Teacher Technological Leadership for Society 5.0

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Abstract

Education plays an important role in building a society aspired to by the nation. Society 5.0 is soon to be a reality instigated by the industrial revolution affecting changes in daily life. These changes affected not only working processes but also the fields of work. Hence, a nation that seeks to move forward with the times must surely have human resources that are able to fulfill the economic needs, as well as people who are willing to live in harmony regardless of the changes that occur, especially in technological advancements. Thus, education is pivotal in supporting individual needs with life skills for now and the future. Teacher technological leadership is an asset to the school. Teachers in all fields of expertise, including business education, mathematics, science, language and many more, should not only be capable of leadership, either formally or informally, but also lead in technological integration in teaching and learning. Through teacher technological leadership, teachers can support learners' technological development ethically whilst prioritizing humanity in preparing learners to be valuable members of Society 5.0. Therefore, this article will discuss the concept of Society 5.0, teacher technological leadership and its practice.

Keywords:

Teacher technological leadership, Society 5.0

INTRODUCTION

Education undeniably affects the development of human resources and, in consequence, society's civilization. In materializing successful education, teachers from various filed are the influence of future society, therefore, they should be highly proficient in their fields of knowledge, not just of their own subject but of futuristic skills and knowledge needed to support learners' learning. Currently, digital technology and artificial intelligence are prevalent, especially in developed cities. In fact, the use of smartphones, various digital applications, perhaps even using robotic vacuums or self-driving cars are becoming common in society. Technological advancements and integration of digital tools are very crucial for educators to empower themselves in maintaining their success in the education realm (Hamid & Ab Wahid). Although technological tools and their uses are accessible and can be self-learned, education has a role in ensuring that the usage of technological tools are correct, ethical, and meaningful. This aligns with the opinion that to build a better future, values and good character are crucial (OECD, 2021). Learning compass is a suitable educational curriculum prioritizing the developmental of individual, social, societal, and humanistic values aside from academic knowledge and skills would ensure necessary development of future skills

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(Caena & Punie, 2019). The balance of intelligence, good character, and humanistic values are the essence of Society 5.0.

The Society 5.0 Strategy

Society 5.0 is a strategy introduced by Japan to achieve the aim of living with technology harmoniously. It stems to deal with issues found through research regarding prolonged life expectancy, decline of birth rate, population migration, financial issues, and concerns with the natural environment. The concept of Society 5.0 as explained by the research team of Hitachi-UTokyo Laboratory (2022) refers to a human-centered society that combines physical and cyberspaces. The concept illustrates the idea of people living in a humanistic smart society. This smart society concept relates to the reliance of data gathering and use of latest technology in living. The smart concept is integrated into every facet of life where data is gathered and used as basis to identify issues and form strategies with suitable advanced technology to overcome them. Thus, the smart concept aims to ease living through facilities such as smart homes, smart cities, self-driving cars, and other aspects of living. An ideal city based on Society 5.0 would be a city where individuals with good values and ethics thrive among advanced and suitable technologies that fulfill their needs. Society 5.0 is not a temporary lifestyle but a futuristic sustainable living condition.

Since technology is advancing rapidly, people should take the opportunity to live more comfortably and systematically. Society 5.0 envisions a dynamic change from merely a smart concept without a focus on the human aspect to a harmonious balance of technology and human needs for survival. People should be able to utilize technology easily and not burdened by it. Society 5.0 also seeks to deal with issues concerning quality of life through interactive data use based on real situations to find realistic solutions. Data is continuously gathered to ensure rapid action to solve the problems. Hence, cyberspace becomes a part of real life as what occurs in the physical world becomes data that is processed in the cyber world to be reapplied for real life living (Hitachi-UTokyo Laboratory, 2022).

Society 5.0 for example is most helpful for the elderly. As humans age, the ability to work will also be somewhat affected and in turn causes implication on human resources and financial income. In addition, health may also become a challenge. With low birth rates, issues on caring for the elderly in their later years due to the lack of a younger population to help them will arise. In this context, Society 5.0 is expected to be a conducive and supportive environment for the elderly as the smart homes they live in will be supervised at an appropriate cost virtually to ensure they will live comfortably and not neglected (Hitachi-UTokyo Laboratory, 2022).

Regarding the environment, Society 5.0 can help as the technology used will rely on renewable energy and materials with low negative impact to the environment. For instance, solar energy will be widely used, and an effective energy system will ensure energy used in all facilities are supervised virtually. Even education in Society 5.0 will undergo changes. Technology will be a norm in teaching and learning, allowing for the learning process to be done both physically and virtually with ease. Moreover, a culture of life-long learning is also emphasized. Society 5.0 encourages learning at the highest level as well as vocational training regardless of age and can be repeated if necessary (Hitachi-UTokyo Laboratory, 2022). This allows people to build their skills in various skills without restraint.

In support of Society 5.0, Masami (2021) states that the Japanese Ministry of Education, Culture, Sports, Science and Technology prepared an indicator and conducted a case study to analyze the reformation needed for education. The education indicator to fulfill the aim of Society 5.0 in Japan is based on the OECD Education 2030 competencies. Research findings

from the case study found that although there are fields of work that can be replaced by artificial intelligence, but there are still many fields that rely on human intelligence and skills especially in abstract fields such as art, history, archeology, philosophy, and theology. Aside from that, jobs that involve feelings, communication relations and humanity cannot be replaced by robots.

This realization led Japan to structure a suitable education policy that seeks to achieve harmony between technology and quality of human life through Society 5.0. One of the strategies created is the Global and Innovation Gateway for All (GIGA) initiative for schools. It is costly to prepare digital learning resources such as textbooks and technology items like computers for each learner, improving infrastructure and education on knowledge for informational use. The main competencies that learners should have from education include knowledge, skills, good character, and values (Masami, 2021). Essentially, the Japanese education policy aims to prepare learners to live in Society 5.0 without difficulty.

Teacher Technological Leadership Concept

Teacher technological leadership refers to teacher leadership with the ability to utilize technology (Norhanida, 2020). To understood further, a brief look into the background of technology use in education in Malaysia followed by the concept of teacher technological leadership should be done.

Technology in Malaysian Education

Technology in Malaysian education is nothing new. Education policies relate closely to national policies. Among them are the National Science, Technology, and Innovation Policy (1986), Long Term Plan 2 (1991-2020), Vision 2020 (1991-2020), National Development Policy (1991-2020), Eighth Malaysian Plan (2001-2005) and Science & Technology Human Resource Pathway Plan 2020. The policies encourages educational innovation through the the use of Information and Communications Technology (ICT) in teaching and learning for learner development (Hasin & Nasir, 2021).

In relation to the policies, ICT in Education Policy was introduced in 2010 and enhanced in the following years with the focus on continuous human resource development with the use of suitable technology for education and inevitably transforming the learning process. This was closely followed by the Smart Strategic Plan 2011-2015 that aims for support in pedagogical and technical; development of human resource and capacity; research and development of technology in teaching and learning; corporate communications; and development of ICT infrastructure.

In schools, the Smart School initiative and Teaching and Learning of Science and Mathematics in English program was also started (Ministry of Education Malaysia, 2010). Through this program, emphasize on teachers' competence in using technology such as computers and digital materials was evident especially for Science, Mathematics and English language teachers. Through the Smart School 2016-2020 initiative, the focus continues improving ICT infrastructure in schools and developing digital competency and computational thinking systemically with the KSSR and KSSM curriculum. Learner's achievement in technology was also assessed through Digital Tech @ Schools in accordance to the Digital Competency Standards (DCS) that assesses the learners digital competency in three domains which are cognitive, technology and ethics (MDEC, 2020).

The ICT Transformation Plan 2019-2023 was next introduced with the aim to improve education success through strategic and effective use of innovative technology in learning to

build a high performing culture and talented individuals (Kementerian Pendidikan Malaysia, 2019a). The emphasize on technology was also apparent in the National Education Policy (4th Edition) specifically in chapter 4.4 Smart School- integration of ICT in Teaching and Learning Fourth Wave: Consolidation and Sustainability (Kementerian Pendidikan Malaysia, 2019b).

Technology is also a main part of the initiative in the Malaysian Education Blueprint 2013-2025 (Preschool to Post-Secondary Education) as seen in the 7th Shift: Leverage ICT to Scale Up Quality Learning Across Malaysia STEM education related to fields of Science, Technology, Engineering and Mathematics is also emphasized. This focus is to encourage skill building for industrial sectors such as oil and gas, aviation engineering, maritime and shipping engineering as well as green technology (Kementerian Pendidikan Malaysia, 2016).

The importance of technology in education was particularly evident during the Covid-19 pandemic where education and work had to be done virtually. Teaching and learning for instance relied heavily on cyber-technology as the main platform. As Malaysia had the capacity to provide for fast networking, internet and technology was able to be utilized by teachers and learners especially in cities. In addition, the common use of smartphones and the internet in daily life had also eased the transition from face-to-face teaching and learning to a virtual one.

Teacher Technological Leadership Concept

Teacher technological leadership stems from teacher leadership with focus on technology integration. Teacher leadership itself can be said to branch from the concept of distributive leadership where power in the school organization is shared between the school leader and teachers. The sharing of power involves teachers taking on leadership roles in certain areas as well as being involved in decision making on school policies. Teacher leadership has a few roles including leading other teachers and learners; leading operations; and, leading in decision making activities (Katzenmeyer & Moller, 2009). Katzenmeyer and Moller (2009) defines teacher leadership as teachers who lead inside and outside of the classroom; contributes to the teacher leaders community and teacher learners; influences others to improve educational practices; and, accepts responsibilities on the implication resulting from the decisions they made. This is supported by Crowther et al. (2002) stating that teacher leadership is an act of leadership by teachers to transform teaching and learning; develop relationship with the community and school; and, maintain social stability and quality of life in society.

Teacher leadership in technology elaborates on these teacher leadership characteristics with the aim to integrate technology to enhance and support education for the benefit of others (Norhanida, 2020). A standard that is recognized and widely used for technology in teaching and learning with leadership in mind would be the ISTE *Standards for Educators* (International Society for Technology in Education, 2017). The ISTE standards lists seven roles for teachers including as learners, leaders, citizen, collaborator,designer, facilitator and analyst. In the standard, the role of leadership for teachers are integral for teaching and learning in the 21st century.

According to the ISTE standards, teachers are learners in the sense that they practice life-long learning. For a teacher to continue to evolve and develop their skills, they should not rely on merely current knowledge but continue to enhance it in different areas with variety of skills that in turn would benefit their learners. As leaders, teachers as leaders of technology is essential as this leadership requires teachers to create, lead and carry out a shared vision for technological learning. To do this, teachers should build rapport with parents and the community. Moreover, access equity to technology-based learning, digital materials, and learning opportunities should also be provided suited to learner needs. In addition, teachers

may also become a role model to colleagues especially in skills of identifying, exploring, evaluating and using latest digital resources and tools for learning (International Society for Technology in Education, 2017).

Next, teachers are digital citizens. Teachers can support learners technology use by providing the space needed to participate and contribute as a digital citizen in a digital community. In learning, the inquiry skills are cultivated to build learners digital literacy. Teachers become mentors to guide learners in using digital tools safely, ethically, and according to regulations (International Society for Technology in Education, 2017).

Finally teachers are also collaborators, designers, facilitators and analysts. As collaborators, they should work together with other teachers and learners to improve technology practices; identify and share new resources and ideas; and, solve problems. As designers, teachers should attempt to create an environment and activities suitable for learners of mixed abilities (Hasin & Nasir, 2021). Teachers as facilitators would encourage learners to set their own learning targets be it individually or as a collective. Teachers should monitor and manage the technology used and provide opportunities for creative processes and computational thinking in the classroom. Teachers would model creative thinking to inspire learners (International Society for Technology in Education, 2017).

As analysts, teachers must be able to skillfully manipulate data. Data can be gathered through technology means and learners' learning data can then be used to analyse their level and needs. Data that are analyzed would serve as a basis to create suitable techniques for learners to increase their competency; learn to reflect on their own learning; create suitable assessment and evaluation; and, improve learners' performance by sharing the data with the learners, parents and other stakeholders (Örtegren & Olofsson, 2024).

Thus, for teacher technological leadership practice, teachers should refer to the ISTE standard as a guide and benchmark to improve competency, skill, and knowledge.

LITERATURE REVIEW

Education for Society 5.0

Education is critical for Society 5.0 (Hitachi-UTokyo Laboratory, 2022). Education is the platform through which skilled workforce is developed. The workforce needed for Society 5.0 are those with competence and proficient in artificial intelligence and able to analyse Big Data to solve problems in various areas. Education is also the force in developing information literacy. Citizens of Society 5.0 should have literacy skills ample for understanding the information around them. It should be noted that in Society 5.0, the citizens should be people capable of complex and forward thinking, ethical and of good moral character.

This belief is echoed by Jamal (2022) on Malaysia's own ability to form Society 5.0 through education. Focus should be made in areas of artificial intelligence technology, improving hard and soft skills, encouraging creativity and develop life-long learning practices. However, it should be noted that challenges would arise to achieve this especially in Malaysia. Jamal (2022) notes that immediate changes to improve the quality of education are imperative especially at the tertiary level. In addition, there must be a priority to support the development of human resources who are not only skilled and innovative thinking, but also holistic, spiritual, able to make decisions, and a strong identity. Furthermore, challenges concerning the socio-economic divide prevalent especially between rural and urban areas; lack of access to

technology facilities; and, lack of solid data at the higher level needs to be addressed for significant changes to be made (Aruleba & Jere, 2022).

To ensure Society 5.0 is achievable, issues and changes that occur with wide technology use should be made aware. Bungin et al. (2021) found that social harmony balance goes through apparent changes when communication is done through technology medium such as WhatsApp application. Human communication that before this relied on face to face or through simple voice calls has been taken over by applications that allow humans to communicate even more effectively without a physical meeting. Although these mediums of communication have value in terms of immediacy of information sharing, cost and time saving but Bungin et al. (2021) believes that there are also disadvantages. One of the issues found was the scam or hoax communication that are widespread as well as unreliable fake information that is easily manipulated through careful editing which when used by unscrupulous individuals could lead to tarnishing the reputation of parties involved. Hence, education is vital to ensure that users of communicative technology are aware of the ethical responsibility they have in discerning harmful communication.

Findings from Teknowijoyo and Marpelina (2021) on the impact of the industrial revolution 4.0 and Society 5.0 on Indonesian education supports the need for Education 5.0. Through Learning Model 5.0, Education 5.0 aims to achieve a balance of needs in skills including mental, social, emotional, as well as higher order thinking; problem solving; communication; collaboration; reasoning; creativity and innovation; cognitive flexibility; identifying information; evaluation and decision making; emotional intelligence; ability to coordinate with others; and ability to manage people (Sajidan et al.,2021).

Teacher Technological Leadership Practices

Teacher technological leadership can influence the way technology is accepted and used by learners. Ribble and Miller (2013) believes that technology leaders has the responsibility to educate learners on ethical digital technology use. There are three categories learners should learn about ethical digital technology use. The first category is respect for oneself and others; the second, build knowledge for oneself and to relate with others; and third is to protect oneself and others. Teachers as technology leaders can guide learners on this.

To further explain, the first category on respecting oneself and others, technology leaders can educate learners on the ethics on using digital resources, prepare adequate access to digital resources and understand digital laws. This is important to prevent matters such as cyber bullying and plagiarism. For the second category on building knowledge for oneself and to relate to others, technology leaders can guide learners on effective ways to communicate with others using technology. This includes the language use, punctuation, and emojis. Knowledge on how to communicate effectively using technology will help learners to avoid from unintentional misunderstandings. Learners should also be taught digital literacy such as basics on using software and related skills; digital commerce including protecting private information online. For the third category, technology leaders can help learners to understand how to protect themselves and others. Learners should be taught on digital copyrights, responsible use of technology, following rules set, digital security regarding software such as using antivirus software correctly, and digital health and well-being where learners should be reminded to have a balance of real life and virtual life so as not to negatively impact their lives and health due to over consumption of technology.

Teacher technological leadership has the potential to support Society 5.0. However, the concept of teacher technological leadership itself has yet to be widely understood in school

organizations in Malaysia (Pawzi & Alias, 2024). Although evidence of teacher technological practices is seen such as in the qualitative research by Norhanida (2020) in selected high performing schools. Teachers were found to integrate technology in teaching and learning such as using computers, projectors, digital software, online gamification, and platforms like VLE Frog and Google Classroom. Nonetheless, the ethical use of technology was found not directly addressed as part of lessons and the technology was used mainly as tools for learning.

Past research pre-pandemic showed that knowledge and skills on information and communication technology (ICT) in teaching and learning was at a minimal stage. This was seen in the research by the Teacher Education Division (Kementerian Pendidikan Malaysia, 2016) using the International Society for Technology in Education (ISTE) instrument. The research found that 86.20% of teachers had a minimum literacy score and 56,987 teachers (13.8%) did not achieve the minimum level. A low literacy score can be implied as low teacher technology leadership.

When the Covid-19 pandemic hit and education was forced to undergo virtual and hybrid mode, the lack of technology knowledge amongst teachers was undoubtedly clearer. This was evident in research by Azlin and Siti Zaidah (2021) who found that teachers did not use ICT in school's pre-pandemic despite having access to the tools and internet as they felt it was time-consuming and a burden. This was further aggravated by the lack of training on technology for practical teaching and learning. Training was merely basic introductions and did not support teachers' continuous needs that is required for effective practice. Thus, when the pandemic required the teachers to use technology, they faced the problem of immediately embracing the change as they lack the knowledge on how to use technology, choosing suitable materials and guiding learners to have the motivation to learn with technology as teachers themselves are struggling. In addition to this, learners had also their own issues with lack of technology tools and internet problems. The research showed that when teacher technology leadership is not developed early, then its' practice will be difficult especially when faced with unplanned situations such as the pandemic.

The issues on technology resources and internet connectivity were also addressed in research on digital divide. The digital divide can be referred to as the differences found between localities or impacted by socioeconomic status. The digital divide can be seen in relation to issues on limited access to internet, technology tools and resources as well as digital knowledge (Noor Hadzlida et al.,2021). In Malaysia, the digital divide can be seen affecting teachers and learners in rural areas such as in Sabah (Sarimah,2021; Halina et al.,2021), and Sarawak (Sharin & Suhaida, 2021). The digital divide affects the ability of using and integrating technology for education.

Nonetheless, due to the dire need for teaching and learning to continue, teachers must improve their technology knowledge and skills. Gonzalez et al. (2023) found that teachers with adequate digital skills are more likely to adapt to teaching and learning method changes compared to teachers who are not as skilled. Thus, teachers had to shoulder the responsibility to improve their technology competence to fulfil their responsibility. In relation to that, Perifanou et al. (2021) found that at the beginning of the pandemic, teachers admitted to having various mental, emotional, and physical health issues due to stress. The stress was the result of the struggle to adapt to virtual teaching and learning as they were ill-equipped with technology tools, knowledge, and skills. Learners also faced similar issues and some even ending up dropping out.

The responsibility to fill in the gap in technology knowledge, skills and competency should not be burdened on the individual teacher. Norhanida (2020) found that there are challenges in developing teacher technological leadership in schools. Some of the challenges

found related to work burden, limited technological knowledge, lack of technological resources and tools, difficulty in outsourcing capable technological trainers, and lack of finance to support continuous professional technology training. Well-organized training and guidance by competent and skilled people are needed to build teacher technological leadership. Training should be systematic and continuous throughout the school year to ensure that teachers are able to develop their skills in stages. However, the challenges faced dampened this possibility. Interestingly, during the pandemic, teachers were suddenly bombarded with various technology training sessions. The training may not fulfil the teachers' individual needs or according to their levels nor was it done systematically. Thus, although some teachers benefited from the training, others continue to fall back.

In addition, a specific model in developing Malaysian teacher technological leadership is still underway. To ensure the quality of developing high teacher technological leadership, professional development programs catering to the needs with adherence to a suitable model and standard is much needed.

CONCLUSION

Teacher technological leadership can contribute to achieve the nation's vision and mission. Teachers with technological leadership can identify and apply the best techniques for teaching and learning using the most suitable technology suited to learner's needs. Teacher's knowledge and technological competence will influence learner's to accept technology without anxiety and build their basic skills in technology application. Learners will be able to develop confidence in independent learning and encourage life-long learning with the skills they have acquired to access different information. Nonetheless, teachers' role is pivotal in instilling values, humanity and ethical practices that should be the main aspect of learning with technology, as the ability to use technology without realizing the impact and boundaries can affect harmony. Hence, a learning culture with technology paired with ethical knowledge as taught by teachers with technological leadership will inevitably support learners development to become a valuable member of Society 5.0.

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