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Technology Integration Analysis Among TVET Lecturers in Sarawak

Mohammad Yunus, Hamidah[1*] & Mohamad, Fitri Suraya[2]

[1*,2]Faculty of Cognitive Sciences and Human Development, Universiti Malaysia Sarawak, 94300 Samarahan City, Sarawak, MALAYSIA

*Corresponding author email: hamidahmy80@gmail.com

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Abstract: High-quality TVET graduates are top priorities, as it directly impacts the country's economic development. Consequentially TVET lecturers should equip themselves with sufficient pedagogical and content knowledge in the skills taught. Furthermore, the Covid-19 pandemic has had an impact on TVET education, urging the use of technology in a more holistic approach. This study evaluates the current level of competencies of TVET lecturers in integrating technology in their teaching and learning from the lenses of the Technological Pedagogical Content Knowledge (TPACK) model. This study used a quantitative research methodology through a survey approach on TVET lecturers. A questionnaire was distributed to all TVET lecturers from six Community Colleges in Sarawak (N = 68, n = 62). Analysis of quantitative study findings showed that TVET lecturers assumed their technological, pedagogical, and content knowledge (M = 5.71, SD = .691). The mean score of technological knowledge (TK) was the most dominant knowledge component (M = 5.91, SD = .726). The mean score of TPACK knowledge was the lowest knowledge component mastered (M = 5.46, SD = 1.046). The main findings are discussed in terms of demographics such as gender, teaching experience, academic level, and field of specialization, to better understand the level of knowledge of current TVET lecturers. As a result, policymakers could design professional development programs that consider the interaction of pedagogical, content, and technological knowledge to improve TVET teaching and learning, in accordance with the Ministry of Higher Education's emphasis on the TVET sector as a catalyst for national development.

Keywords: Technological pedagogical and content knowledge (TPACK), technical and vocational education and training (TVET), community college, technology, covid-19

1. Introduction

Technical and Vocational Education and Training (TVET) in the national education system is one of the country's economic development agendas. The change towards making Malaysia one of the productive developed countries, producing skilled human capital in TVET, is used as a catalyst in the country's economic progress. The government has made several efforts, including a professional development programme for TVET instructors in the context of the Fourth Industrial Revolution (4IR) (MOE, 2018). The government is dedicated to ensuring that the country's education is more global, considering the 4IR. On the other hand, Malaysia was stated to have a skilled labour shortage in the Economic Report 2017/2018. Malaysia is still 25.5% lower in terms of the number of people with such skills, compared to developed countries such as Singapore (56.2%), Australia (45.2%), and the United States (42.2%). Furthermore, when Malaysia is placed 46th out of 137 nations in terms of industrial productivity, the efficiency of technology utilisation among Malaysians is determined to be low (MOF, 2017). When Malaysia suffers from workforce disparity, our country's production suffers as well (MOF, 2017). The execution of development and improvement in the education system, particularly in boosting the professionalism of TVET lecturers, demonstrates that they play a critical role in accomplishing the government's goal of making Malaysia a competitive country (Wahab & Saud, 2021). As a result, competent instructors should be able to address the problem of employability skills and non-marketability among graduates and the problem of mismatch in the workforce (Hanapi & Nordin, 2014). It is also hoped to modify the attitude

*Corresponding author: hamidahmy80@gmail.com

of most Malaysian companies, who believe that most TVET graduates do not meet quality standards, particularly in terms of technical capabilities in the workplace (MOE, 2018).

TVET education is a skills-based education in an industry that focuses on employability skills. TVET is defined as all aspects of the educational process involving general education, technology, and related scientific research, as well as the acquisition of practical skills, attitudes, understanding, and knowledge related to employment by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) (MOE, 2018). TVET Education also attempts to ensure that the essential workforce requirements in each field fulfil standards, focusing on practical components, psychomotor skills, and exposure to industrial training. Based on this, TVET lecturers should address this demand by ensuring that students can master the knowledge presented as expected. Proficiency in abilities in various economic and social domains, such as the application of technologies. Therefore, TVET education should be led by skilled and quality TVET lecturers in terms of content knowledge, pedagogical knowledge, and knowledge in the use of the latest technology to support the aspirations of TVET.

Due to the rapid development of technology, TVET lecturers face several challenges, especially in integrating technology in their teaching and learning. TVET lecturers are aware that they need to keep up to date on technological developments in teaching and learning (Koehler et al., 2013; Mahat et al., 2019; Okundaye, 2017). However, in the national education situation that is actively expanding technological education, some educators still practice conventional teaching and learning (Mahat et al., 2019). Nowadays, the use of technology in teaching and learning has become a demand for education that must be met. Technology has a significant impact on education, how students learn, and how teachers and students interact (Cox & Prestridge, 2020; Hwang & Tsai, 2011). Technology has also benefited education through various distant education programmes and the internet, which both instructors and students may use (Pooja, 2021; Stošić, 2015).

Nonetheless, due to various causes, the rapid progress of technology in education has become a difficulty and constraint for specific instructors. Presentation tools, digital publication, document management, online communication tools, and drawing tools, for example, all demand lecturers to improve their teaching quality through their technical capabilities (Pooja, 2021). In addition, the lack of provision of technological tools in educational institutions by the authorities is also among the constraints that need to be faced by some educational institutions (Santos & Castro, 2021). As most industry developments are now recommended to support the Industrial Revolution 4.0 (4IR), TVET lecturers and educational institutions should also be on the same track to support these developments to ensure the TVET graduates produced are of quality in line with industry requirements.

The Covid-19 epidemic has posed a significant issue for TVET lecturers. As a result of this predicament, TVET lecturers' teaching and learning habits have shifted. Because TVET education emphasizes practical training, adapting technology to guarantee that students understand the practical learning outcomes is becoming increasingly difficult. In this context, educators must understand how to use technology effectively and how to develop effective teaching practices. Previous research (Hanapi et al., 2015, 2017; Hanapi & Nordin, 2014; Stošić, 2015) has revealed that teaching effectiveness is essential in producing quality graduates. Due to TVET education which emphasizes industrial employment, the responsibilities of lecturers become more challenging when they also need to constantly update their skills in line with current industry needs while not ignoring the importance of pedagogical mechanisms. TVET institutions have adapted the implementation methods of technology education and training by providing courses based on demand, significantly reducing capacity differences in terms of efficiency with the 4IR industry (MOE, 2018). TVET lecturers must wisely create teaching strategies using technology based on the ministry's actions. However, they must also consider the knowledge of the use of technology in the 4IR industry and adapt it to the current condition. The most recent issue, the Covid-19 pandemic, has put TVET education to the test and transformed the pattern of TVET learning outcomes, with a greater emphasis on understanding of practical skills.

Undoubtedly, educators require teaching abilities, specifically material knowledge and how to teach the content (Herold, 2019; Shulman, 1986). Content knowledge and pedagogy should not be the only elements learned in today's educational environment. Teaching, particularly in TVET education, requires a high technological understanding. Technology is used to aid in the teaching process, but it is also one of the essential tools in teaching and learning. During the Covid-19 outbreak, its relevance may be seen both in-person and virtually. In addition, teaching practices that stress 21st-century pedagogical delivery include deep learning and student-centered learning.

Koehler & Mishra (2009) emphasized the importance of technological knowledge by developing a TPACK (Technological Pedagogical and Content Knowledge) model framework. Based on the framework of this model, Koehler & Mishra (2009) proposed to add technological knowledge in the knowledge base of educators by Shulman (1986). According to Koehler & Mishra (2009), educators should have essential basic knowledge, including three main parts, namely content knowledge, teaching knowledge, and technology knowledge. The TPACK framework also emphasizes how teachers understand the interaction between teaching content, teaching practices, and the technology used in the teaching process to produce a meaningful learning experience (Alenezi, 2018; Ebil et al., 2020; Koh & Chai, 2014). Since TVET teaching and learning emphasizes the use of technology, the TPACK theoretical framework is used to examine the level of existing knowledge of the TVET lecturers. Many past studies have proven how this model can provide visual explanations of the complex relationship between technological knowledge, pedagogy, and content.

TPACK's research has given meaning to technological teaching and learning (Koh et al., 2014; Koh & Chai, 2014; Yeh et al., 2014). Research that uses the TPACK model in TVET education is primarily to identify the level of knowledge of TVET lecturers in implementing the TVET curriculum (Brien, 2015; Chua & Jamil, 2012, Chua & Jamil, 2014; Mutanga et al., 2018). The proficiency in the knowledge level of TVET lecturers is often questioned following the feedback from employers who stated that TVET graduates are still inept in terms of knowledge, skills, and attitudes (MOE, 2015). Although the total marketability percentage of some institutions exceeds 90% (MOHE, 2018), the majority most of believes that TVET graduates are still unable to contribute to increased productivity based on the work quality (MOE, 2018). Therefore, the level of knowledge of TVET lecturers is often questioned due to the occurrence of incompetence in TVET graduates in various aspects of employment and knowledge. Thus, in particular, TPACK research in TVET education is fundamental to providing more precise feedback on questions faced on the incompetency of TVET graduates as informed by employers in Malaysia.

The degree of expertise of TVET instructors has not yet reached an appropriate level, according to several previous studies employing TPACK. For example, Chua & Jamil (2012, 2014) indicated that TVET teachers in public institutions still have a moderate degree of TPACK. Brien (2015) also stated that TVET teachers have a moderate level of TPACK. Furthermore, the same authors revealed that all levels of technology component knowledge were lower than expected. Furthermore, Mutanga et al. (2018) discovered that most engineering lecturers (55 %) are still confused about how to employ technology in their teaching and learning. Despite earlier research indicating that TVET teachers still lack technology knowledge,

Past studies examining the relationship of demographic factors with TPACK proficiency among educators show mixed findings (Akun, 2019; Antonelli, 2019; Chua & Jamil, 2012; Koh et al., 2010). Among the demographic factors that are often studied are gender factors and duration of teaching experience that affect the level of knowledge of TPACK. However, factors such as field of specialization and level of academic achievement are also considered essential to generate knowledge in more focused TVET teaching and learning. Although demographic factors such as gender, length of experience, and academic level are often studied, for this study, the field of specialization will impact the study differently when it involves a broader range of field clusters. A gender study has been conducted by Chua & Jamil (2012), and Antonelli (2019) has shown differences in findings by Koh et al. (2010). Through quantitative studies, Chua & Jamil (2012) and Antonelli (2019) found no significant difference between gender and level of knowledge. At the same time, Koh et al. (2010) found significant differences between genders on the level of knowledge of pre-service teachers in Singapore.

The number of years teachers taught fundamental subjects (English, Mathematics, and Science) did not affect TPACK knowledge, according to Voithofer et al. (2019). However, contrary to a study of kindergarten and primary school teachers (Technology subject teachers), their TPACK competence level was statistically demonstrated to be associated with their total years of teaching ($t(151) = 2.16$, $p = 0.032$). Jang & Chang (2016) showed that people with a PhD degree assessed their topic material knowledge significantly higher than those without a doctoral degree in a study on the level of academic credentials. While Chua & Jamil (2014) and Voithofer et al. (2019) looked at the relationship between specialization and knowledge level, they discovered that field of specialization has a positive relationship with knowledge level.

Collectively, demographic factors such as gender, duration of teaching experience, academic level, and field of specialization need to be studied in TVET education based on inconsistencies in the findings of studies that have been conducted. Given that the field of TVET has become a catalyst for developing a technological nation, then the context of technological knowledge in the teaching and learning of TVET should be examined. Based on the research problems stated, to examine the level of knowledge of TVET lecturers to integrate technology in the teaching and learning of TVET through the following research objectives:

a. To measure the current level of knowledge of TVET lecturers using the TPACK model.
b. To analyze the differences between content knowledge, pedagogy, and technology (TPACK) and demographic factors among TVET lecturers.

2. Methodology

This study employs a quantitative research methodology, with questionnaires as the primary tool. A survey questionnaire was used to determine the degree of topic knowledge, pedagogy, and technology among TVET lecturers and examine the disparities in the level of knowledge and demographic characteristics.

The data was analyzed using descriptive statistics such as frequency, mean, and standard deviation. A total of 62 people (27 men and 35 women) were involved, all of whom are currently working as lecturers in various sectors of the TVET specialty. The participants' academic qualifications ranged from diploma to bachelor's to master's degrees, with the time of instruction varying. The lecturers who took part in this study were from Sarawak Community College, which comprises six community colleges in the state.

The instrument of this study is a questionnaire adapted from previous studies by Schmidt (2020) and Sahin (2011) and modified according to the context of the study, which is TVET education. Section A consisted of 76 items, 17 items of content knowledge ($\alpha = .956$), 11 items of pedagogical knowledge ($\alpha = .944$), 7 items of pedagogical content knowledge ($\alpha = .949$), 21 items of technology knowledge ($\alpha = .960$), 6 items of technology content knowledge ($\alpha = .964$), 9 items of technology pedagogy knowledge (α = .968) and 5 items of content knowledge, technology pedagogy (α = .961). Section B consists of demographic information of the respondents such as gender, age, and academic qualification, duration of teaching experience, the field of specialization, and the field taught. Respondents' responses were evaluated using a Likert scale of 7 where scale seven represents strongly agree while scale 1 represents strongly disagree.

3. Findings

3.1 Level of Pedagogy, Content and Technology Knowledge of TVET Lecturers

Descriptive statistical analysis shows that the level of content knowledge, pedagogy, and technology of TVET lecturers (n = 62) is at an elevated level (M = 5.71, SP = .691). The values for the mean scores of all TPACK knowledge components are as in Table 1.

Table 1: Mean Score for TPACK Component of TVET Lecturers and Standard Deviation

TPACK components	Min	Standard deviation
Content Knowledge (CK) component	5.65	.633
Pedagogical Knowledge (PK) component	5.78	.636
Pedagogical Content Knowledge (PCK) component	5.70	.722
Technological Knowledge (TK) component	5.91	.726
Technological Content Knowledge (TCK) component	5.72	.860
Technological Pedagogical Knowledge (TPK) component	5.72	.801
Technological Pedagogical Content Knowledge (TPACK) component	5.46	1,046
TPACK overall	**5.71**	**.691**

Table 1 shows that the TK)component has the highest mean score value (M = 5.91, SP = .726) while the lowest mean value is the TPACK component (M = 5.46, SP = 1.046). As a result of the ongoing Covid-19 pandemic, expanded online teaching and learning may have influenced higher levels of confidence in using technology. These findings also indicate that TVET lecturers' understanding of integrating the components of pedagogical knowledge, content, and technology requires clearer and more structured exposure. Although they showed confidence in the use of technology separately, it may still require an understanding to determine the appropriateness of the use of technology based on the content taught and the teaching methods used. Therefore, a comprehensive understanding of these three components should make the knowledge of TVET lecturers more dynamic in TVET teaching to help increase the level of TPACK among them (Koh et al., 2013).

3.2 Analysis of TPACK Component Levels on Demographic Factors of TVET Lecturers

3.2.1 Gender

Based on the frequency distribution of gender analysis, the number of female respondents is more at 56.5% compared to the number of male respondents at 43.5%. Table 2 details the gender demographic mean score values showing the similarity of high TPACK level mean scores between males (M = 5.65, SP = .699) and females (M = 5.75, .691).

Table 2: Gender Demographics, Number, Mean Score, Standard Deviation, t-Value and Significance Level

Gender	N	Min	Standard deviation	T-Value	Significance Level
Male	27	5.65	.699	-.534	.982
Female	35	5.75	.691		
Amount	62	5.71	.690		

Based on Table 2, the mean score difference between male and female respondents is 5.65 - 5.75 = -0.10. A negative t-value indicates that the mean score of male respondents is lower than that of female respondents. However, the results of independent sample t-test analysis showed no significant difference between the level of TPACK ($t = .534$; $p > .05$) between male and female respondents. Fig. 1 shows that the percentage rate of respondents for each component is the same between males and females. The finding further confirms that statistically, the level of knowledge between men and women has no significant difference. However, the findings showed significant differences between the genders on the TCK component. A total of 83% of female respondents compared to 59% of male respondents agreed they have a prominent level of knowledge for the TCK component. Although male respondents showed they were slightly ahead in CK compared to female respondents, they were still weak in integrating the content taught using specific technologies (TCK) (Koehler & Mishra, 2009).

In summary, no significant differences between male and female respondents were found in any knowledge components. Despite this, both genders indicate less understanding of the TPACK component than in other areas. The percentage of responses to combined components like PCK, TCK, and TPK reveals that the high degree of knowledge has a smaller percentage of respondents than the single components like CK, PK, and TK. These findings suggest that they are still hesitant to include technology into their teaching and learning while considering methodology and content.

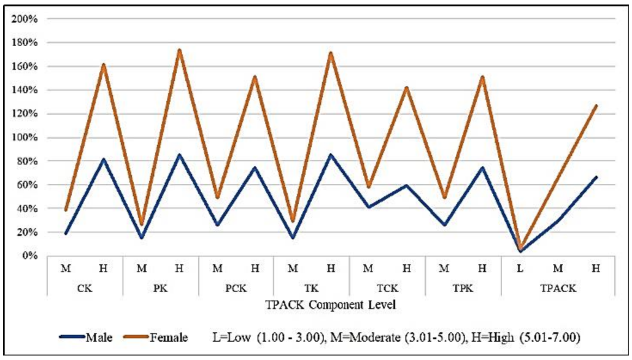

Fig. 1: Percentage of Respondents by TPACK Component and Gender.

3.2.2 Teaching Experience

According to Table 3, a total of 20 respondents (32.2%) has 1 to 5 years of teaching experience and 6 to 10 years of teaching experience. Eighteen respondents had 11 to 15 years of teaching experience (29.0%). Only four responders (6.4%) have 16 years or more of teaching experience. Table 3 depicts the distribution of mean knowledge level scores across the five levels of teaching experience. The one-way ANOVA statistical test revealed that there was no significant difference (F (4, 57) between the overall level of knowledge and the five levels of teaching experience duration (P =.849).

Table 3: Demographic Information: Teaching Experience, Number, Mean Score, Standard Deviation, t-Value and Significance level

Teaching experience	N	Min	Standard deviation	The t-value	Significance Level
1-5 years	20	5.7869	.72666	.341	.849
6-10 years	20	5,6796	.59390		
11-15 years	18	5.7419	.82142		
16-20 years	3	5.3020	.32721		
26 years above	1	5,5509	.		
Total	**62**	**5,7119**	**.69067**		

Despite this, most respondents agreed that they have a high degree of understanding for all knowledge components during their time as educators, as seen in Fig. 2. The finding demonstrates that their strong confidence in content understanding, pedagogy, and technology is unaffected by their brief teaching experience. Compared to more experienced respondents, a higher percentage of respondents with 1 to 5 years of experience claim to have strong knowledge of the PK component. The finding demonstrates that, even though their teaching duration is short, they are more confident in adopting technology in their teaching and learning.

Finally, the length of teaching experience has little bearing on the degree of knowledge of TVET professors when it comes to teaching and learning. During their whole teaching experience, only 36% of lecturers regarded themselves as having a high knowledge of the TPACK component. This modest percentage indicates that most of them still misunderstand how the components of pedagogical expertise, content, and technology interact.

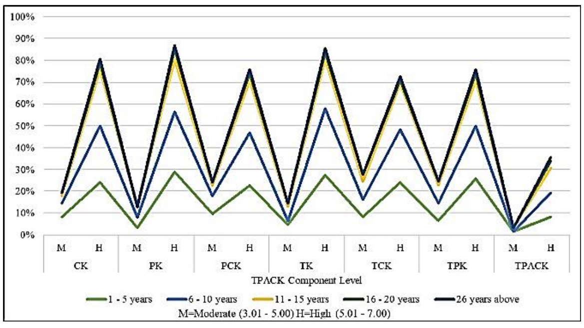

Fig. 2: Percentage of Respondents by TPACK Component and Teaching Experience.

3.2.3 Academic Qualification Level

As stated in Table 4, 33 respondents (53.2%) have a bachelor's degree. While 23 people (37.1%) have a master's degree, six have a diploma (9.7%). According to one-way ANOVA statistical tests, the total level of knowledge (F (2, 59) = 1.027, P =.364) with the three groups of different academic levels was not significantly different.

Table 4: Demographic Information: Academic Level Demographics, Number, Mean Score, Standard Deviation, t-Value and Significance level

Academic Level	N	Min	Standard deviation	The t-value	Significance Level
Diploma	6	5.3375	.65842	1,027	.364
Bachelor degree	33	5,7276	.66520		
Master degree	23	5.7871	.73211		
Total	**62**	**5,7119**	**.69067**		

According to Fig. 3, those with a bachelor's degree were the majority of those who evaluated themselves as having a high degree of understanding for each component of TPACK expertise. The high percentage of each component of knowledge has influenced the outcomes of this research because most of the respondents in this survey have a bachelor's degree. However, a considerable proportion of diploma-holder respondents (9.7%) said they were more confident in possessing a prominent level of expertise for each knowledge component. Respondents with a master's degree have reported being less confident in their knowledge, as evidenced by the lower proportion of knowledge in Fig. 3.

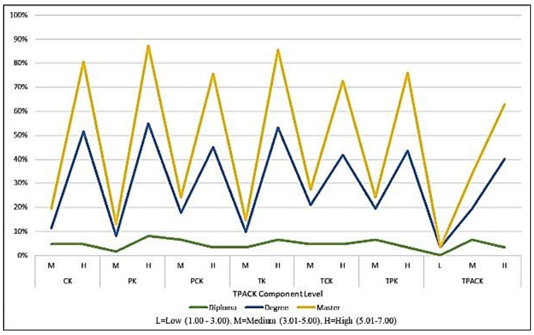

Fig. 3: Percentage of Respondents by TPACK Component and Academic Level.

The data analysis revealed that the level of academic qualification of TVET lecturers had no bearing on their knowledge. The data also reveal that professors with lower academic degrees have more faith in their teaching and learning abilities. As a result, respondents with greater academic degrees do not necessarily feel more confident in their pedagogical, content, and technological skills in TVET teaching and learning, according to the findings of this study.

3.2.4 Field of Specializations

The data obtained is based on the field of specialization of the respondents. Based on Table 5, the distribution of respondents' data consists of 13 different areas of specialization. The distribution shows that the Tourism and Adventure field has the highest number of respondents (12.9%) compared to other fields of specialization. Accordingly, there are three areas of specialization of the highest approval of the respondents that are not related to the field taught, such as Education, TVET, and Management. Nevertheless, the area of specialization of the respondent was an area related to the field being taught. One-way ANOVA statistical test shows that the mean score of the knowledge level of TVET lecturers had no significant difference (F (12, 49) = 1.183, P = .322) with different areas of specialization studied.

Table 5: Demographics Areas of Specializations, Number, Mean Score, Standard Deviation, t-Value and Significance level

Field of Specializations	Number	*Min*	*Standard deviation*	The t-value	Significance Level
Fashion and Apparel	7	6.0563	.50783	1,183	.322
Architectural Technology	5	5.3567	.34600		
Tourism & Adventure	8	5.7402	.55797		
Information Technology	3	5,8591	.16957		
Landscape	5	5.7232	.46732		
Electric Technology	7	5.8560	.78551		
Industrial Maintenance	3	5.2550	.36431		

Interior Design	1	5.9240	.
Computer Systems & Networks	6	6.2658	1.00647
Culinary	6	5.4625	.78953
Education	2	5,8145	.04734
TVET	6	5.1433	.73941
Management	3	5,7698	1.12742
Total	**62**	**5,7119**	**.69067**

Fig. 4 shows that the study's findings are divided into two categories, namely technological fields, and non-technological fields. The results indicates that the mean score value of the highest level of knowledge consists of 3 fields of technology, namely the field of Computer Systems and Networks (M = 6.26, SP = 1.00), Interior Design (M = 5.92, SP = .000) and Information Technology (M = 5.85, SP = .169). The three highest areas of specialization listed belong to the computer cluster, where teaching and learning are based on the use of computers. Based on the mean scores for the level of each component studied, the TK component (M = 5.91, SP = .726) shows the highest mean score for all respondents. The high mean score value in the TK component has led to the overall TPACK level mean score value to this cluster (Nelson et al., 2018). These findings have also directly shown that lecturers for this field of specialization have high confidence in the use of computers adaptation in TVET teaching and learning.

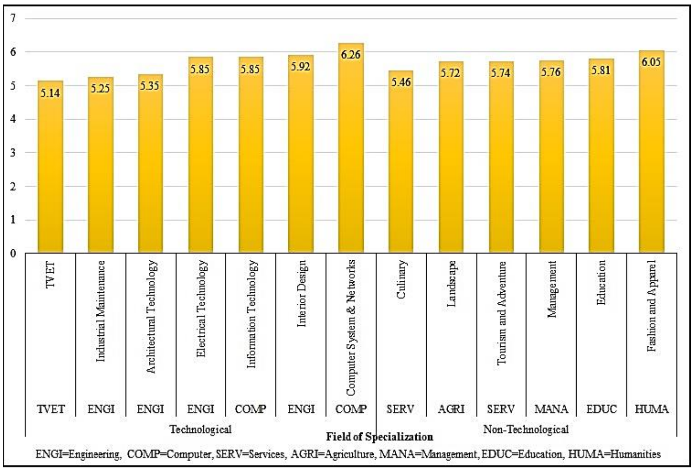

Fig. 4: TPACK mean score by Field of Specializations.

Fig. 4 further demonstrates that among all areas of specialization analyzed, the TVET field of specialty has the lowest mean score (M = 5.14, SP =.739). Because the TVET field of specialty is one of the most popular among respondents and is not provided at community colleges, the respondents' Content Knowledge (CK) in this field is distinct from the field taught. The significance of Content Knowledge (CK) in the subject of expertise taught should be stressed so that lecturers can confidently and accurately communicate educational content. These findings imply that one's level of academic qualification is less essential than one's level of Content Knowledge (CK) in the subject of expertise taught. The academic level is also considered.

Additionally, the Fashion and Apparel field from the non-technological field category shows the highest TPACK mean score value (M = 6.05, SP = .507) compared to other non-technological fields. The Fashion and Apparel field is under the humanities cluster, where it is categorized as a field that uses less computer technology and the internet. The learning outcome of this field is the production of products in the form of clothing and accessories. Through practical training, the teaching of this field makes extensive use of technological equipment such as sewing machines and other sewing hardware. The application of high-level knowledge in sewing machines and hardware has indirectly contributed to the high-level knowledge of TPACK in their teaching and learning. Although this field is not based on computer and internet skills, the high factor of Technological Knowledge (TK) on sewing machines and equipment makes them confident in using technology for practical training purposes in the classroom. At the same time, these findings also show that Technological Knowledge (TK), whether in the form of technology or non-technology, is critical in TVET teaching to integrate the content taught with appropriate teaching methods to optimize pedagogical approach.

In conclusion, the findings suggest that the level of expertise of TVET lecturers is unrelated to the field of specialization taught. Other demographic criteria investigated, such as gender, length of teaching experience, and academic degrees, had no bearing on the lecturers' level of TVET knowledge. Between the categories of technological areas and non-technological fields, there is a difference in the mean score of knowledge level. Compared to the non-technical field, the technological field has the most outstanding mean score value. Nonetheless, when the mean score value for this component leads to a high TPACK mean score value for both fields, Technological Knowledge (TK) demonstrates its importance.

4. Discussion and Conclusion

This study examines the level of technological, pedagogical, and content (TPACK) knowledge of TVET lecturers in their teaching and learning. The two main objectives outlined in this study are to assess the current level of knowledge of TVET lecturers by using the TPACK model framework and analyse the differences in the knowledge level of the lecturers with demographic factors of TVET lecturers. The results show that the level of technological, pedagogical, and content knowledge of TVET lecturers is high for the entire knowledge component. The knowledge level of TVET lecturers is found to have no difference with the factors of gender, teaching experience, academic level, and field of specialisation studied (Ebil et al., 2020; Shafie et al., 2019).

The majority of TVET lecturers who participated in this study expressed confidence in Technological Knowledge (TK) and applied it as a skill that can be passed on to students. The lower mean score of Pedagogical Knowledge (PK) relative to Technological Knowledge (TK) impacts overall understanding of the TPACK level. Some TVET lecturers believe that pedagogical knowledge (PK) is a less relevant aspect in TVET teaching and learning because TVET education emphasises practical activities and specific machines (Chua & Jamil, 2014). As a result, TVET lecturers are deemed to have the potential to improve their instructional knowledge. Even if they demonstrate proficiency in knowledge on their own, the absence of understanding fluidly between subject, pedagogy, and technology is more evidence of their pedagogical incompetence.

Most TVET lecturers in the study agreed that they have adequate technical skills (CK) in their field. The results also show that they have mastered the skills required in the guided curriculum. Although the guided curriculum is at a basic level, the challenge of expanding technical skills in line with industry requirements may be a constraint that must be faced. Facing the Industrial Revolution 4.0, mastering the latest technical skills should also be the role of TVET lecturers and require them to be more competent in this context (Spöttl & Windelband, 2021). In line with the needs of the national education system that emphasises the understanding of occupational skills, the technical skills component or content knowledge in the field of TVET will have a more convincing impact on the teaching. While the curriculum provided may not be fully up to date with technology, TVET lecturers should take initial steps to be more competitive with the current industry. As such, the TVET curriculum that drives the expansion of this 4.0 industry will help the competence of TVET lecturers towards more meaningful teaching and learning.

In conclusion, this study provides an overview of the country's community college TVET professors' skills and preparation. Even while some firms claim that TVET graduates lack the abilities necessary by the industry, they have a high degree of knowledge on average. The status of TVET lecturers' knowledge levels in the twenty-first century can impact TVET teaching and learning in the industry. 4.0. The outcomes of this study also demonstrate that the increased usage of technology during the Covid-19 pandemic has boosted TVET instructors' confidence in the technological learning environment. Furthermore, the findings of this study show that continual development training in Teaching Professional Development is beneficial.

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