE has conducted various courses to equip teachers with skills in using digital learning platforms and building teaching materials, and this is where technological leadership plays a role in ensuring that all teachers can share the information they receive. Additionally, teachers can also self-train to enhance their technology skills through various free online applications. All of these efforts are not impossible, as we can now see various digital learning materials produced by teachers themselves, especially throughout the year 2020 through applications like CikgoTube, the Google Classroom Malaysia Telegram group, and the Teacher Library and Media Facebook group. School leaders can also ensure that continuous training is still ongoing at the school level for a few teachers who still need guidance, and it is hoped that the role played by skilled teacher colleagues and appointed trainers can assist them. Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive.”

C. Administration

Teacher and principal competencies have a significant influence on the quality management, administration, and students as the product of current school education (Widhyanti and Shahril@Charil, 2016). However, traditional leadership models are mostly no longer suitable for addressing the problems and challenges that arise, such as dealing with this pandemic. Modern leadership models such as technological leadership require 21st-century leaders to always be prepared to face crises, be responsive to changing dynamics in leadership and management. Leaders need to be adept at adapting to sudden changes, making good decisions, being creative, engaging in collaborative decision-making, and being trustworthy when unforeseen circumstances arise (Rahayu Ahamad Bahtiar et al., 2020).

In addressing the problems that arise, leaders need to be flexible and understand the tasks carried out by teachers in conducting online learning. Flexibility here includes the willingness and ability to respond quickly to changing circumstances and expectations, especially during difficult times (Doyle, 2020). The new norms in work with remote work require leaders who can use all available alternatives to ensure their roles as leaders and educators continue as usual. Furthermore, to ensure that this virtual leadership can enhance teacher digital integration, action needs to start from the beginning by designing school goals based on digital competency as this is the school management's jurisdiction. By making digital competence and technology use the backbone of every school's planning and activities, teachers will be more motivated and subsequently enhance their own digital competence. Among the changes in the current school leadership landscape are more organized and easier forms of communication with the aid of communication technology. Through mobile devices, the Internet, wireless connections, and new virtual communication mediums like WhatsApp and Telegram, administrators can cultivate all aspects of this communication to ensure that the welfare and needs of teachers are not neglected.

D. Teachers and Students

Teachers play important roles as guides, leaders, facilitators, and facilitators in the teaching and learning processes conducted in schools previously. Teachers who actively motivate students to learn can create a sense of enjoyment for learning among students, thereby enhancing their achievements (Suwardi and Farnisa, 2018). Taking the current situation as an example, the main problem with online learning is that students will easily get bored as they cannot interact with peers as before, but when teachers play a good role in teaching and creating interaction and communication among themselves, this issue can be overcome. To improve face-to-face or online teaching performance, Muniroh Hamat, Siti Balqis Mahlan, and Ch'ng Pei Eng (2020) explain that this digital competence can be a catalyst for teachers to improve the quality of teaching and learning when teachers can use more interactive teaching materials to ensure students remain motivated.

Furthermore, students need to take advantage of this by enhancing their understanding to improve their achievements through available technology. Learning access has now been expanded because students can access learning materials such as videos regardless of time and place (Malini and Tan, 2020). Therefore, students need to play a role by participating in the conducted learning, obtaining as much information and materials available on the Internet to make the learning meaningful and effective.

VIII. CONCLUSION

The integration of technology in Teaching and Learning (PdP) processes can indeed enhance motivation for learning, develop problem-solving abilities, promote technology-based skills, and improve social and communication skills (KPM, 2019). Continuous efforts are being made to enhance educational leaders' and teachers' ICT skills in Malaysia (Wei, Piaw, & Kannan, 2017). Educational leaders and teachers need to master these new skills and adapt to remain relevant amidst every pattern of change in the current education system.

REFERENCES

- [1]. Avolio, B. J., & Kahai, S. S. 2003. Adding the “e” to e-leadership: How it may impact your leadership. *Organizational Dynamics*, 31(4), 325–338.
- [2]. Avolio, B. J., Sosik, J. J., Kahai, S. S., & Baker, B. 2014. E-leadership: Re-examining transformations in leadership source and transmission. *The Leadership Quarterly*, 25(1), 105–131.
- [3]. Bity Salwana Alias, Ahmad Basri Yussof, Ramlee Mustapha & Mohammed Sani Ibrahim. 2008. Kompetensi pengetua sekolah menengah Malaysia dalam bidang pengurusan kurikulum. Kertas kerja Seminar Nasional Pengurusan dan Kepimpinan Pendidikan ke-15 IAB, Genting Highland.
- [4]. Che Nidzam Che Ahmad, Kamisah Osman, & Lilia Halim. 2010. Hubungan ramalan persekitaran pembelajaran makmal sains dengan tahap kepuasan pelajar. *Jurnal Pendidikan Malaysia*, 35(2), 19–30.

- [5]. Fong, S., Ch'ng, P., & Por, F. 2013. Development of ICT competency standard using the Delphi technique. *Procedia-Social and Behavioral Sciences*, 103, 299-314.
- [6]. Hallinger, P. 2011. A Review of Three Decades of Doctoral Studies Using the Principal Instructional Management Rating Scale: A Lens on Methodological Progress in Educational Leadership. *Educational Administration Quarterly*, 47(2), 271-306.
- [7]. Harrison, C., Comber, C., Fisher, T., Haw, K., Lewin, C., Lunzer, E., et al. 2002. Impact 2: The impact of information and communication technologies on pupil learning and attainment. http://www.becta.org/uk/page_documents/research/Impact2_strand1_report.pdf [1 Januari 2021]
- [8]. Hennessy, S., Ruthven, K., & Brindley, S. 2015. Teacher perspectives on integrating ICT into subject teaching: commitment, constraints, caution, and change. *Journal of Curriculum Studies*, 37(2), 155-192.
- [9]. Hollenbeck, G.P., McCall, W.M. Jr. & Silzer, R.F. 2006. Leadership competency models. *The Leadership Quarterly* 17(4): 398-413.
- [10]. Jabatan Perangkaan Malaysia. 2020. Laporan Survei Penggunaan Dan Capaian ICT Oleh Individu Dan Isi Rumah 2019 (Issue April).
- [11]. Kohsamut, T., & Sucaromana, U. 2017. Using blog to enhance english writing skill among high school students in Thailand. *PEOPLE: International Journal of Social Sciences*, 3(2).
- [12]. König, J., Jäger-Biela, D. J., & Glutsch, N. 2020. Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany. *European Journal of Teacher Education*, 43(4), 608–622. <https://doi.org/10.1080/02619768.2020.1809650>
- [13]. Kung, F. W. 2018. Assessing an innovative advanced academic writing course through blog-assisted language learning: Issues and resolutions. *Innovations in Education and Teaching International*, 55(3), 348-356.
- [14]. Leong, M. W. 2010. Principal technology leadership and the level of ICT application of teachers at a secondary school in Seremban district. (Unpublished master thesis). University of Malaya, Kuala Lumpur.
- [15]. Ministry of Education. 2012. National education policy. <https://www.moe.gov.my> [2 Januari 2021]
- [16]. Mullen, C. 2019. 21st-century priorities for leadership education and prospective school leaders. https://www.researchgate.net/publication/331718834_21st-Century_Priorities_for_Leadership_Education_and_Propective_School_Leaders [14 Januari 2021]
- [17]. Muniroh Hamat, Siti Balqis Mahlan, Ch'ng Pei Eng. 2020. Adaptasi Pengajaran Dan Pembelajaran Secara Maya Dalam Kebiasaan Baharu Semasa Pandemi Covid-19. September, 23–30.
- [18]. Nyikes, Z. 2018. Contemporary digital competency review. *Interdisciplinary Description of Complex Systems: INDECS*, 16(1), 124-131.
- [19]. Rahayu Ahamad Bahtiar, Sham Ibrahim, Halijah Ariffin, Nor Hazimah Ismail, & Wan Mohd Khairul Wan Isa. 2020. Peranan Dan Cabaran Pemimpin Pendidikan Dalam Memastikan Matlamat Dan Agenda Pendidikan Dilestari Dalam Tempoh Perintah Kawalan Pergerakan (PKP) COVID-19. April 2020, 1–23. http://iab.moe.edu.my/bahanportal/pemberitahuan/2020/2.PERANAN_DAN_CABARAN_PEMIMPIN_PENDIDIKAN.pdf
- [20]. Savolainen, T. 2013. Trust building in e-leadership – Important skill for technology-mediated management in the 21st century. In *Proceedings of the International Conference on Management, Leadership and Governance* (pp. 288–296). Bangkok, Thailand.
- [21]. Schwab, K., & Davis, N. 2018. *Shaping the fourth industrial revolution*. New York: Crown Publishing Group.
- [22]. Setyaningsih, R., Abdullah, A., Prihantoro, E., & Hustinawaty, H. 2019. Model penguatan literasi digital melalui pemanfaatan e-learning. *Jurnal ASPIKOM*, 3(6), 1200-1214.
- [23]. Sincar, M. 2013. Challenges school principals facing in the context of technology leadership. *Educational Sciences: Theory & Practice*. 13(2), 1273-1284.
- [24]. Soni, S. & Dubey, S. 2018. Towards Systematic Literature Review of E-learning. *International Journal of Scientific Research in Computer Science, Engineering and Information*, 3(3), 1389-1396.
- [25]. Sulistyoto, T., Mukminatien, N., Cahyono, B. Y., & Saukah, A. 2019. Enhancing learners' writing performance through blog-assisted language learning. *International Journal of Emerging Technologies in Learning (IJET)*, 14(09), 61-73
- [26]. Suruhanjaya Komunikasi Dan Multimedia Malaysia. 2020. Internet Users Survey 2020. <https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/IUS-2020-Infographic.pdf> [10 Januari 2021].
- [27]. Thannimalai, R. & Raman, A. 2018. The influence of principal's technology leadership and professional development on teachers, technology integration in secondary schools. *Malaysian Journal of Learning and Instruction*, 15(1), 203 – 228.
- [28]. Tondeur, J.; van Braak, J.; Sang, G.; Voogt, J.; Fisser, P.; Ottenbreit-Leftwich. 2012. Preparing preservice teachers to integrate technology in education: A synthesis of qualitative evidence. *Comput. Educ.*, 59, 134–144.
- [29]. UNESCO. 2019. Recommendation on open educational resources (OER). Recommendation. Vol. 33, Issue 0.
- [30]. Wan, Y. S. 2020. Education during COVID-19. *Brief Ideas*, Issue 19 (April), 3–9
- [31]. Wei, L. M., Piaw, C. Y., & Kannan, S. 2017. Relationship between principal technology leadership practices and teacher ICT competency. *MOJEM: Malaysian Online Journal of Educational Management*, 4(3), 13-36.

- [32]. William and Flora Hewlett Foundation. 2008. Open educational resources (OER) – Making high quality educational content and tools freely available on the web. www.hewlett.org/Programs/Education/OER [10 Januari 2021].
- [33]. YTL Foundation 2020. Siaran Media: Teach For Malaysia sertai inisiatif belajar dari rumah Yayasan YTL. <https://ytlfoundation.org/wp-content/uploads/2020/04/310320-YTL-TFM-PRESS-RELEASE-BM.pdf>. [20 Januari 2021]
- [34]. Yusof, Mat Rahimi, Yaakob, Mohd Faiz & Ibrahim, Mohd Yusri. 2019. Digital leadership among school leaders in Malaysia, *International Journal of Innovative Technology and Exploring Engineering* 8(9), 1481-1485.