Technological Pedagogical Content Knowledge (TPACK) in Teaching 21st Century Skills in the 21st Century Classroom

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ABSTRACT

This conceptual paper explores the concept of technological pedagogical content knowledge (TPACK) in relation to the teaching of 21st century skills with a purpose of establishing a relationship between them. Due to the advancement and development of industrial revolution and technology, the education scenario also changes towards 21st century education, whereby more focus is given on the use of technology and 21st century skills. The teachers' roles change, and they are required to not only teach the core subject matters, but they also have to teach and train the students with the 21st century skills. However, not all teachers are well-trained on how to teach those skills to the students, especially when they also have to integrate technology in their teaching as well. Therefore, it is crucial to investigate whether the teachers understand and know how to teach the 21st century skills while integrating technology at the same time. Based on this needs, this paper will discuss the teachers' knowledge, understanding and application of the TPACK framework by Koehler et al. (2006) and how will this framework affect their teaching of 21st century skills in the classroom. The 21st century skills framework suggested by the Malaysian Ministry of Education called the 4C1V (communication, collaboration, critical thinking, creative thinking and values and ethics) which is based on the P21 framework is included in the conceptual framework of this study, along with the TPACK framework. This study will attempt to establish a relationship between these two frameworks through a quantitative study, and the findings from this study would contribute to the knowledge on what aspects or skills that teachers will need to improve in order to teach the 21st century skills to the students.

KEYWORDS: *Pedagogical Content Knowledge (PCK), Technological Pedagogical Content Knowledge (TPACK), 21st Century Education, 21st Century Skills*

INTRODUCTION

The world in 21st century is progressing very rapidly due to the development of the Information and Communication Technology (ICT) and the advancement of technology in the Fourth Industrial Revolution (4IR). The 4IR involves highly disruptive technologies (such as artificial intelligence, Internet of things, robotics and virtual reality) that change the economic, social, and political systems of the world, and it puts such a huge pressure on the leaders and policy-makers of a country to respond to these changes (World Economic Forum & Asian Development Bank, 2017). These development and advancements have not only changed the economic, social and political systems, but they also change the education scenario. The ways

of learning for the 21st century students (also known as digital natives or millennials) learn in the classroom are different than the students of the previous generations. The millennial students are very dependent on technology (Lemley, Schumacher, & Vesey, 2014; Elam, Stratton, & Gibson, 2007) since their lives are surrounded by technology, and they learned a lot with the technology around them. Therefore, teachers can no longer solely depend on the chalk and talk method of teaching in the classroom.

Teachers nowadays should be aware of the 4IR demands, hence the need to change their way of teaching in 21st century classrooms. The methods of teaching need to move towards Education 4.0, a term that emerges following the 4IR. "Education 4.0 is a response to the needs of IR4.0 where human and technology are aligned to enable new possibilities" (Anealka, 2018, p.92). The most recent technology like artificial intelligence, robotics, and the Internet of Things (IoT) will replace some human jobs in the future, therefore it is crucial for the students today to possess skills that will not be replaceable by the technology. This is where the 21st century skills take place in today's education. In order for students to be and stay relevant at the workplace, teachers and educators have to train them with the 21st century skills demanded in the 4IR. However, students would not be able to develop those skills if the teachers themselves have insufficient knowledge in training those skills to the students.

Teachers do not only have to be subject matter experts, but they also need to know the pedagogy of teaching as emphasized by Shulman (1986) in his Pedagogical Content Knowledge (PCK) framework. Meanwhile in the 21st century, it is essential for teachers to be well-versed in integrating technology into teaching. Therefore, they need to have knowledge on technology, as proposed by Mishra and Koehler (2006) in their Technological Pedagogical Content Knowledge (TPACK) framework. Teaching in 21st century is no longer the same, as the priority of teaching has shifted. To ensure that students are able to develop, practise and apply the 21st century skills, teachers need to be knowledgeable and competent in teaching and training the 21st century skills to the students.

RESEARCH BACKGROUND

Education system in Malaysia has encountered five major curriculum reforms since the independence, and in 2011, the curriculum was reinforced and enhanced with more emphasis given on 'soft skills' such as ICT skills, innovation, creativity and entrepreneurship (UNESCO, 2013). In 2011, the Ministry of Education has taken an effort to reform the education system from the examination-oriented system to a more holistic approach. Abdullah, Idris, Hamzah, and Sembak (2015) stated that SBA was an assessment of the students' cognitive, affective and psychomotor aspects in a holistic manner and was in line with the National Education Philosophy. In this SBA system, the students are not only assessed through written examinations, but also through varied assessments such as oral, physical and hands-on assessments.

Since the SBA system was introduced, teachers have to change the way they assess students and indirectly, they have to change their teaching approaches as well. Teachers need to suit their approaches to allow students to develop their personal and interpersonal skills. Therefore, teaching and learning process in the classroom can no longer be teacher-centred, but more learner-centred so that students are able to develop their soft skills. However, the development of soft skills among students heavily depends on the teachers' skills and competence which means that teachers' readiness, comprehension, and knowledge about soft

skills are important to ensure the effectiveness of soft skills integration during the teaching and learning process (Subramaniam, 2013).

Ilhaamie, Rosmawani, and Yusmini (2018) stated that most graduates in Malaysia lack employability skills (as in the knowledge and skills students need to possess to fulfil the employment demands in the labour market). These employability skills, including the soft skills and hard skills are in high demand these days, which is why the shift towards 21st century education is happening in the Malaysian education system. The government is aware that they need to put more efforts into transforming the system in Malaysia towards the 21st century education and to produce manpower who will be able to fulfil the demands of the Fourth Industrial Revolution. However, these efforts cannot be initiated only when the students are in their tertiary education, but they need to start earlier, from the primary and secondary education.

Although Malaysian education system is adapting to 21st century education, its implementation among teachers in schools are not going very well. Tee et. al. (2018) concluded in their study that classroom practice by teachers (both pre-service and in-service teachers) lack activities that build the 21st century skills. On top of that, Nair (2014) mentioned in her study that some teachers and school heads agreed that their training had a lack of focus on the 21st century skills, and some of them even claimed that those skills were not mentioned specifically. If the teachers have no specific trainings on how to teach the 21st century skills, they will have some difficulties to teach the skills to the students. Tee et al. (2018) also revealed that whenever there is a change in policy, neither novice nor experienced teachers are able to transform their pedagogical practices following the new policy.

Teachers are also unable to integrate technology into teaching. This issue is closely related to the teachers' competencies in technological pedagogical content knowledge (TPACK) framework, which has been studied by previous researchers. However, even though there are some studies conducted in Malaysia regarding TPACK (Hasniza & Tengku Faekah, 2016; Nor'ain & Noor Zarinawaty, 2014; Junnaina & Hazri, 2012; Nur Filzah, 2016), studies on the relationship between TPACK and 21st century skills are scarce and not yet widely discussed. Therefore, this study intends to do a research with the purpose of establishing relationship between TPACK and the teachers' teaching of the 21st century skills in the classroom. The objectives determined for this study are:

1. To determine the secondary school teachers' level of TPACK in Petaling Perdana district.
2. To investigate the methods of teaching 21st century skills among secondary school teachers in Petaling Perdana district.
3. To study the relationship between the secondary school teachers' level of TPACK and their teaching of 21st century skills.
4. To identify which domain/s of the TPACK is/are the best predictor/s to the teaching of 21st century skills.

To serve as a guide for this study, a conceptual framework is constructed and generated based on the framework by Koehler and Mishra (2009), which is the TPACK framework and the 21st century skills framework proposed by Education Performance and Delivery Unit Malaysia (PADU). The conceptual framework of this study is illustrated as shown in Figure 1 below:
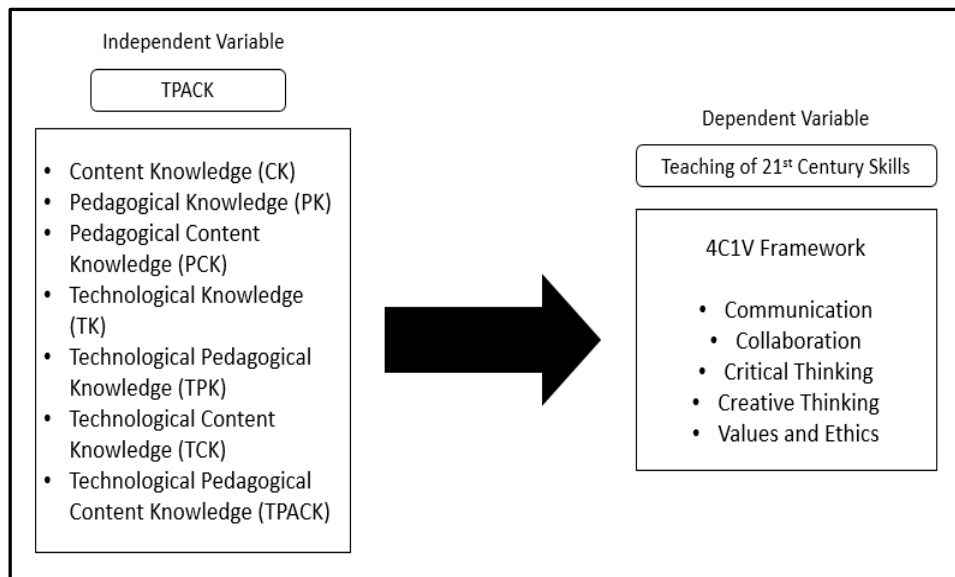
Figure 1: Conceptual framework of the study

The TPACK framework is the independent variable of the study, while the teaching of 21st century skills (based on the 4C1V framework) is the dependent variable. TPACK describes the knowledge that are essential for teachers in the millennial era to integrate technology in their teaching process (Zhang, 2011). It involves interactions between technology, pedagogy, and content which are separate from each other, and this framework emphasizes the interaction between these three aspects and other forms of knowledge (Koehler, Mishra, Kereluik, Shin, & Graham, 2014).

Meanwhile, the 4C1V framework is a guidance for teachers in Malaysia to follow in order to implement 21st century teaching and learning in schools. In general, there are five 21st century skills included in this framework and they are: Communication, Collaboration, Critical Thinking, Creative Thinking, and Values and Ethics. This framework is derived from the 21st century skills framework by Partnership for 21st Century Learning (2009) which is known as the P21 framework. With this framework, the Malaysian Ministry of Education hopes that education in Malaysia will start to focus more on the students' development of 21st century skills.

LITERATURE REVIEW

Previous researchers have conducted a lot of studies regarding TPACK among teachers and the 21st century teaching and learning in the classroom. The need to integrate technology and 21st century skills in teaching has made it complicated for teachers to educate students to reach the national goals and aspirations. Previous researchers have conducted studies and discussed on teachers' level of TPACK (Fontanilla, 2015 ; Walker, 2017), challenges to apply TPACK in teaching (Handal, Campbell, Cavanagh, Petocz, and Kelly, 2013), development and validation of TPACK measurement instrument (Koehler & Mishra, 2009; Valtonen et al., 2017), integration of technology in education (Ghavifekr & Wan Athirah, 2016; Abu Bakar, 2013; Siti Noridah, 2012; Delgado, 2016), and the integration of 21st century skills in teaching and learning (Anagün, 2018; Norazlin, 2018; Vail, 2010; Wan Nor Fadzilah et. al, 2016; Utami, Cikarge, Ismail, & Hashim, 2018; Arnita, Sajidan, Yudi, Afandi, & Nanik, 2019; Mohd Husni, 2019).

Firstly, most studies that investigated teachers' levels of TPACK mainly involved the pre-service teachers, and not among the in-service teachers which is also evident in the context of Malaysian teachers. A study conducted by Fontanilla (2015) compared beginner and experienced teachers' readiness to integrate technology in teaching and has found that there is a significant negative correlation between technological knowledge and years of teaching experience. In another study, Garba et al. (2015) interviewed in-service teachers and found that most of the teachers have no problem in mastering the technological knowledge and the technological content knowledge. However, the teachers are yet to acquire technological pedagogical knowledge, which is related to integrating technology in teaching and integrating technology with teaching pedagogy (Garba et al., 2015). This result supports Fontanilla's (2015) study that showed the more experienced teachers scored lower on the TPACK domains compared to the beginner teachers. In addition, Walker (2017) also found in his study that elementary school teachers are not confident with their TPACK, as compared to their pedagogical content knowledge (PCK).

The interaction between these technology, pedagogy and content could be very complicated, therefore the issue of not understanding how they work together among the teachers are understandable. Some studies proved that there are some issues occurred among the in-service teachers in embracing and applying TPACK in the teaching and learning process. Handal et al. (2013) in their study stated that there are three factors that complicate teachers' efforts to apply TPACK in their teaching and they are:
1. instructional factors - teaching and learning issues,
2. curricular factors - the issue of ICT use in school environment, and
3. organizational factors – the logistic issue of materializing the integration of ICT in curriculum.

In general, when it comes to integrating technology in education, previous studies investigating teachers' perspectives have shown that there are both positive and negative perspectives towards the integration of technology in the classroom. A study conducted by Ghavifekr and Wan Athirah (2016) revealed that most teachers are aware that ICT and digital technology are very useful in teaching, and these technologies help teachers to obtain more updated materials which improves their teaching. On top of that, Abu Bakar (2013) stated that the positive aspects of digital technology such as its attraction, convenience, multimodality, relevance, interactivity, and importance provide teachers with a lot of advantages in teaching. With these advantages that the digital technologies are providing, teachers are supposed to be able to integrate them successfully in the teaching and learning process. However, the effectiveness of the technology integration depends on the teachers' level of TPACK as well. The educators' technological skills and knowledge will determine the success of ICT integration (Siti Noridah, 2012; Ghavifekr & Wan Athirah, 2016).

Delgado (2016) asserted that the use of technology in learning provides opportunities for students to build their personal skills, and the various levels of tasks that students could do with technology allows the students to work by themselves at their own pace. As the lessons designed with technology integration are essentially more interesting and engaging, it is proven that students' learning could be fostered and students are able to learn better and more effectively (Ghavifekr & Wan Athirah, 2016). Digital technology has allowed students to explore more by themselves, and it helps them to be more resourceful than before. Therefore, teachers need to be more creative and shift their roles in teaching, since they are no longer the sole provider of information and content. It was found that teachers today are more motivated

and interested to learn about technology integration, due to its flexibility and autonomy (Delgado, 2016).

Meanwhile in 21st century education, teachers are required to teach and train students with 21st century skills. Anagün (2018) found that there is a positive relationship between teachers' perspectives of their 21st century skills and the constructivist learning in classroom. This finding indicates that as teachers' 21st century skills increase, they are more likely to conduct constructivist learning in their classroom which reflects the 21st century education. In addition, Norazlin (2018) also reported that teachers are highly ready to implement 21st century learning in the classroom but their perspectives and readiness regarding 21st century learning are not always executed well. This is proven in a study by Vail (2010), who stated that the school teachers involved in the study did not practise the 21st century standards and their implementation of 21st century learning in the classroom is very little, even though they have a strong belief towards the standards.

A few researchers conducted studies investigating the use of learning models that integrated 21st century skills in teaching and learning process. For example, Handajani, Pratiwi, and Mardiyana (2018) investigated the use of Model Eliciting Activities (MEA) that integrated the skills of creativity, collaboration, communication and problem-solving. Based on the results, it was observed that the students who learned Mathematics with MEA actually got better learning outcomes compared to the students who did not. In addition, Wan Nor Fadzilah et al., (2016) also found similar results through the use of Project Oriented Problem Based Learning (POPBL) which resulted in an increase as much as 4.9% in the 21st century skills. Utami et. al (2018) also found out that students who used 21st century teaching aids had better achievement in digital electronics course, compared to students who did not use the teaching aids. These studies showed that compared to conventional teaching methods, the 21st century teaching and learning produced better learning results among the students. This reinforces the needs to transform and shift the teaching and learning process to the 21st century learning as it produces better results, as well as develops students' soft skills better.

Other than that, Arnita et. al (2019) conducted a study to improve students' 21st century skill, which is critical thinking skill using a model called Stimulating Higher Order Thinking Skills (Stim-HOTS) model. Based on the results of the study, it was found that the use of the said model managed to enhance students' critical thinking skills such as the skills to interpret, analyse, explain, evaluate, conclude and to self-regulate. Another study also supported that the integration of 21st century skills in learning is beneficial. This is proven by Motallebzadeh et al. (2018) who reported that a significant relationship exists between 21st century skills and students' English language writing and speaking skills. In speaking test score, the collaboration and communication skills contributed highest correlations while in writing test score, technology literacy contributed the most.

Aside from using 21st century learning models, other researchers used projects involving technology that enhanced students' English language learning. For example, Thang et al. (2014), conducted Digital Story Telling (DST) project in the course of English for Academic Purpose (EAP). Through this project, the researchers found that students were able to work both independently and collaboratively, and the team work value was very evident in this project. Aside from that, the DST project also lead students to improve other 21st century skills such as creative thinking, digital skills, and communication skills. Meanwhile, Carrió-pastor and Skorczynska (2015) found that when collaborative learning is combined with communication technologies such as Google Doc, students became more motivated. The

researchers found that the combination of collaborative learning and communication technologies enabled students to collaborate meaningfully to complete activities and tasks while interact actively through the Google Doc application.

Results from the studies mentioned above have demonstrated that 21st century learning in the classroom and technology are beneficial to students and they develop their skills better. While it is possible to teach 21st century skills without the use of technology, the study by Motallebzadeh et al. (2018) shows that technology also takes part in developing students' 21st century skills. In Malaysia, even though teaching and learning of 21st century skills could be done without technology and have been proven by teachers who won the 21st century learning teacher campaign or "Kempen PAK21" (Mohd Husni, 2019), the use of technology in schools will soon be more vigorous. Sooner or later, teachers will have to adopt technology as Ministry is actively transforming schools all around Malaysia to be more ICT friendly, as stated in the ICT Transformation Plan 2019 - 2023 (Ministry of Education, 2019).

The TPACK framework has been discussed widely in various researches involving the integration of technology in teaching and learning. Most researchers generated and developed self-reported TPACK measurement instrument based on the work of Koehler and Mishra (2009) to measure teachers' level of TPACK. However, with the transformation in education revolving around the 21st century skills nowadays, it is crucial to investigate whether teachers are able to apply TPACK while teaching 21st century skills. Thus, Valtonen et al. (2017) improvised the TPACK framework to fit in the 21st century education context. Valtonen et al. (2017) argued that TPACK framework should be aligned with the 21st century skills and pedagogies. Hence, they introduced a new instrument called TPACK-21 which was grounded on the 21st century skills. There were already a lot of researches that investigated teachers' level of TPACK, but the study by Valtonen et al. (2017) introduced a new angle in investigating teachers level of TPACK by aligning it with the 21st century skills. This is something new that could provide new perspectives in education; hence the current study hopes to explore more on the variables of TPACK in the 21st century skills teaching.

RESEARCH METHODOLOGY

The current research chooses to employ a purely quantitative research approach to achieve the objectives of the study. The purpose of this study is to establish a relationship between the secondary school teachers' TPACK and their teaching of 21st century skills in the classroom. Therefore, the quantitative approach is the most suitable approach to be employed, and the design of correlational research is chosen to be conducted. The collection of data in correlational research design is done not only to determine whether a relationship between variables exists, but also to determine to what degree does the relationship exists (Gay, Mills, & Airasian, 2014).

Target population is generally a researcher's group of interest in which a researcher wants to generalize in a study (Singh, Chan, & Sidhu, 2015). The study's target population is the secondary school English language teachers in Selangor, under the Petaling Perdana education department. The researcher chooses to conduct this study in public secondary schools because teachers in public schools work under the same policies, curriculum and syllabuses under the Ministry of Education, hence the homogeneity of the sample can be guaranteed. To choose the sample of this study, a cluster sampling process will be employed.

To collect the data for this study, an instrument of questionnaire will be used. In this questionnaire, there will be three sections included: demographic profile section, the measurement of TPACK level section, and the teaching of 21st century skills section. This study will adapt the measurement of TPACK level section from Schmidt et al. (2009) and Valtonen et al. (2017). Meanwhile, for the teaching of 21st century skills among the teachers section, it will be a self-developed questionnaire items from the researcher of the present study.

To ensure the reliability and validity of the instrument, the researcher will conduct a pilot study. The pilot study will help the researcher to figure any amendment or correction needed to be done before the actual study. Then, Cronbach's Alpha and Explanatory Factor Analysis (EFA) will also be conducted to determine both the reliability and validity of the instrument used. Meanwhile to analyse the data, this study has chosen to utilize SPSS software involving both descriptive and inferential statistics analysis.

CONCLUSION

To conclude, it is vital to see whether there is a significant relationship between TPACK framework and the teaching of 21st century skills among secondary school teachers. It is important so that knowledge about teachers' capacity and ability to teach in the 21st century education effectively is known, especially to the Ministry of Education. This study could give a significant impact in the teaching and learning process of the 21st century skills to the students in Malaysia. Besides, the findings of this study could also provide a significant contribution to teachers' training, either for the pre-service or the in-service educators. Continuous professional and personal development among the educators are important to ensure a quality education for the students.

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