

ICT Integration Practices of STEM Teachers in TVET

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Abstract: *STEM Education is important for a country to be advanced in economy and technology. It is achieved through skilled and multi-talented workforce produced by Technical Vocational Education and Training (TVET) which is a component of STEM Education. Technology becomes a mechanism for STEM teachers to engage their students in STEM disciplines. However, STEM teachers have barriers and challenges integrating technology in STEM Education. Therefore, it is the purpose of this study to examine STEM teachers' technology integration practices in the context of ICT. This is a preliminary study that is conducted in MARA TVET – one of the private providers of TVET in Malaysia. Using a quantitative data collection tool, 32 STEM teachers from MARA TVET in Borneo Region participated in the study. The study employed adopted SPMa (Standard Practices MARA Educators) instrument that consists of three dimensions: basic ICT skills, integrating ICT in teaching and learning and communicate skillfully using ICT. The overall result revealed that the level of ICT integration of STEM teachers in MARA TVET is high ($M = 2.63$, $SD = 0.80$). Dimension basic ICT skills had the lowest mean ($M = 2.41$, $SD = 1.04$) and followed by dimension integrating ICT in teaching and learning ($M = 2.69$, $SD = 0.90$). Dimension using ICT to communicate had the highest mean ($M = 2.78$, $SD = 1.04$). In conclusion, the level of ICT integration of STEM teachers in MARA TVET of Borneo Region based on adopted SPMa instrument is moderate. Though ICT skills affect ICT integration in teaching and learning, there is also a need to examine other factors that affect the success of ICT integration. STEM teachers' knowledge is a proposed variable to be investigated in future research.*

Keywords: *engineering field, in-service STEM teachers, MARA TVET, teaching experiences.*

I. INTRODUCTION

Globally, STEM Education becomes the subject of interest of ministries of education since it is the platform of economic growth by many countries [19]. STEM education produces workforce with STEM skills which includes analytical thinking, critical thinking and innovation [17],[31]. STEM skills are necessary to level up the future workforce to a standard that can compete globally. It is through STEM Education that a country can improve its productivity by having innovativeness in their work [7], [29]. Therefore, a country that leads in STEM Education brings economic growth to their countries.

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Like other countries, STEM Education also becomes a main focus in Malaysia Education system [24]. Malaysia Education Minister, Dr. Maszlee Malik expressed his concern about the declining number of students choosing STEM in his keynote speech during Global Summit Asia Bett Leadership and Expo 2019. He also reported that the number of students opts for STEM was only 44% in the year 2018 compared to 49% in the year 2012 [32]. The same scenario persists in the state of Sarawak, the largest state in Malaysia. It was reported there was only 24.3% students enrolled in STEM stream in Sarawak schools [6]. The declined number of students pursuing STEM disciplines will cause shortage number of engineers and scientists produced by Malaysia. Based on statistics from National Council for Scientific and Research Development, Malaysia in need of 500 000 scientists and engineers to support the Industrial Revolution 4.0 yet there are only 70 000 registered engineers in the country [31]. This is an alarming situation for Malaysia.

Technology becomes part of our lives. Since future work evolves according to the changes of technology, so does its workforce. Internet of Things (IoT), big data, cloud computing are among technologies in TVET that support industrial revolution 4.0 [2]. Therefore, STEM teachers in TVET need to equip themselves with these technologies to strengthen the quality of STEM teachers. Several studies indicate the importance of technology in STEM Education. In 2009, Sanders first emphasized the potential of technology in STEM education as a critical key to global competitiveness [28]. The author argued technology as the mechanism to maintain students' interest and motivation in STEM disciplines and play a vital role in 21st century. A decade later, similarly, [12] pointed out that integrating technology can enhance STEM learning. In his narrative review, de Jong proposed for technology-based learning which applied to STEM topics could foster deep conceptual knowledge [12]. However, STEM teachers found barriers and challenges integrating technology [21], [23].

In order to have an effective STEM teaching and learning, STEM teachers need sufficient technology knowledge and skills [14], [33]. Yet, STEM teachers are found to have limited knowledge on technology [13], [35]. [13] conducted a STEM seminar as an intervention to increase the technology usage by STEM teachers [13]. However, the study revealed that STEM seminars had no influence on technology level of use of teachers. On the contrary, [16] found a positive impact on the usage of iPad as teaching and learning tool in STEM classroom. There were nine STEM teachers participated in a summer professional development perceived competency in using iPad to design lesson plan that engaged students in the learning. Another study conducted by [38] found that technology integration in STEM applications had no positive impact on Technology Knowledge, Pedagogical Content Knowledge and