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Factors Influencing TVET Teacher's TPACK Competencies

Mohammad Hafiz Salleh[1], Suhaida Abdul Kadir[1*], Rahimah Jamaluddin[1], Mohd Hazwan Mohd Puad[1]

[1]Faculty of Educational Studies,
Universiti Putra Malaysia, Serdang, Selangor, 43400, MALAYSIA

*Corresponding Author

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Abstract: Developing competent teachers is one of the main focuses of national TVET's transformation. The teaching profession demands that teachers constantly strive to improve the quality of their professionalism to become competent and quality teachers. In addition, TVET teachers must be prepared to withstand the technological boom in the industrial revolution 4.0 digital era to keep them in line with 21st-century learning. Thus, the Technological Pedagogical Content Knowledge (TPACK) framework is designed to meet the competencies that TVET teachers need. The primary purpose of this study was to assess the factors that influence the TPACK competency of TVET Teachers. Furthermore, to determine the relationship between mentoring role, school environment, and TVET teacher's competencies. A total of 400 TVET teachers from two categories of TVET-related institutions under the Malaysian Education TVET division were selected as the study's sample: vocational education upper secondary stream (PVMA) from National Secondary School (SS) and Vocational College (VC). Data were analyzed using a t-test, correlation, and multiple linear regression. The findings revealed significant differences in the level of technological knowledge competency between the two school categories. The role of mentoring and the school environment is also significantly related to the TPACK competency of TVET teachers. Meanwhile, the school environment predicts a change in the TPACK teachers' competency for TVET teachers in Peninsular Malaysia. Therefore, the study discovers the role of mentoring role and school environment in determining new factors influencing TVET teachers' TPACK competency. For further research, it is recommended to study the mentoring role in mediating the relationship between the school environment and TVET teachers' TPACK competency.

Keywords: Competency, mentoring role, TVET teachers, TPACK competency

1. Introduction

According to UNESCO (2002), technical and vocational education (TVE) is referring the aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding, and knowledge relating to occupations in various sectors of economic and social life. The definition clearly states that the TVET teachers must produce a competent graduate in the workforce. Furthermore, technological acceleration during the pandemic increased global engagement emphasis on skills acquisition through the digitalization of technical-vocational education and training (TVET). As in China and Germany, their national aspirations to restructure their economy and promote innovation has persuaded them to focus on TVET education. Thus, TVET has become the crucial agenda in every major leading economy country.

The 12th Malaysia Plan, RMK-12 sets the strategic direction for Malaysia's development for the period of 2021 to 2025 as we move forward as a nation. Competent and skilled human resource development has been given special attention to meet the country's skilled workforce needs for the country to become a high-income nation. Therefore, competency is an important indicator of job performance. However, according to Boyatzis (1982), competency is not sufficient to describe the effectiveness of an employee's performance. Successful work performance is built on three key

*Corresponding author: suhaida@upm.edu.my

components namely individual competence, job requirements, and organizational environment. These three dimensions are illustrated in the model for the effective performance of Boyatzis (1982). Thus, in the context of TVET teachers, their work performance can be measured by the individual's teaching competence aspect as one of the key components of job performance.

Competence

The word competence is a word derived from the Latin verb *competere*. *Competere* is a combination of two words, *com* means together and *petere* means fight. So, it literally means to fight together. Competency is a term often associated with the ability to do a job. The definitions used often vary according to the goals or approaches that an organization wants to achieve to boost an employee's achievement. This is because according to Sampson and Fytros (2008), the degree of competence is one of the key aspects of measuring a job's ability level of employees. This finding is consistent with the statement of the United Nation Industrial Development Organization (2002), that competence is a set of knowledge, related skills, and personality traits that enable one to complete tasks in a specific function. TVET teacher competence means the ability to master the knowledge, skills, and attitudes required by teachers in practical teaching settings at vocational school workshops and Vocational colleges. Therefore, the competence of TVET teachers is seen as an important element for them to prepare themselves for the students and to convey the knowledge and skills they need in school workshops. Teachers are the backbone of the education system and are the implementers of all policies and goals set by the government through the Ministry of Education in Malaysia. In this regard, teacher education programs are essential to equip teachers with the knowledge of professional skills to enable them to teach more effectively and to meet the standards recognised by their professional bodies and the public.

Work Environment

A work environment or work climate is among the important factors that influence the effectiveness of individual job performance. This is because according to Rogers et. al. (2012), environments that support one's goals can increase their potential to achieve their goals while inhibiting environments may have a negative impact on goal achievement. Thus, in the context of TVET teachers, the school environment is an important aspect that affects their potential. The concept of the school environment has been widely discussed in educational studies over the past few decades, and its discussion has become more sophisticated. The combination of curriculum factors, resources, outcomes, leadership, and environment contributes significantly to school effectiveness (Creemers et al., 1989). The term environment first introduced by Tye (1974) is a set of factors that give the school personality, spirit, and culture. Rudolf Moos (1974), a professor of psychiatry and behavioural science from Stanford University has described this social and psychological environment in three dimensions. Moos (1979) believes that any definition of a complete human environment should cover these three dimensions. According to him, this dimension can be used to describe the human psychological and social environment. The three domains or dimensions are relationships, personal development, and systems of maintenance and change. Hence, the school environment plays a pivotal role in the effectiveness of the organization also job performance.

Mentoring

Mentors play a vital role in the mentoring process, and they form the backbone of the TVET teacher work process. Without a good mentor, the effectiveness of the mentoring process will be compromised because mentors are the main reference point for their protégé in any circumstances of the teaching journey. For example, in a teaching fellowship for high school teachers and IPGs, a lecturer and a teacher will guide the trainees on the subject matter knowledge, teaching, and learning planning while applying the value of professionalism by playing their role as mentor to the coach (Meor Ibrahim & Norziana 2010; Zuria, 2010).

According to Hasriani (2008), mentoring guidance by the mentor teacher during the teacher's practical has a greater impact on teacher quality formation, especially in the planning and implementation aspects of teaching. As such, it is evident that a mentor in any given field plays a very significant role in the protégé as well as their programs and competencies. In this aspect, mentoring career guidance appears to play a larger role because technical and vocational subjects are highly skilled and require high levels of competence. The role of a more experienced teacher is important to novice teachers in their guidance. Mentors also play a role in creating a conducive environment for learning and subsequently publish their potential in the areas of teaching practice (Mahyudin & Mardiah, 2008).

According to Lacey (1999), the role of a mentor is determined by the purpose of a mentoring program itself. This means that the duties and roles of a mentor are different for each of the different program goals. Not all mentors will be appropriate for all mentoring programs. Each mentor has a special role depending on the mentoring program. This is due to taking on the role of a mentor is not a simple and easy task. It differs from that of a teacher or facilitator. Cullingford (2016) argues that the role of a mentor is not only complex but also emotional. Therefore, it is clear here that mentors play a vital role in the success of a mentoring program. Kram (1980, 1985) also found that mentors and mentees can shape and nurture the spirit of self-worth because of the positive values they show to one another. Mentors will provide

support and encouragement while working towards building competencies as well as providing support and encouragement for TVET teachers.

1.1 Theoretical Framework

TVET teacher competence, mentoring role, and work environment are the main domains explored in the study. The role of TVET teachers is significant in providing highly skilled human capital in line with the 12th MP's requirement to provide a skilled workforce. In addition, leading to the Industrial Revolution 4.0 which involved the discovery of many new technologies such as automation, Internet of Things (IoT), analytics and big data, simulation, system integration, robotic and cloud applications, TVET teacher competency is not only fit the old framework by Shulman (1986) consisting of content knowledge and pedagogy. Admiraal et al. (2017) in their study show that the effectiveness of teacher technology teaching in their education programs is depending how they apply technology in schools when they become teachers. The new Technological pedagogical content knowledge (TPACK) framework developed by Koehler & Mishra (2009) is seen as more appropriate for the industrial revolution 4.0 where technological knowledge is incorporated into the teacher competence framework. This framework is considered better and more comprehensive because it incorporates the domain of technological knowledge in the light of 21st-century learning.

The TPACK framework refers to the knowledge and ability to integrate technology based on specific pedagogical strategies in delivering knowledge of specific content especially involving technology applications such as Vocational Technical Education. It is the result of a fundamental development of the professional knowledge of teachers that Shulman has introduced (Shulman, 1986, 1987). According to Shulman (1986), teacher competence consists of content knowledge (CK) and pedagogical knowledge, (PK) and one overlapping dimension between CK and PK is pedagogical content knowledge (PCK). The TPACK incorporates the technology dimension into Shulman's framework into a more complex and dynamic three-dimensional teacher discovery process. This framework was introduced by Koehler and Mishra (2011) as presented in Figure 1.

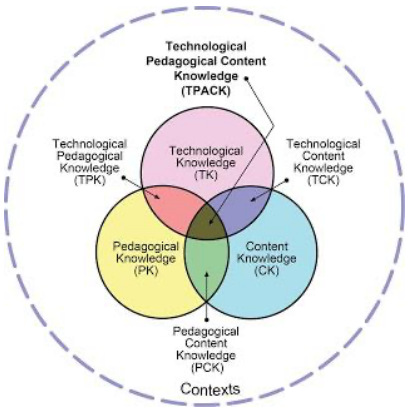

Fig. 1 - Model TPACK – Technological Pedagogical Content Knowledge, source Koehler, M. J. (2011)

The three main domains studied in this paper are the role of mentoring, working environment, and TPACK competency in the TVET teachers' work context. These domains are expected to have a significant relationship with the TPACK competency of TVET teachers. This study is therefore important to look at the TPACK competency of TVET teachers in the school. It is because TPACK is focusing the technological knowledge aspect in teaching and learning along with the pedagogical knowledge and content knowledge aspect. In addition, the relationship between the mentoring role and school environment to TPACK teacher TVET competency while determining which factor is the best predictor of TPACK teacher TVET competence. Therefore, this paper outlines three main objectives namely to

i) Evaluate the differences in teachers' TPACK competencies in VC and SS
ii) Determine the relationship between the role mentoring and the school environment with the competency of TPACK teacher TVET
iii) Assess factors influencing TVET teacher's TPACK competency

2. Methodology

A quantitative research approach was employed to carry out the study, and we collected through a survey questionnaire. Teachers from two categories of TVET institutions under the supervision of the Ministry of Education Malaysia have been selected to participate in this research. The institutions are a vocational college (VC) that is under the supervision of the Technical Vocational Education and Training Division (BPLTV) and a National Secondary School (SS) supervision by the School Management Division (BPSH). Both schools offer vocational and technical subjects such as Vocational Subject (MPV) and Vocational Program Upper Secondary (PVMA). Whereas TVET teachers who teach in both categories are from the same teacher scheme, known as the DG scheme and they hold at least Malaysian Skill

Certificate Level 3 (SKM3) qualification. A total of 400 TVET teachers in VC and SS were randomly selected from all over Malaysia. Samples were divided into four state zones namely north, middle, east, and south. The division of these zones makes data collection more systematic and representative. The questionnaire was distributed using the drop-and-pick method with a 97% return rate.

The TPACK competence-dependent variables were measured using the TPACK survey scale developed by Schmidt et. al (2009). For the independent variables of the school environment, the instrument adapted from the "School Level Environment Questionnaire" (SLEQ) developed by Rentoul and Fraser (1983) was used. To measure the role of mentoring, a questionnaire developed by Fowler (2002) was used. The data were then processed using the Statistical Package for Social Science (SPSS) version 25. Descriptive statistics and inferences were used to describe the differences in levels and relationships between dependent and non-dependent variables. To measure the level of each variable, the means and standard deviations were used. Lastly, to determine the factor for teacher's competency, multiple linear regression was used for the analysis.

3. Results and Discussion

3.1 Level of Difference of TPACK Competency

Based on the *t*-test results in Table 1, there is a significant difference ($p = 0.01$ $df = 386$, $t = 2.56$) between the levels of TPACK competence in SS and VC. However, comparisons of content knowledge dimensions and pedagogical knowledge did not indicate significant differences between the two school categories. These findings indicate that there are significant differences in the level of technological knowledge for SS and VC. This may be due to the exposure and ease of technology in these two categories of schools. According to Suriyansyah (2019), differences in school categories give different levels of achievement. This difference was more noticeable in the domain of technological knowledge making significant decisions ($p = 0.00$ $df = 386$, $t = 3.98$) than in content knowledge and pedagogy which did not reach a significant level. This indicates that the level of technological knowledge of teachers in VC is different from SS.

Table 1 - *T*-test analysis of the different levels of TPACK

	Type of Institution	*N*	Mean	SD	*t*	*df*	Sig. P
Technological knowledge	VC*	201	3.82	0.449	3.984	386	0.000
	SS**	187	3.64	0.398			
Content knowledge	VC*	201	3.96	0.436	1.774	386	0.077
	SS**	187	3.88	0.443			
Pedagogical knowledge	VC*	201	3.99	0.417	1.107	386	0.269
	SS**	187	3.95	0.409			
TPACK competency	VC*	201	3.92	0.395	2.563	386	0.011
	SS**	187	3.82	0.366			

**VC – Vocational College, **SS – Secondary School*

3.2 The Relationship between Mentoring Role and School Environment with Teacher Competence

Table 2 shows the relationship between the mentoring role and the school environment with the TPACK teachers' competence in TVET by dimension. The dimensions of the teaching role are a) career support, b) psychosocial support, and c) role model. The dimensions of the school environment consist of a) citizen relationships, b) personal development c) maintenance and change systems. Pearson's correlation shows that there is a strong positive and significant relationship between the role of the teacher and the school environment with the competence of TPACK teacher TVET. Each obtained a value of $r = .502$ (role of teacher and $r = .677$ (school environment) at a significant level of $p < 0.01$. Based on the analysis, it appears that the school environment shows a stronger correlation compared to the role of mentoring. However, both have a strong correlation to the TPACK teachers' competence in TVET, which is in line with previous studies on the relationship between mentoring role and school environment with competence. This focus on mentoring has broad goals including skills development and competence, psychosocial support and social emotion, and career development (Haggard et al., 2011; Jacobi, 1991; Kram, 1985) This finding is also in line with Ross's (2019) study of nurse coaches showing peer mentoring to improve their competence, and Čiučiulkienė 2019) in his qualitative study of 10 trainee teachers found mentoring increased pedagogical and didactic competence or willingness to teach.

Meanwhile, a significant finding of the school environment's relationship with TPACK teacher TVET competencies is in line with recent studies on school environment and learning with achievement and competence. A recent study by Mallari (2018) found a significant relationship between the learning environment and student mathematics achievement in second-year engineering students. This is in line with the findings of Suriyansyah (2019) which show that the school environment has a significant relationship with teacher job satisfaction while improving teacher performance. Khine et. al. (2019) claims in their study that trainee teachers from Persian Gulf Countries are achieving complete TPACK

Knowledge, teacher education programs need to construct the content including pedagogical skills, and technology know-how simultaneously. It means that the domain resources for the TVET teachers should be completely holistic in terms of the TPACK framework.

Table 2 - Correlations between Dimensions of mentoring roles and school environment with teacher TPACK competency

	Teachers TPACK Competency	
	r	Sig.*p*
Mentoring Role	.502**	.000
School Environment	.677**	.000

** $p < 0.01$

3.3 Predictor Factors

Table 3 shows a summary of regression analysis of various enterprises for the role of teaching and the school environment to predict TPACK teachers' TPACK competencies. The findings show that the two predictors of predictor variables (β = 0.209, p <0.05) and school environment (β = 0.570, p <0.05) were significant predictors of TPACK teacher TVET competencies. Both factors significantly accounted for 49% of the variance in TPACK teacher TVET competence [F (2, 385) = 185,169; Sig. F = 0.000]. Therefore, the change in the TPACK competency level of TVET teachers was 49% affected by factors of the mentoring role and school environment. The other 51% were explained by factors from other variables not studied in this study. This finding is consistent with previous studies by Hrimech & Tasse (2003) who explain that learning transfer can be influenced by many factors that may facilitate or hinder it. Among these are work-related factors and the environment that contribute to the process of transferring learning. Factors related to work are job requirements, time for opportunities, norms and demands of the group, contextual similarities, supervisory support, and disruption of work. Organizational factors are a reward system such as positive reinforcement or organizational cultures such as the role of the mentor and the work environment. Therefore, environmental factors and the role of mentoring are among the factors that influence teachers' TPACK competencies.

Table 3 - Summary of multiple regression analysis for the mentoring role and school environment predicting TPACK teacher competence TVET

	B	**Std. Error**	**Beta**	***t***	**Sig.**
(Constant)	1.213	0.139		8.713	0.000
Mentoring Role	0.141	0.029	0.209	4.918	0.000
School Environment	0.555	0.041	0.570	13.420	0.000
R^2 = 0.490; F (2, 385) = 185.169; Sig. F = 0.000					

4. Conclusion and Recommendation

This study set out to explore the factors that affected the TVET teachers' TPACK competency. It was found that the mentoring role and the school environment influence the TPACK competency of TVET teachers. Thus, the mentoring role and the school environment are important factors that need special attention from the ministry, educational institutions, and TVET teachers themselves in ensuring that general competencies and TPACK competencies can be enhanced. Emphasis on mentoring programs among TVET teachers especially between experienced and novice teachers should be emphasised systematically so that the impact can be more clearly seen on TVET teacher competencies. Likewise, aspects of the school environment should be emphasised by both the ministry and school administrators because the school environment is important to TVET teacher competencies especially TPACK competencies as facilities such as teaching aids and technology support are crucial in improving the effectiveness and performance of TVET teachers. TVET policymakers should also proactively provide teachers with TVET teacher training programs to improve their performance and support lifelong learning processes. It is recommended that further research could be conducted on a mentoring role in mediating the relationship between the school environment and TVET teachers' TPACK competency.

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