

Analysis of Predictor Factors of Teacher Competency in Vocational Colleges: A Multinomial Logistic Regression Approach

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Abstract

Teacher competency is a key pillar in ensuring the effectiveness of the Technical and Vocational Education and Training (TVET) system. This study aims to identify the factors that predict teacher competency in Vocational Colleges based on the dimensions of teaching knowledge, learning methods, and learning assessment. This study employed a quantitative cross-sectional explanatory study design involving 447 final-year Malaysian Vocational Diploma (DVM) students from Vocational Colleges in the central and southern zones of Peninsular Malaysia. Data were analysed using Multinomial Logistic Regression (MLR) analysis via SPSS software. The findings showed that all three predictor variables had a significant influence on teacher competency ($p < .05$). Learning assessment was identified as the most dominant predictor factor, followed by learning methods, and teaching knowledge. The findings confirm that mastery of competency in learning assessment and the

implementation of industry-oriented pedagogy are important factors influencing the level of TVET teacher competency. Accordingly, this study recommends that continuous professional development programmes place emphasis on strengthening authentic assessment skills and implementing learning methods aligned with industry needs in order to comprehensively enhance teacher competency.

Keywords: TVET, Teacher Competency, Learning Assessment, Learning Methods, Multinomial Logistic Regression

1. Introduction

Technical and Vocational Education and Training (TVET) in Malaysia is undergoing a significant transformation phase to produce highly skilled, competitive human capital that meets current industry needs in line with the nation's development aspirations (Mulder, 2017; Ministry of Education Malaysia, 2023). This transformation requires Technical and Vocational Education and Training (TVET) institutions, particularly Vocational Colleges (VCs), to provide a learning environment capable of producing graduates who possess not only solid technical skills but also soft skills, the ability to adapt to technological change and industry needs, as well as professional competencies that meet labour market demands (UNESCO-UNEVOC, 2025; Zaid & Kamin, 2026). In striving to achieve this goal, teaching staff play a very important role as they are the key catalyst in determining the effectiveness of the teaching and learning (T&L) process and the quality of graduates produced (OECD, 2021; UNESCO-UNEVOC, 2025).

Teacher competency is the main element determining the success of TVET education implementation. TVET teachers not only need to master technical skills in their respective areas of expertise, but also need to possess teaching knowledge, delivery skills, the ability to handle diverse learning methods, and the ability to implement effective assessment (Shulman, 1987; Diao & Hu, 2022). Mastery of these elements enables teachers to plan and implement teaching that is more systematic, interactive, and student-centred, thereby enhancing the level of mastery of knowledge, skills, and employability of TVET graduates.

However, the TVET system in Malaysia still faces the challenge of misalignment between the training provided by educational institutions and current industry demands. The issue of mismatch between graduate competency and actual industry needs continues to be a concern as it affects graduate employability and the overall effectiveness of the TVET system (Ibrahim & Mat Nashir, 2022). This situation shows that improving teacher competency needs to be given serious attention, as teachers are the main agents responsible for ensuring that learning content, teaching methods, and assessment remain relevant to technological developments and current industry needs.

Accordingly, efforts to identify the factors influencing teacher competency are becoming increasingly important in ensuring the sustainability of TVET education quality. Teaching knowledge, learning methods, and learning assessment are among the main components with the potential to enhance teacher competency and subsequently contribute to producing quality graduates who meet industry demands. Therefore, a study analysing the predictor factors of

teacher competency in Vocational Colleges using a Multinomial Logistic Regression (MLR) approach is important for generating empirical evidence that supports the formulation of policies and strategies for teacher professional development. The findings of this study are expected to help stakeholders strengthen teacher competency and enhance the effectiveness of TVET implementation in Malaysia.

2. Literature Review

This study focuses on three main elements identified as influencing teacher competency: teaching knowledge, learning methods, and learning assessment. These three constructs are elaborated in greater depth based on the following recent literature review.

2.1 TVET Teacher Competency

Teacher competency is a core element that determines the effectiveness of Technical and Vocational Education and Training (TVET) implementation, as it reflects teachers' ability to carry out the teaching and learning (T&L) process effectively in order to produce graduates who meet industry needs. Based on the competency theory introduced by Spencer and Spencer (1993), competency refers to a combination of knowledge, skills, abilities, values, and personal traits that influence a person's performance in carrying out tasks excellently. In the TVET context, teacher competency involves not only mastery of technical and pedagogical aspects, but also encompasses the ability to plan learning, facilitate the learning process, implement assessment, integrate technology, and adapt teaching practices to industry developments and job requirements. Hence, comprehensive competency mastery enables teachers to produce authentic learning experiences, enhance T&L effectiveness, and support the development of student competency.

Along with educational transformation, the Fourth Industrial Revolution, and digital technology development, the scope of teacher competency has increasingly expanded from mastery of traditional pedagogy to the ability to integrate technology, understand industry needs, apply student-centred learning, and master 21st century skills. In this context, the Technological Pedagogical Content Knowledge (TPACK) framework introduced by Mishra and Koehler (2006) explains that teaching effectiveness depends on teachers' ability to integrate content, pedagogical, and technological knowledge in a balanced manner. Mastery of TPACK enables teachers to design more interactive, flexible, and authentic learning experiences, thereby enhancing student engagement, the effectiveness of competency-based learning, and digital literacy development (Salleh, Abdul Kadir, Jamaluddin, & Mohd Puad, 2022).

Beyond pedagogical and technological aspects, teacher competency also encompasses professionalism, including professional attitude, communication skills, instructional leadership, mentoring ability, lifelong learning, and the ability to transfer knowledge and skills to students effectively. In the ever-changing TVET environment, teachers also need to possess industry competency in order to be able to connect classroom learning with actual workplace practice and guide students in mastering the skills required by employers (Diao, Han, Zhou, & Wang, 2024). In line with this, Ismail (2023) asserts that technical, pedagogical,

personal, and social competencies are the main dimensions that need to be strengthened in teachers' professional development to ensure they remain relevant to technological change, industry demands, and TVET transformation.

Overall, teacher competency is a prerequisite for the excellence of the TVET system as it forms the basis for the effectiveness of the T&L process, the development of student competency, and the enhancement of graduate employability. Teachers with high competency are better able to integrate knowledge, pedagogy, technology, and industry experience into their teaching practice, thereby enhancing the quality of TVET education and supporting the nation's human capital development agenda. Therefore, efforts to identify the factors influencing teacher competency are important in providing empirical evidence that can support the continuous professional development of teachers and strengthen the TVET system in Malaysia.

2.2 Teaching Knowledge

Teaching knowledge is one of the main factors influencing teacher competency, as it forms the basis for the effectiveness of the teaching and learning (T&L) process, the development of student competency, and the achievement of learning outcomes. Based on the Pedagogical Content Knowledge (PCK) theory introduced by Shulman (1987), effective teaching does not merely depend on the separate mastery of content or pedagogy, but requires teachers' ability to integrate content knowledge (CK), pedagogical knowledge (PK), and knowledge of how to deliver content according to students' needs. Therefore, teaching knowledge encompasses mastery of content, pedagogical strategies, understanding of students' characteristics and needs, and the ability to adapt teaching approaches according to the learning context. Teachers with solid teaching knowledge are better able to plan meaningful learning experiences, select appropriate teaching strategies, explain concepts systematically, encourage active learning, and facilitate the learning process effectively. This ability directly strengthens teachers' professional competency and enhances student achievement and competency mastery (Berry, Friedrichsen, & Loughran, 2015).

Along with the development of digital technology and educational transformation, the concept of PCK has been expanded to Technological Pedagogical Content Knowledge (TPACK), which emphasises the integration of content, pedagogical, and technological knowledge in teaching practice (Mishra & Koehler, 2006). The TPACK framework explains that competent teachers not only master content and pedagogy, but are also able to leverage technology strategically to enhance learning effectiveness. In this context, mastery of TPACK enables teachers to design more interactive, flexible, and student-centred learning experiences, while also enhancing student engagement, the effectiveness of competency-based learning, and digital literacy development. In addition, mastery of pedagogical and technological knowledge enables teachers to adapt their teaching practices to 21st century learning needs, including integrating Artificial Intelligence (AI) ethically and effectively in the T&L process (OECD, 2023; UNESCO, 2023, 2024).

In the context of Technical and Vocational Education and Training (TVET), teaching knowledge encompasses three main components, namely content knowledge, pedagogical

knowledge, and pedagogical content knowledge. Content knowledge refers to in-depth mastery of the field of expertise being taught, including theoretical concepts, operating procedures, safety standards, equipment use, the latest technology, and industry practices. Pedagogical knowledge refers to teachers' ability to select and apply teaching strategies, manage learning, facilitate learning activities, and implement assessment effectively. Meanwhile, pedagogical content knowledge enables teachers to connect technical content with appropriate pedagogical approaches so that complex concepts can be understood and applied by students in real work situations. Mastery of these three components enables teachers to deliver knowledge systematically, connect theory with practice, guide students in solving authentic problems, and adapt teaching to technological developments and industry needs. Conversely, a lack of teaching knowledge can undermine the effectiveness of teaching delivery, student competency mastery, and the achievement of learning outcomes (Diao & Hu, 2022).

Along with TVET transformation and the demands of the Fourth Industrial Revolution, comprehensive mastery of teaching knowledge is becoming increasingly important in strengthening teacher competency. Studies show that teachers with high teaching knowledge are better able to integrate content, pedagogy, and technology, adapt teaching strategies according to industry developments, and produce authentic and meaningful learning experiences for students. Therefore, teaching knowledge is not only the basis for the effectiveness of the T&L process, but is also an important factor that continuously supports the development of TVET teacher competency and subsequently enhances the quality of graduates who meet industry needs.

2.3 Learning Methods

In addition to teaching knowledge, learning methods have also been identified as an important factor influencing teacher competency, as their implementation requires teachers to master pedagogical knowledge, professional skills, and the ability to connect theory with industry practice. Based on Constructivism Theory (Vygotsky, 1978) and Experiential Learning Theory (Kolb, 1984), effective learning occurs when students construct knowledge through experience, social interaction, and problem-solving in real situations. Hence, teachers no longer act merely as transmitters of knowledge, but instead act as facilitators, mentors, and guides who plan authentic learning experiences to enable students to construct knowledge and master the required competencies. In the context of Technical and Vocational Education and Training (TVET), the implementation of student-centred and industry-oriented learning methods indirectly also enhances teacher competency, as it requires them to master pedagogical, technological, communication, assessment, and learning management skills in an integrated manner.

Among the approaches practiced in TVET at VCs are Project-Based Learning (PjBL), Competency-Based Learning (CBL), and School Enterprise (SE). The implementation of PjBL enhances teacher competency through managing authentic projects that integrate theoretical knowledge, technical skills, and problem-solving in real contexts. This approach strengthens teachers' pedagogical competency by improving their skills in designing learning

activities, facilitating collaboration, guiding self-directed learning, and integrating digital technology in the teaching and learning process (Martini, Sariani, Marzuki, & Apriyanti, 2024). Meanwhile, CBL strengthens teacher competency in designing curricula, planning learning experiences, and implementing assessment based on competency standards. This approach also enhances teachers' ability to adapt teaching strategies according to each student's level of mastery, needs, and learning pace to ensure the set learning outcomes are achieved (Zhong & Juwaheer, 2024). In the context of School Enterprise (SE), teachers have the opportunity to conduct teaching in an environment that simulates real industry and entrepreneurial operations. This experience strengthens teachers' professional competency by improving their understanding of current industry practices, operations management, work culture, and collaborative networks with industry, thereby strengthening their role as facilitators, mentors, and links between educational institutions and industry (Zeng, Chieng, & Liu, 2024).

Along with TVET transformation, the Fourth Industrial Revolution, and digital technology development, mastery of innovative and industry-oriented learning methods is becoming increasingly important in strengthening teacher competency. Studies show that teachers who master various innovative learning approaches are better able to enhance pedagogical competency, digital competency, reflective skills, creativity, and the ability to adapt teaching practices to technological change and industry needs (Mohd Rokeman et al., 2024; Awang Jafar et al., 2025). These findings show that the selection and implementation of appropriate learning methods not only enhances the effectiveness of the teaching and learning process, but also serves as an important mechanism in the continuous development of TVET teacher competency. Therefore, mastery of effective learning methods needs to be given attention in efforts to strengthen teacher professionalism and enhance the quality of TVET implementation in Malaysia.

2.4 Learning Assessment

Learning assessment is one of the important factors influencing teacher competency, as it enables teachers to evaluate student achievement, identify learning gaps, and continuously improve teaching practice. Based on the Assessment for Learning (AfL) theory, assessment is not merely intended to measure student achievement, but functions as a process that supports learning through the provision of continuous, constructive, and meaningful feedback (Black & Wiliam, 1998; Wiliam, 2011). Through this approach, teachers use assessment information to identify students' level of mastery, plan appropriate interventions, and adapt teaching strategies to enhance the achievement of learning outcomes. Therefore, mastery of assessment knowledge and skills is an important element that strengthens teachers' professional competency.

Along with educational transformation and digital technology development, assessment practices have also undergone a shift from conventional approaches to authentic assessment, digital assessment, and data-based assessment. The use of digital platforms, learning analytics, and Learning Management Systems (LMS) enables teachers to monitor student progress in real time, provide faster feedback, and make data-informed teaching decisions. Mastery of

technology in assessment not only enhances the effectiveness of the assessment process, but also strengthens teacher competency in aspects of professional judgement, improving teaching strategies, and enhancing student engagement in the learning process (OECD, 2023).

In the context of Technical and Vocational Education and Training (TVET), learning assessment needs to be implemented authentically and based on competency to ensure students not only master theoretical knowledge but are also able to apply technical skills and demonstrate performance that meets industry standards. Hence, teachers need to master competencies in designing assessment instruments, developing assessment rubrics, implementing performance assessment, interpreting learning evidence, and providing constructive feedback to students. Mastery of these assessment competencies enables teachers to holistically evaluate cognitive, psychomotor, and affective aspects, while ensuring validity, reliability, and fairness in the assessment process (Xin, Tang, & Mou, 2024).

Overall, learning assessment is not merely a mechanism for measuring student achievement, but is a catalyst for teacher competency development. Teachers with high assessment competency are better able to use assessment information to improve the teaching process, support student learning, and ensure the achievement of competency aligned with industry needs. Therefore, comprehensive mastery of learning assessment is an important aspect in the professional development of TVET teachers and is one of the factors contributing to the continuous enhancement of teacher competency.

2.5 The Relationship between Teaching Knowledge, Learning Methods, and Learning Assessment on Teacher Competency

Teaching knowledge, learning methods, and learning assessment are three main components that complement each other in shaping teacher competency, particularly in the context of Technical and Vocational Education and Training (TVET). Based on Pedagogical Content Knowledge theory (Shulman, 1987), Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006), and Assessment for Learning (Black & Wiliam, 1998; Wiliam, 2011), these three components function as the foundation for effective teaching implementation. Teachers who master teaching knowledge are better able to integrate content, pedagogy, and technology in the teaching process, while mastery of learning methods enables them to design authentic, student-centred learning experiences aligned with industry needs. At the same time, competency in learning assessment enables teachers to systematically evaluate student achievement, provide constructive feedback, and continuously improve teaching practice.

Previous studies show that all three components have a significant relationship with teacher competency. Mastery of teaching knowledge enhances teachers' ability to plan and implement quality teaching (Berry et al., 2015), while the implementation of industry-oriented learning methods can strengthen teachers' pedagogical, professional, and digital competency (Mohd Rokeman et al., 2024; Awang Jafar et al., 2025). In addition, mastery of learning assessment enables teachers to implement authentic assessment, accurately interpret learning evidence, and use assessment findings to enhance teaching effectiveness (OECD, 2023; Xin et al., 2024). These findings show that teaching knowledge, learning methods, and learning assessment are not only interrelated, but also function as

elements that holistically support the development of teacher competency.

Although various studies have discussed the relationship between these three constructs and teacher competency, most only examine the relationship separately using correlation or linear regression analysis. Studies examining the relative contribution of each construct as a predictor factor for the level of teacher competency, particularly in the context of Vocational Colleges in Malaysia using a Multinomial Logistic Regression (MLR) approach, remain limited. Therefore, this study was conducted to identify the most dominant factors in predicting teacher competency based on the dimensions of teaching knowledge, learning methods, and learning assessment.

3. Methodology

This study employed a quantitative approach with a quantitative cross-sectional explanatory study design to identify the influence of teaching knowledge, learning methods, and learning assessment on teacher competency in Vocational Colleges (VCs). This design was chosen because data were collected at a single point in time without manipulation of study variables, while enabling the researcher to explain the relationship and contribution of predictor variables to the dependent variable through inferential statistical analysis (Creswell & Creswell, 2023; Fraenkel et al., 2019).

The study sample consisted of 447 final-year Malaysian Vocational Diploma (DVM) students representing the population of Vocational College students in five states in Peninsular Malaysia. Sample selection was carried out using probability sampling, namely proportional stratified random sampling, to ensure that each group in the population received balanced representation. This method can enhance the accuracy of study findings and reduce the risk of bias in sample selection (Fraenkel et al., 2019; Creswell & Creswell, 2023).

Study data were analysed using Multinomial Logistic Regression (MLR) analysis via Statistical Package for the Social Sciences (SPSS) software to determine the influence of teaching knowledge, learning methods, and learning assessment on teacher competency. The dependent variable, teacher competency, was operationalised as a three-category ordinal scale: (1) Low Competency, (2) Moderate Competency, and (3) High Competency, based on students' perceptions of their teachers' performance across the three dimensions assessed. MLR analysis was selected because the dependent variable comprised more than two nominal categories, while the predictor variables consisted of continuous scale data. For the purpose of the multinomial logistic regression analysis, the "High Competency" category was designated as the reference category. This classification was theoretically supported by the conceptualization of TVET teacher competency as a multidimensional construct encompassing professional knowledge, occupational ability, pedagogical competence, and other professional competencies (Diao & Hu, 2022; Ismail, 2023), where in the highest competency level serves as the benchmark against which lower categories are compared. This approach allows for meaningful interpretation of the odds of teachers being perceived at lower competency levels relative to the ideal standard. Wald statistics were used to determine the significance of each predictor variable, while the odds ratio value [Exp(B)] was used to interpret the strength of each variable's influence on the probability of membership in a given

teacher competency category (Agresti, 2018; Hosmer et al., 2013; Long & Freese, 2014).

4. Findings

Prior to examining individual predictors, the overall model fit was evaluated. The likelihood-ratio chi-square test was statistically significant, $\chi^2(3) = 114.923$, $p < .001$, indicating that the full model with all three predictors provided a significantly better fit than the intercept-only model. The Nagelkerke $R^2 = .682$ suggested that approximately 68.2% of the variance in teacher competency categories was explained by the model, reflecting a strong explanatory capacity. The overall classification accuracy of 96.6% further confirmed the adequacy of the model in correctly classifying respondents into their respective teacher competency categories. These results collectively support the validity of proceeding with the interpretation of individual predictor coefficients.

To answer the study objective, namely to identify the influence of teaching knowledge, learning methods, and learning assessment on teacher competency, Multinomial Logistic Regression (MLR) analysis was conducted using SPSS software. The analysis results are shown in Table 1. The results show that all three predictor variables have a significant influence on teacher competency ($p < .05$).

Table 1. Multinomial Logistic Regression Analysis Results

<i>Teacher Competency</i>	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>df</i>	<i>Sig.</i>	<i>Exp(B)</i>
Learning Assessment	4.237	.930	22.299	1	.001	80.845
Learning Methods	2.381	.769	9.585	1	.002	10.811
Teaching Knowledge	1.704	.594	8.234	1	.004	.182

The analysis results show that all three predictor variables have a significant influence on teacher competency ($p < .05$). However, the strength of each variable's contribution differs based on the Wald statistic and odds ratio [Exp(B)] values. Learning assessment was identified as the most dominant predictor factor (Wald $\chi^2(1) = 22.299$, $p = .001$, $Exp(B) = 80.845$), followed by learning methods (Wald $\chi^2(1) = 9.585$, $p = .002$, $Exp(B) = 10.811$) and teaching knowledge (Wald $\chi^2(1) = 8.234$, $p = .004$, $Exp(B) = 0.182$). These findings proved that teacher competency in Vocational Colleges was significantly influenced by all three aspects, although the degree of influence differs.

4.1 Learning Assessment

The study results show that learning assessment is the most dominant factor in predicting teacher competency. This finding illustrates that mastery of assessment competency plays a very important role in determining the level of TVET teacher competency. Teachers who are able to plan, implement, and evaluate assessment systematically and use assessment information to improve the teaching process have the potential to enhance learning effectiveness and student achievement.

This finding is consistent with the Assessment for Learning theory introduced by Black and Wiliam (1998) and reinforced by Wiliam (2011), which asserts that assessment is not merely intended to measure student achievement, but is a key mechanism for enhancing learning

through continuous and meaningful feedback. In the TVET context, competency-based assessment emphasises the holistic evaluation of knowledge, skills, and attitude mastery to ensure students achieve the competency standards set by industry.

In addition, this finding also supports the view of OECD (2023), which states that assessment competency is one of the professional competencies that TVET teachers need to master to ensure teaching decisions are made based on valid learning evidence. Mastery of assessment also enables teachers to identify student weaknesses earlier, provide appropriate interventions, and adapt teaching strategies according to current learning needs. Therefore, it is not surprising that learning assessment emerged as the most dominant predictor factor in this study.

This finding has important implications for teacher professional development in Vocational Colleges. Training and professional development programmes need to emphasise the development of quality assessment instruments, the implementation of authentic assessment, the use of competency-based rubrics, and the integration of digital technology in the assessment process to continuously enhance teacher competency.

4.2 Learning Methods

Learning methods were identified as the second most significant predictor factor for teacher competency. This finding shows that the mastery and implementation of appropriate learning methods play an important role in enhancing the professional competency of TVET teachers.

This finding supports Constructivism Theory (Vygotsky, 1978) and Experiential Learning Theory by Kolb (1984), which explain that effective learning occurs when students are actively involved in authentic learning experiences. In the TVET context, the implementation of approaches such as Project-Based Learning (PjBL), Competency-Based Learning (CBL), and School Enterprise not only enhances student learning, but also strengthens teachers' pedagogical competency through the experience of designing learning activities, guiding students in solving real problems, and integrating technology and industry practices in the teaching process.

This finding is also consistent with the studies of Mohd Rokeman et al. (2024) and Awang Jafar et al. (2025), which found that teachers who master various innovative learning approaches have higher pedagogical competency, digital competency, and professional adaptability. This shows that the changing TVET landscape requires teachers to continuously enhance their ability to apply flexible, student-centred learning approaches aligned with technological developments and industry needs. The implication is that TVET institutions need to expand training related to innovative pedagogy and industry-based learning so that teachers are always able to adapt their teaching practices to technological change and labour market demands.

4.3 Teaching Knowledge

The findings of the study indicate that teaching knowledge is significantly associated with teacher competency. Although its contribution was lower than that of learning assessment and

learning methods based on the Wald statistic, teaching knowledge remains an important component in understanding teacher competency in Vocational Colleges. However, the direction of the association warrants careful interpretation. The odds ratio for teaching knowledge [$\text{Exp}(B) = 0.182$, $p = .004$] indicates a significant inverse association, suggesting that higher perceived teaching knowledge was associated with lower odds of being classified in the higher teacher competency categories relative to the High Competency reference category. Thus, although teaching knowledge was statistically significant, its relationship with teacher competency was not in the expected positive direction.

This finding can be interpreted within the theoretical perspective of Pedagogical Content Knowledge (PCK) proposed by Shulman (1987), which emphasises that effective teaching requires more than mastery of subject matter; teachers must also be able to transform their content knowledge into forms that are pedagogically meaningful and accessible to learners. Similarly, Mishra and Koehler (2006), through the Technological Pedagogical Content Knowledge (TPACK) framework, emphasised the integration of content knowledge, pedagogical knowledge, and technological knowledge to support effective teaching, particularly in technology-rich learning environments. From this perspective, high levels of content or teaching knowledge alone may not necessarily translate into higher perceived teacher competency unless such knowledge is effectively integrated into pedagogical practice.

In the TVET context, teaching knowledge is particularly important because teachers are expected to connect theoretical concepts with practical applications, select appropriate instructional strategies, demonstrate technical procedures, and adapt learning content to technological developments and industry requirements. The findings are therefore broadly consistent with the arguments of Berry et al. (2015) and Diao and Hu (2022), who emphasised the importance of teachers' knowledge and pedagogical capacity in designing meaningful learning experiences and supporting student competency development. Nevertheless, the present findings suggest that knowledge must be effectively translated into observable teaching practices if it is to contribute positively to students' perceptions of teacher competency.

The significant contribution of teaching knowledge, despite its inverse direction, also highlights that teacher competency cannot be understood solely in terms of knowledge mastery. Rather, teacher competency in TVET appears to involve the ability to translate knowledge into effective learning methods and meaningful assessment practices. This is particularly relevant in vocational education, where learning is strongly oriented towards practical application, competency development, authentic tasks, and industry-related performance. Consequently, teachers may be evaluated more favourably when their knowledge is demonstrated through effective instructional delivery, practical guidance, learner engagement, and competency-based assessment rather than through the extent of theoretical knowledge communicated alone.

The relative contribution of the three predictors further supports this interpretation. Overall, learning assessment emerged as the most dominant predictor of teacher competency, followed

by learning methods and teaching knowledge, based on the respective Wald statistics. This finding suggests that students may place greater emphasis on the extent to which teachers can effectively implement assessment practices and facilitate learning activities than on teaching knowledge alone. In the context of TVET, assessment is particularly important because it provides direct evidence of whether students have acquired the knowledge, skills, and competencies required for practical and occupational settings. Therefore, effective teacher professional development should adopt a holistic approach that strengthens assessment competency, innovative pedagogical practices, and teaching knowledge concurrently.

Notably, the inverse association between teaching knowledge and teacher competency raises an important issue regarding the interpretation of the regression findings. The odds ratio for teaching knowledge [$\text{Exp}(B) = 0.182$, $p = .004$] indicates that the association remains statistically significant after accounting for the other predictors in the model. To determine whether this unexpected direction could be attributable to multicollinearity among the predictors, collinearity diagnostics were examined. The VIF values for teaching knowledge (2.22), learning methods (2.63), and learning assessment (1.92) were well below the commonly accepted threshold of 10, while the corresponding Tolerance values of 0.45, 0.38, and 0.52 were above the minimum threshold of 0.10 (Field, 2018). These results indicate that multicollinearity was not a substantive concern in the model. Therefore, the inverse association should not be attributed solely to excessive overlap among the predictors.

Several theoretically plausible explanations may account for this finding. First, students were the primary evaluators of teacher competency in this study. Their perceptions may therefore reflect not only the extent of teachers' knowledge but also how that knowledge was communicated and translated into classroom and practical learning experiences. Teachers with strong teaching or content knowledge may, in some circumstances, be perceived as more academically demanding or less accessible if their knowledge is not accompanied by clear explanations, appropriate instructional adaptation, and learner-centred pedagogical practices. This interpretation should, however, be regarded as a plausible explanation rather than a direct causal conclusion because the present study did not specifically measure students' perceptions of teacher accessibility or instructional difficulty.

Second, the finding reinforces the distinction between possessing knowledge and effectively applying knowledge in teaching. Deep content mastery does not automatically guarantee perceived teaching effectiveness if such knowledge is not transformed into pedagogically appropriate instruction and authentic assessment practices that students can observe and experience (Berry et al., 2015; Diao & Hu, 2022). This interpretation is consistent with Shulman's (1987) view that content knowledge becomes educationally meaningful when it is transformed through pedagogical reasoning and adapted to learners' needs.

Third, the finding may reflect the distinctive characteristics of TVET education. In vocational education, students are frequently required to demonstrate practical skills, solve authentic technical problems, and perform competency-based tasks. Consequently, students may place greater emphasis on teachers' ability to demonstrate procedures, facilitate hands-on activities, provide meaningful feedback, and assess practical competencies than on the breadth of

theoretical knowledge conveyed. Thus, the negative coefficient should not be interpreted as indicating that teaching knowledge is unimportant. Rather, it may suggest that teaching knowledge, when considered simultaneously with learning methods and learning assessment, does not necessarily translate directly into higher perceived teacher competency unless it is effectively operationalised through observable pedagogical and assessment practices.

Overall, the findings demonstrate that teaching knowledge, learning methods, and learning assessment are important and complementary dimensions in explaining teacher competency in Vocational Colleges. However, their relative contributions indicate that learning assessment and learning methods may play a more prominent role than teaching knowledge in the present model. The significant inverse association observed for teaching knowledge further suggests that knowledge mastery should not be considered in isolation from its pedagogical application. For TVET teacher professional development, this finding highlights the need for an integrated approach that combines strong teaching knowledge with innovative instructional strategies, authentic learning experiences, competency-based assessment, and effective translation of theoretical knowledge into practical learning. Such integration is essential to ensure that TVET teachers remain responsive to technological developments, industry requirements, and the continuing transformation of vocational education.

4.4 Summary of Findings

Overall, this study proves that teacher competency in Vocational Colleges is significantly influenced by three main factors, namely learning assessment, learning methods, and teaching knowledge. The results of the Multinomial Logistic Regression analysis show that all three variables are significant predictors of the level of teacher competency, although the strength of their influence differs. Learning assessment was identified as the most dominant predictor factor, followed by learning methods and teaching knowledge. This finding shows that TVET teacher competency depends not only on the mastery of knowledge and pedagogical skills, but is also influenced by teachers' ability to implement systematic, authentic, and competency-oriented assessment.

Specifically, the dominance of learning assessment shows that teachers' ability to develop assessment instruments, evaluate learning evidence, and use assessment information to improve the teaching process is an important aspect in shaping TVET teacher professionalism. In addition, the influence of learning methods proves that the use of student-centred, project-based, competency-based, and industry-oriented learning approaches plays an important role in strengthening teachers' pedagogical ability. Meanwhile, teaching knowledge remains an important foundation that supports teacher competency through mastery of content knowledge, pedagogy, and the ability to adapt teaching strategies to students' needs and the learning context.

This finding shows that TVET teacher competency is a multidimensional construct that cannot be developed through a single aspect alone. Instead, competency development requires the integration of teaching knowledge, the implementation of innovative learning methods, and the mastery of effective learning assessment. This finding is consistent with the needs of current TVET transformation, which requires teachers to possess comprehensive

professional ability to face technological change, industry development, and 21st century skills demand.

Therefore, this study implies that efforts to enhance the competency of Vocational College teachers need to prioritise professional development focused on strengthening assessment competency, enhancing mastery of innovative pedagogy, and consolidating teaching knowledge. This holistic approach to competency development is important to ensure TVET teachers continue to be able to provide quality learning experiences and produce competent, adaptive graduates who meet labour market needs.

5. Implications of the Study

The findings of this study have important implications for stakeholders in TVET teacher professional development, particularly the management of Vocational Colleges (VCs), the Technical and Vocational Education and Training Division (BPLTV), the Ministry of Education Malaysia, and teacher training institutions. Based on the Multinomial Logistic Regression analysis, learning assessment was identified as the most dominant predictor factor for teacher competency, followed by learning methods and teaching knowledge. Therefore, TVET teacher competency development needs to be implemented holistically, prioritising mastery of competency-based assessment, the integration of innovative pedagogy, and the consolidation of professional knowledge.

From the professional development perspective, continuous professional development (CPD) programmes need to emphasise enhancing teachers' ability to develop valid, authentic, and competency-oriented assessment instruments. In addition, training related to digital formative assessment, learning analytics, and the use of artificial intelligence (AI) technology needs to be expanded to enable teachers to implement assessment that is more responsive, data-based, and aligned with future educational developments (OECD, 2023; UNESCO, 2024). At the same time, mastery of learning methods such as Project-Based Learning (PjBL), Competency-Based Learning (CBL), and School Enterprise needs to be strengthened through pedagogical workshops, professional learning communities (PLC), mentoring programmes, and strategic collaboration with industry to ensure learning experiences are more authentic and relevant to job requirements (Mohd Rokeman et al., 2024).

Although teaching knowledge showed a lower influence compared to the other variables, this aspect remains an important foundation in shaping TVET teacher competency. Mastery of content knowledge, pedagogical knowledge, and Pedagogical Content Knowledge (PCK) enables teachers to deliver content accurately, select appropriate teaching strategies, and adapt teaching practices to students' needs. Accordingly, teacher professional development needs to continue focusing on strengthening PCK and Technological Pedagogical Content Knowledge (TPACK) to ensure the integration of digital technology, including AI applications, can be effectively implemented in the teaching and learning process (Mishra & Koehler, 2006; Salleh et al., 2022; UNESCO, 2024).

In addition, the findings of this study have implications for TVET policy planning through the need to develop a teacher competency framework that combines teaching knowledge,

learning methods, and learning assessment as the main indicators of teacher professionalism. Overall, enhancing TVET teacher competency requires a systematic and continuous development approach so that teachers are able to adapt to technological change, industry needs, and 21st century educational demands. This effort is important to ensure the Malaysian TVET system continues to be able to produce competent, adaptive, highly skilled graduates who meet future labour market demands (Diao & Hu, 2022).

6. Limitations and Suggestions for Further Research

This study has several limitations that need to be considered in interpreting the findings. First, the quantitative cross-sectional explanatory study design only involved data collection at a single point in time. Although the Multinomial Logistic Regression (MLR) analysis successfully identified the influence and relative contribution of predictor variables on teacher competency, this design does not allow for absolute conclusions regarding cause-and-effect relationships. Second, the study data were obtained based on the perceptions of final-year Malaysian Vocational Diploma (DVM) students, which, although providing an important picture of their learning experiences, may be influenced by respondent subjectivity. In addition, the scope of the study, which only involved Vocational Colleges in five states in Peninsular Malaysia, limits the generalisability of the findings to other TVET contexts such as Sabah, Sarawak, and private TVET institutions.

Based on these limitations, further research is recommended to use a longitudinal design or mixed-methods approach to examine the development of teacher competency in greater depth and to understand the mechanisms by which teaching knowledge, learning methods, and learning assessment influence teacher competency in actual practice. Future studies could also combine various sources of evaluation, such as teacher self-assessment, teaching observation, peer assessment, and industry feedback, to produce more objective and comprehensive measurements of competency.

In addition, further research could expand the study model by including other factors such as industry experience, continuous professional training, digital competency, institutional support, and organisational culture as mediator or moderator variables. This approach has the potential to produce a more comprehensive understanding of TVET teacher competency formation and support the development of a more holistic, adaptive teacher professionalism model aligned with future technological changes and industry needs.

7. Conclusion

Overall, this study proves that learning assessment, learning methods, and teaching knowledge are significant predictor factors for teacher competency in Vocational Colleges, with learning assessment identified as the most dominant factor, followed by learning methods and teaching knowledge. This finding shows that TVET teacher competency is a multidimensional construct that requires the integration of professional knowledge mastery, innovative pedagogy implementation, and competency-based assessment proficiency. Therefore, continuous teacher professional development needs to be strengthened to ensure teachers are able to adapt their teaching practices to technological developments, industry

needs, and 21st century educational demands. This study provides important implications for the management of Vocational Colleges, BPLTV, and policymakers in formulating a more systematic teacher competency development strategy to support the production of competent, adaptive, and competitive TVET graduates aligned with the aspirations of Malaysian TVET transformation (Ministry of Education Malaysia, 2023; UNESCO, 2024).

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