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Exploring Teacher Competency In Vocational Education: A Focus On Pedagogical And Content Knowledge

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ABSTRACT

Teachers' proficiency in pedagogy and their mastery of subject matter are pivotal determinants in the effectiveness of vocational education. These attributes are essential to ensure that the educational experience is not only impactful but also captivates and motivates students. In Malaysia, vocational education was introduced at the secondary school level prior to the implementation of the Technical and Vocational Education and Training (TVET) reform initiative in 2011. This initiative was strategically aimed at aligning educational outcomes with the evolving skill requirements of the labor market. However, questions have been raised about the extent to which teachers are competent to ensure the effective application of concepts and understanding in the teaching of TVET subjects. Issues have emerged regarding teachers' limited mastery of different pedagogical approaches and weak mastery of the content of the subjects taught. Therefore, this study aims to assess the level of teachers' competencies in Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK), guided by the Technological Pedagogical Content Knowledge (TPACK) framework introduced by Mishra & Koehler (2016). Using a quantitative approach, the study distributed an online questionnaire to 66 secondary school teachers offering vocational subjects in Terengganu. The findings revealed that Content Knowledge (CK) was the most dominant component, followed by Pedagogical Content Knowledge (PCK) and Pedagogical Knowledge (PK). Based on these findings, the researchers proposed several intervention measures, including the provision of workshops, in-service training to enhance knowledge in innovative content and pedagogy and implementing mentoring teacher. The study concludes that the use of the TPACK model is a critical aspect of teacher competence in the current era. The holistic and effective use of the TPACK model in the professional development of TVET teachers is essential to ensure the success of TVET in producing a competent future-ready workforce.

Keywords: TPACK; Vocational Subject Teacher; Competency; Google Classroom

Introduction

The enhancement of teacher professionalism is an essential facet in adapting to the multifaceted and ever-changing landscape of education, reflecting the need for continuous adaptation and responsiveness within the educational domain over time. Vocational education, or Technical and Vocational Education and Training (TVET), has emerged as a global agenda in tandem with the advancements of the Fourth Industrial Revolution (Diao & Hu, 2022). In Malaysia, the Ministry of Education emphasizes TVET programs to produce skilled students who meet the demands of the job market (MOE, 2023). Vocational education, which begins at the secondary school level, opens opportunities for students to explore various skill areas encompassing aspects such as information technology, engineering, entrepreneurship, and services (UNESCO, 2013). These programs are

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designed to provide early exposure to industry practices by integrating theoretical and practical learning within the curriculum.

Consequently, various changes have been implemented in the curriculum of this subject to align with the social and economic development of the country (Schulte et al., 2020). In this context, teachers play a crucial role in providing quality and relevant education (Tee et al., 2020; Yunos et al., 2019). However, questions arise regarding the extent to which teachers have sufficient competencies to apply concepts and understandings in vocational education, especially in regular secondary schools. Kert (2020) posits that a teacher's deep understanding of the subject matter can prevent misconceptions among students. Putra et al. (2021) emphasize that teachers' mastery of subject content can enhance creativity and pedagogical diversity, thereby attracting students' interest and active participation in the teaching and learning process. Therefore, developing teachers' professionalism, especially in improving pedagogical knowledge and content, becomes a priority to ensure effective teaching and learning (L. Liu et al., 2022).

One of the principal challenges in vocational education is the necessity for teachers to possess comprehensive mastery of the subject matter they teach. This capability is crucial to ensure that concepts and understandings are effectively communicated to students (Kert, 2020). However, it has been recognized that many teachers have yet to master the relevant curriculum, partly due to the absence of a specific curriculum for TVET teachers and a gap in the academic qualifications required for these educators (Nkwadipo & Rabaza, 2021; Von Christopher, 2020). This situation also influences the development of their pedagogical skills, subsequently leading to constraints in adapting suitable teaching approaches.

In the field of vocational education, the diversity in teachers' pedagogical approaches can stimulate students' interest and motivation. These approaches enable teachers to tailor their teaching methods to the individual needs and learning styles of each student (Haron et al., 2021), thereby contributing to more effective learning in preparing students for the challenges of the labour market (Abdullahi & Othman, 2021). However, a lack of teachers' comprehensive mastery of pedagogical knowledge has been observed by (Nopriyeni et al., 2019), which may be due to a lack of professional development training or limited resources. It is crucial to create an environment that supports the sharing of knowledge and practices among teachers. Through collaboration and the exchange of experiences, teachers can learn from each other and implement more effective teaching techniques in their classrooms (Thi & Huyen, 2022). This ensures that vocational education not only meets the current needs of the industry but is also prepared to meet future challenges.

1.1 Literature Review

Researchers define teacher competencies differently due to differences in perspectives. Abd. Madjid et al. (2020) defined competence as a combination of knowledge, skills, and abilities, emphasizing the importance of these aspects in the context of teacher competence. Meanwhile, Dayangku Suraya Awang Jafar et al. (2020) provided a more general definition, applying elements of a professional teacher's ability to realize oneself in a particular task, adapt to changes in the profession, as well as manage professional mobility and self-regulation. Osman M.Z et al. (2019) added that competence is a combination of knowledge, skills, and experience that helps individuals to perform tasks perfectly.

Taken together, these definitions suggest that teacher competence involves various aspects including knowledge, skills, and dispositions. Abd. Madjid et al. (2020) and Dayangku Suraya Awang Jafar et al. (2020) emphasized more on the aspects of skills, proficiency and ability, whereas Osman M.Z et al. (2019) focused on knowledge as an important component. This affirmation illustrates that the quintessence of teacher competence

encompasses not only a deep understanding of content and pedagogy, but also the skillful integration of these two central components to facilitate effective teaching and learning. This comprehensive paradigm of teacher competence thus brings together a wide range of knowledge, skills, and dispositions, underscoring a multifaceted and holistic approach to educational excellence.

1.1.1 Technological Pedagogical Content Knowledge (TPACK) Model

The Technological Pedagogical Content Knowledge (TPACK) model is an important framework in contemporary education, which integrates technology, pedagogy, and content knowledge. This model has been developed by Mishra & Koehler (2006), represents an expansion of the Pedagogical Content Knowledge (PCK) by Shulman (1986) by adding a technology dimension to the components. The illustration in Figure 1 provides an overview of the knowledge components that are combined to form the TPACK framework.

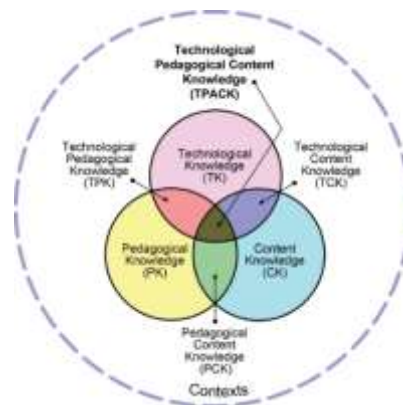


Fig.1 TPACK model by Mishra & Koehler (2006)

Based on Figure 1, Mishra & Koehler (2006) stated that the TPACK framework contains seven components, of which the three main components are: i) Content Knowledge (CK), which involves understanding the subject matter to be taught; ii) Pedagogical Knowledge (PK), which emphasizes understanding the teaching and learning process; and iii) Technological Knowledge (TK), which refers to the ability to use technological tools productively. The interaction between the three main components has resulted in four subcomponents, namely: i) Technological Pedagogical Knowledge (TPK), which assesses how specific technologies can transform teaching and learning; ii) Pedagogical Content Knowledge (PCK), which is a combination of CK and PK for teaching specific subjects; iii) Technological Content Knowledge (TCK), which explores how technology and content influence each other; and iv) TPACK itself, which represents a comprehensive understanding of how to teach with technology, integrate technology into learning, and understand concepts using technology.

The TPACK framework is used to examine the integration of technology into educational practices, a necessity given the rapid technological advancements in the field of education. The TPACK model provides a comprehensive understanding of the blending of content, pedagogy, and technology. This approach is instrumental in identifying how these elements of the TPACK model converge in daily classroom activities, significantly shaping students' digital literacy and equipping them to meet the evolving demands of today's job market (Hsu & Chen, 2019; Kara, 2021). However, this study specifically narrows its focus to delve into three critical constructs of the TPACK framework: Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK). This focused examination provides a nuanced understanding of how these key elements impact instructional effectiveness, particularly in the context of digital education. By focusing on CK, PK, and PCK, the research illuminates the fundamental aspects of teaching that are essential to preparing students with the skills and knowledge needed for a technologically

advanced job market. This particular focus is consistent with the broader educational discourse that emphasizes the importance of deep integration of content and pedagogy in a digitally enhanced learning environment.

1.2 Issues and Gaps in Study

The integration of pedagogical knowledge and strategies in vocational education is critical for effective teaching and student success. This literature review examines three key studies that explore various aspects of pedagogical knowledge and challenges in the context of vocational and technical education.

The study of Nopriyeni et al. (2019) focused on the gap in pedagogical knowledge among prospective teachers, particularly in biology. Despite prior microteaching experiences, these teachers exhibited a lack of comprehensive pedagogical understanding. Utilizing a quasi-experimental design with 60 biology students, the study demonstrates the significant impact of a mentoring model in enhancing pedagogical knowledge, surpassing conventional models. This study underscores the importance of mentoring in developing effective teaching strategies and classroom management skills, emphasizing the need for comprehensive pedagogical training.

Following this, the study from Von Christopher (2020) delved into the Mathematical Knowledge for Teaching (MKT) model. The study revealed a mixed impact of MKT on teaching quality and student achievement, indicating that while a strong MKT correlates with better instructional practices, it doesn't uniformly translate to student gains. The research called for a deeper understanding of MKT, its influence on classroom practice, and its adaptation in various cultural contexts. Chua's work contributes significantly to the discussion on teacher knowledge, particularly in mathematics education.

Next, the study from Nkwadipo & Rabaza (2021) grounded in Shulman's categories of teacher knowledge, used observations and interviews in a qualitative case study with two economics teachers and their students. The research uncovered pedagogical challenges related to content knowledge, curriculum knowledge, and interaction with students, highlighting the lack of specialized training programs for TVET economics teachers. The study suggests the need for tailored educational programs to mitigate these challenges.

These studies collectively emphasize the importance of robust pedagogical knowledge and tailored teacher training in vocational education settings. Whether it's the implementation of mentoring models, the refinement of MKT, or addressing specific challenges in economics teaching, each study contributes to a broader understanding of the complexities and necessities in vocational education pedagogy. Building on the existing literature, the current study aims to address several identified gaps in the context of vocational education in secondary schools. Despite the findings of previous research, there is still a lack of studies that specifically focus on teachers who teach vocational subjects in secondary schools, especially in the geographical context of Terengganu. Furthermore, while the TPACK model has been extensively researched in various educational settings, its application, and implications in the area of vocational subjects in this particular region have not been thoroughly investigated. This study seeks to fill these gaps by applying the TPACK model to understand the integration of pedagogy, and content knowledge among vocational teachers in Terengganu. Consequently, this study contributes to a more comprehensive understanding of effective teaching practices in vocational education in this unique setting.

Research Objective

The objective of the study is to identify the competency level of Vocational Subject Teachers based on Content Knowledge (CK), Pedagogical Knowledge (PK) and Pedagogical Content Knowledge (PCK).

Method

This study adopted a quantitative approach, encompassing five phases based on Figure 2.

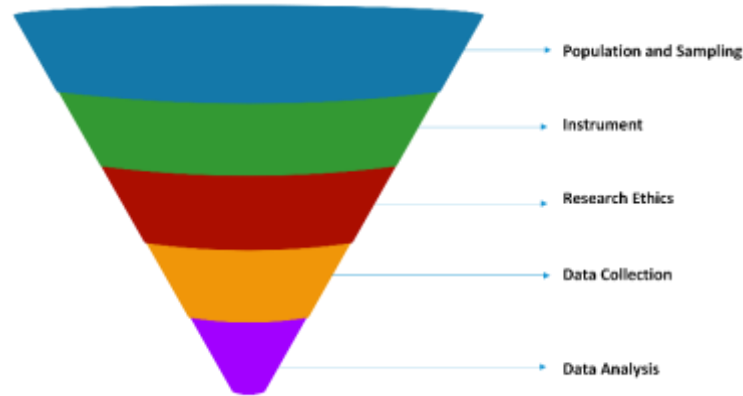


Fig.2 Phases in the research design

Based on Figure 2, the five phases namely: (i) Population and sampling; (ii) Instrument; (iii) Research Ethics; (iv) Data Collection; and (iv) Data Analysis. The next section provides a detailed description for each phase.

1.3 Population and Sampling

The population of this study was a total of 66 teachers who teach vocational subjects in 55 daily secondary schools in Terengganu. The limited number of teachers assigned to vocational subjects in schools is due to specific logistical and resource constraints. Typically, each school designates only one elective subject for one or two classes, resulting in the allocation of only one or two teachers per school for these subjects. This constraint is influenced by several factors, including the need for teachers with specialized skills in vocational areas and the need for workshops and tools, which incur significant costs. These factors contribute to the limited allocation of teachers to vocational subjects within schools. The total sample that will be used was a total of 56 people using the Krejcie & Morgan (1970) determination method. The sampling method used was simple random sampling to ensure that the selected teachers were representative of all districts in Terengganu. However, according to (Ghazali & Sufean, 2021; Lay & Khoo, 2016) emphasized that the best research was to include the population as the study sample or to take a sample that approximates the population. Therefore, the researcher took a total of 66 teachers as a sample in this study. Table 1 shows the number of teachers in each school that have been offered this elective subject, where they were categorized by district in Terengganu.

Table 1
Number of Teachers Following District

District	Number of Teachers
Besut	6
Dungun	11
Hulu Terengganu	6
Kemaman	11
Kuala Nerus	9
Kuala Terengganu	12

Marang	7
Setiu	4
Total	66

Source: Data obtained from the Terengganu State Education Department, which was generated on 20 September 2023.

Based on Table 1, the number of vocational stream teachers by district is as follows: (i) Besut had six teachers; (ii) Dungun had 11 teachers; (iii) Hulu Terengganu had six teachers; (iv) Kemaman had 11 teachers; (v) Kuala Nerus had nine teachers; (vi) Kuala Terengganu had 12 teachers; (vii) Marang had seven teachers; and (viii) Setiu had four teachers. The total number of teachers amounted to 66.

1.4 Instrument

The instrument used was adapted and customized according to the context of the study. This instrument is divided into two parts: Part A and Part B. Table 2 shows the use of the research question instrument according to part, construct, scale, item number, and source.

Table 2
Questionnaire Instrument

Part	Construct	Scale	Item Numbers	Source
Part A	Demographics	Nominal	3	
Part B-S1	Pedagogical Knowledge (PK)	Likert Scale	8	(Chen & Jang, 2014; Schmidt et al., 2009)
Part B-S2	Content Knowledge (CK)	Likert Scale	3	(Chen & Jang, 2014; Schmidt et al., 2009)
Part B-S3	Pedagogical Content Knowledge (PCK)	Likert Scale	5	(Chen & Jang, 2014; Schmidt et al., 2009)
Total			19	

Based on Table 2, Part A addresses the demographics of the respondents, which consists of three items using a nominal scale. Meanwhile, Part B consists of seven sections categorized according to different constructs. All constructs are measured using a five (5)-point Likert scale, with 5 representing Strongly Agree (SA), 4 Agree (A), 3 Uncertain (U), 2 Disagree (D), and 1 Strongly Disagree (SD).

Section B-S1 measures the Pedagogical Knowledge (PK) construct, which consists of eight items. Section B-S2 assesses Content Knowledge (CK), which consists of eight items, while section B-S3 assesses Pedagogical Content Knowledge (PCK), which consists of five items. These constructs utilize the research of (Chen & Jang, 2014; Schmidt et al., 2009).

The instrument utilized in this research was meticulously customized to align with the study's objectives and was subjected to a back-translation procedure to verify its accuracy. As outlined by H.-J. Liu (2002), the process of translating for cultural contexts requires the involvement of two translators, with conclusions drawn from both of their translations. Following this approach, two translators were used for the initial translation of the instrument from English to Malay. These individuals were experienced English language teachers with over five years of experience. To maintain the integrity of the original meaning of the tool, a subsequent retranslation into English was done. A third translator with similar qualifications to the first two, was employed for this task.

To ensure efficient data collection and subsequent analysis, each construct was coded. As emphasized by Fuad (2017), this method of data coding facilitates a more organized recording of information into a computer system for the purpose of analysis. In addition, the researcher assigned unique codes to each construct to enhance the precision and clarity of the data analysis process. Table 3 shows the codes for each construct tested in this study.

Table 3
Construct Coding

Construct	Code
Pedagogical Knowledge	PK
Content Knowledge	CK
Pedagogical Content Knowledge	PCK

Based on Table 3, the Pedagogical Knowledge construct is coded as PK. Next, Content Knowledge is represented by the code CK while Pedagogical Content Knowledge is recognized through the PCK code.

1.4.1 Validity and Reliability

The survey instrument underwent a thorough analysis to verify its validity and reliability. To rigorously assess the validity of the instrument, the research team conducted both face validity and content validity assessments. These assessments were meticulously conducted in collaboration with a panel of experienced evaluators comprising teachers, lecturers, officials from the District Education Office (PPD) and Terengganu State Education Department (JPNT), and professional evaluators. This method was used to ensure that the instrument accurately and effectively represented the specific aspects it was designed to measure, thus ensuring its relevance and accuracy.

In terms of reliability, the researchers used Cronbach's alpha coefficient. Table 4 shows the values of Cronbach's alpha coefficients for each construct, where these values were analyzed using SPSS software version 29.

Table 4
Cronbach's Alpha Mean Value for Each Construct

Construct	Item Numbers	Cronbach's Alpha Value
PK	8	0.917
CK	3	0.825
PCK	5	0.898

Based on Table 4, the Cronbach's alpha values for the seven constructs are in the range of 0.825 to 0.917. These values indicate a very high and acceptable level of reliability (Ghazali & Sufean, 2021; Pallant, 2020; Rahmat et al., 2019). This high reliability indicates that the survey instrument is consistent in measuring the specified constructs.

1.5 Research Ethics

Ethical considerations are paramount in maintaining integrity and protecting the rights of participants in research, as emphasized by Cohen et al. (2007). In this study, the researchers obtained permission to use and modify the survey instrument from its original creators, following the guidelines outlined by Chua (2021). They ensured adherence to ethical principles in research design, particularly regarding the validity and reliability of the instrument, as emphasized by Cohen et al. (2007). The study was approved by Educational Research Application System 2.0 (eRAS) and Terengganu State Education Department (JPNT). Throughout the data collection phase, the researchers informed participating schools and emphasized the voluntary nature of teacher participation, in accordance with the ethical standards outlined by Lay & Khoo (2016). Integrity in data analysis and reporting of results was carefully maintained, consistent with the ethical standards recommended by Creswell & Creswell (2018), which emphasized the importance of

honesty and integrity. Ultimately, strict adherence to these ethical research design principles significantly enhanced the overall credibility and trustworthiness of the study.

1.6 Data Collection

To facilitate an organized and seamless data collection procedure, the researchers meticulously adhered to several essential preparatory steps prior to the distribution of the questionnaire. To ensure the smooth execution of the data collection process, several key considerations were emphasized prior to the distribution of the questionnaire for data collection as shown in Figure 3, guided by the framework approached by Mills & Gay (2016).



Fig. 3 Process of questionnaire administration, adapted and visualized from Mills and Gay (2016)

Based on Figure 3, the process of distribution questionnaire were conducted as followed: (1) Selection of respondents: The sample consisted of teachers teaching vocational subjects in daily secondary schools in Terengganu; (2) Questionnaire distribution: The questionnaire, implemented through Google Forms, was distributed online over a period of two weeks; (3) Follow-up activities: The cooperation of the supervisors of the vocational teachers was sought to ensure the wide distribution of the questionnaire link among the respondents; (4) Management of non-response: Individual distribution of the questionnaire link through WhatsApp was used to manage non-response; and (5) Questionnaire collection and analysis: This involved data collection and analysis using SPSS software version 29 and Microsoft Excel.

1.7 Data Analysis

To fulfill the objectives of this study, the researchers adopted an approach that used mean values in each construct assessed. This approach involved classifying and interpreting the data into three main categories: low, moderate, and high. Data interpretation included the classification of the data into these three categories. Table 5 shows the data interpretation and mean value classification used in this study, based on previous research by (Mahamod & Nor, 2012; Mohd. Kosnin & Tan, 2012).

Table 5
Data Interpretation According to Mean Value

Mean Value	Interpretation
1.00–2.33	Low
2.34–3.67	Moderate
3.68–5.00	High

Based on Table 5, mean scores that fall between 1.00–2.33 are categorized as low, whereas mean scores of 2.34–3.67 are classified as moderate, and the high category includes mean

scores in the range of 3.68–5.00. This approach had allowed for a more detailed and structured analysis in assessing the data collected in this study.

Findings and Discussions

In order to fulfill the objective of this study, a descriptive analysis was carried out using the mean scores based on a five-point Likert scale. Table 6 shows the mean scores for the seven constructs, namely, PK, CK and PCK. The next section provides a detailed description of the results for each construct and discussion.

Table 6
Mean Score for Each Construct

Construct	Mean Score	Standard Deviation	Data Interpretation
PK	4.02	0.61	High
CK	4.10	0.61	High
PCK	4.05	0.51	High
Overall	4.06	0.58	High

1.8 Pedagogical Knowledge Stage (PK)

PK refers to teachers' understanding of effective teaching methods and strategies for different levels of students. There are eight items used to measure teachers' PK. The results showed that the teachers in this study had a high level of Pedagogical Knowledge (PK). This is evidenced by a mean score of 4.02 and a standard deviation of 0.61. This finding is in line with the results of previous studies by (Li et al., 2022; Thohir et al., 2021), where these studies recorded a high level of PK among teachers. This shows a consistent trend in achieving a high level of pedagogical knowledge among education professionals where the understanding and application of pedagogical principles among educators.

This finding indicates that the teachers in this study have effective skills in assessing student mastery by adapting various teaching approaches. The findings of this study underscore the teachers' deep understanding in critical pedagogical aspects, particularly in identifying and addressing misconceptions experienced by students. In this regard, it also reflects their mastery of practical and theoretical pedagogical principles.

In an important context, the results provide clear evidence of the effective pedagogical skills of vocational teachers not only in practical aspects but also in theory. Although their teaching orientation is more towards the practical application of skills, the results show that they are also able to integrate theoretical concepts into their practical teaching. This implies that vocational teachers' efforts to balance these two aspects simultaneously demonstrate a comprehensive understanding of pedagogy and contribute to the success of vocational education. Therefore, the importance of continuing education for teachers, especially in enhancing their pedagogical knowledge, needs to be emphasized in order to equip teachers to meet the growing challenges of education in both academic and vocational contexts (Nyaruwata, 2022).

1.9 Content Knowledge Stage (CK)

CK refers to the teacher's understanding of the content of the subject or topic being taught. There are three items used to measure teachers' CK. The findings of this study indicate that the teachers in this study have a high level of CK. Unexpectedly, the data revealed that the Content Knowledge (CK) construct was prominently dominant in comparison to other competency constructs. This is evidenced by the mean score of 4.10 with a standard deviation of 0.61. This finding is in line with the previous studies conducted by by (Akun

& Mohamad, 2021; Chieng & Tan, 2021), where they also found that this construct is the most dominant and is at a high level.

Different studies were conducted by (Juwait & Siew, 2022; Surahman et al., 2020) also support the finding that this construct also has a high level among their respondents. This proves teachers' good mastery of the content in the subjects they teach. In this study too, it is a necessity for teachers to master vocational subjects to provide highly skilled students in their elective fields, which in turn will open wider employment opportunities.

Through the TPACK approach introduced by (Mishra & Koehler, 2006), the role of CK can encourage teachers to apply various teaching methods and strategies. With a solid grasp of the Content Knowledge (CK) principles demonstrated in this study, vocational teachers can design and apply innovative teaching techniques in line with the skill areas they teach. This approach leads to a responsive and dynamic learning environment that meets the needs of educational development. Overall, vocational teachers can create comprehensive and practical skills-oriented learning experiences to meet the demands of the work industry.

1.10 Pedagogical Content Knowledge Stage (PCK)

PCK refers to the teacher's ability to integrate subject content with appropriate teaching methods to be delivered to students. There are five items used to measure teachers' PCK. The study results showed that the level of Pedagogical Content Knowledge (PCK) among vocational teachers reached a high level, with a mean score of 4.05 and a standard deviation of 0.51. The findings are in line with the findings in previous studies by (Bingimlas, 2018; Thohir et al., 2021), where their studies also reported high levels of PCK among teachers of various educational levels and disciplines. This finding also confirms the ability of vocational teachers to understand and deliver course content effectively and manage classroom interactions well.

In addition, this finding shows that respondents have a thorough knowledge of learning approaches through which they can guide students' thinking and improve their mastery in the subjects they teach. In addition, respondents also could apply various teaching methods to facilitate students' understanding of the subject while reflecting flexibility and creativity in the teaching and learning process. This finding also shows teachers' awareness of the importance of conducive learning in creating an effective classroom atmosphere that contributes to active and productive learning among students.

Emphasizing the construct of PCK is an important aspect in the development of teacher professionalism and teaching effectiveness. PCK plays a major role in education, spanning a variety of disciplines and contexts (Kulgemeyer & Riese, 2018; Tian & Huang, 2019). Despite the rapid development of educational technology, the effectiveness of teachers' PCK plays an important role in providing quality instruction in a diverse classroom environment (Opiyo, 2022) and promoting inclusive education (Tandon, 2021). Therefore, there is a need to continuously emphasize the development of PCK in teacher education programs and their professional development. Thus, the integration of PCK with new teaching methodologies can contribute to improving the quality of education in the future.

Recommendations

Based on these findings, the researchers proposed a series of interventions aimed at enhancing teachers' competencies. These include organizing workshops and in-service training programs specifically designed to increase teachers' knowledge of innovative content and contemporary pedagogical practices. In addition, the implementation of a mentoring system is recommended, whereby experienced teachers can guide and support their less experienced colleagues. This mentoring approach could contribute significantly

to the professional development of teachers, particularly in improving their pedagogical skills and content mastery. The study also advocates the promotion of knowledge sharing among teachers, encouraging the exchange of scholarly materials and best practices. Such collaborative efforts are essential to fostering a culture of continuous learning and improvement within the educational community.

Conclusion

The aggregate mean score across all domains of 4.06 indicates that the teachers' overall competence is at a high level. In particular, the Content Knowledge (CK) domain stands out with the highest mean score, underscoring the teachers' strong mastery of their subject matter. This reflects their deep understanding and mastery of the content they teach. At the same time, both pedagogical knowledge (PK) and pedagogical content knowledge (PCK) show high levels of competence. This finding underscores vocational teachers' proficiency in these areas and suggests that they have a solid foundation in both the theoretical and practical aspects of their teaching disciplines. The high scores in PK and PCK indicate that teachers are adept at using effective teaching methods and strategies and integrating them with subject content knowledge.

However, despite the high levels of competency observed, it is important to note that PK, while still high, is relatively low compared to CK. This suggests a potential area for intervention and further improvement. Strengthening PK would support teachers in refining their pedagogical approaches, thereby contributing to even more effective teaching practices. In conclusion, while teachers show considerable strengths in all areas, a focused effort to strengthen aspects of PK could further enhance the overall quality of teaching in vocational education.

Therefore, the application of the TPACK model is deemed imperative for the improvement of teacher competencies particularly in improving their pedagogical and content knowledge. In an era of rapid technological advancement and diverse classroom environments, the role of teachers in fostering inclusive and dynamic learning experiences remains critical. Therefore, continued emphasis on the development of PCK in teacher education programs and professional development is essential to improving the quality of education in the future.

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