

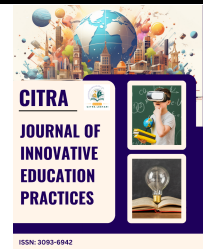


Citra Journal of Innovative Education Practices

Journal homepage:

<https://citralestari.my/index.php/cjiep/index>

ISSN: 3093-6942



Assessing Vocational Teachers' Readiness for Inquiry-Based and Technology-Integrated Final Year Project Supervision: A Case Study at Batu Lanchang Vocational College

Muhammad Afif Ammar Muhammad Hijaz^{1,*}, Nur Hazirah Noh@Seth¹, Zi Jian Oh^{2,*}, Tuan Noor Hazariani Tuan Zakaria³

¹ Faculty of Educational Sciences and Technology, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

² Department of Business Management, Batu Lanchang Vocational College, Lorong Batu Lanchang, 11600 Jelutong, Penang, Malaysia

³ Psychology and Career Unit, Batu Lanchang Vocational College, Lorong Batu Lanchang, 11600 Jelutong, Penang, Malaysia

ARTICLE INFO

Article history:

Received 25 December 2025

Received in revised form 19 February 2026

Accepted 1 June 2026

Available online 8 June 2026

Keywords:

Inquiry based learning; digital competency; teacher readiness; vocational education; future learning and education

ABSTRACT

Future learning and education emphasise inquiry-driven, technology-integrated pedagogies that foster higher-order thinking, digital competence, and independent problem solving. Within vocational education and training, the Final Year Project serves as a critical platform for students to integrate theoretical knowledge, practical skills, and digital tools in addressing authentic industry-related challenges. However, supervision practices in many vocational institutions remain largely traditional, with limited structured inquiry processes and inconsistent technology integration. This study examines vocational teachers' readiness to supervise inquiry-based and technology-integrated Final Year Projects at Batu Lanchang Vocational College. A quantitative case study design was employed using a structured questionnaire administered to thirty vocational teachers. The instrument measured technological self-efficacy, acceptance of inquiry-based learning, perceived implementation barriers, and behavioural intention. Descriptive and correlational analyses revealed generally positive attitudes toward inquiry-based and technology-supported supervision, moderate to high levels of technological self-efficacy, and strong behavioural intention to adopt innovative practices. Nevertheless, significant barriers were identified, including heavy workload, inconsistent digital infrastructure, limited pedagogical training, and concerns regarding students' digital literacy. The findings highlight the need for systematic professional development, strengthened institutional support, and structured pedagogical frameworks to enhance inquiry-based and technology-integrated supervision practices in vocational education.

* Corresponding author.

E-mail address: ammar1997@graduate.utm.my

1. Introduction

Future learning and education increasingly emphasise active, inquiry-oriented, and technology-enabled pedagogies that prepare learners for rapidly evolving economic and social environments. Educational systems worldwide are shifting towards instructional approaches that encourage students to formulate questions, investigate problems, and construct knowledge with the support of digital tools. Within vocational education and training, these approaches are particularly relevant because students are expected to demonstrate industry-aligned competencies that integrate technical proficiency with cognitive and problem-solving skills. Inquiry-based learning has been shown to support creativity, independent learning, and higher-order thinking, which are recognised as essential competencies for future work environments [2,15].

Recent empirical studies further demonstrate that technology-enhanced inquiry environments can significantly improve student achievement, motivation, and engagement compared to inquiry-based instruction alone. Research indicates that digital inquiry tools, including augmented reality and AI-supported platforms, strengthen creativity, problem-solving, critical thinking, and knowledge construction in STEM and vocational learning contexts [6,17]. Evidence also shows that inquiry-based digital environments evoke epistemic emotions such as curiosity and pride, which play a crucial role in sustaining engagement and analytical thinking during complex learning tasks. These findings underscore the transformative potential of technology when embedded within structured inquiry-driven pedagogical designs.

The pedagogical shift towards inquiry-based and technology-integrated learning places increasing demands on teachers' digital competence and instructional design capabilities. Teachers are required to integrate digital tools meaningfully into inquiry processes rather than using technology as a supplementary add-on. Recent scholarship highlights that AI-driven and technology-mediated pedagogical ecosystems in vocational institutions require teachers to adopt personalised, inquiry-oriented supervisory practices to remain aligned with future industry expectations [1,23]. Empirical evidence further indicates that generative artificial intelligence, when embedded within constructivist and inquiry-based learning environments, enhances conceptual understanding and reduces misconceptions, while unstructured or unguided use yields limited educational benefits [10,16,19,32].

Within vocational education, the Final Year Project represents a critical capstone component that enables students to synthesise theoretical knowledge, practical skills, and digital tools in addressing authentic, industry-related challenges. Ideally, supervision of Final Year Projects should involve structured inquiry cycles supported by digital platforms, project management tools, and emerging technologies. However, international research suggests that many vocational teachers continue to rely on traditional, teacher-directed supervision approaches that limit students' engagement with inquiry processes and digital resources. Studies across TVET institutions indicate that although teachers acknowledge the importance of digital competence, their ability to apply digital tools pedagogically during project supervision varies considerably due to limited confidence, insufficient access to resources, and uncertainty in adapting inquiry-based strategies to vocational contexts [7,30,31].

Teacher readiness has been consistently identified as a decisive factor in the successful implementation of inquiry-based and technology-integrated pedagogies. Readiness encompasses technological self-efficacy, pedagogical beliefs, acceptance of instructional innovation, perceived institutional support, and behavioural intention. Research grounded in technological self-efficacy, TPACK, and technology acceptance frameworks demonstrates that teachers with higher self-efficacy are more effective in integrating digital tools and inquiry-based strategies into their instructional

practices [3,20,21,28]. Conversely, vocational institutions frequently face structural barriers such as limited digital infrastructure, heavy workload, insufficient professional development, and restrictive administrative procedures, which constrain teachers' capacity to innovate [8,26,29]. Malaysian-focused evidence further indicates that Final Year Project supervision often lacks systematic inquiry structures and technology literacy components, highlighting persistent gaps in teachers' preparation for inquiry-oriented supervision [12,14,22].

Despite extensive international literature on digital competence and inquiry-based teaching, empirical evidence examining vocational teachers' readiness to supervise inquiry-based and technology-integrated Final Year Projects within Malaysian TVET institutions remains limited. Previous studies suggest that while teachers may possess foundational digital skills, behavioural intention does not consistently translate into practice due to contextual and institutional constraints [4,5,25]. In response to this gap, the present study examines vocational teachers' readiness to supervise inquiry-based and technology-integrated Final Year Projects at Batu Lanchang Vocational College by focusing on technological self-efficacy, acceptance of inquiry-based learning, perceived barriers, and behavioural intention. By addressing these dimensions, the study contributes empirical insights to the discourse on future learning and education and provides evidence to inform institutional strategies, professional development planning, and policy decisions in vocational education.

2. Methodology

2.1 Research Design

This study employed a quantitative case study design to examine vocational teachers' readiness to supervise inquiry based and technology integrated Final Year Projects at Batu Lanchang Vocational College. In this study, the case study refers to the bounded institutional context rather than methodological triangulation, with quantitative survey data used to examine teacher readiness within this setting. The case study approach was selected because it enables an in depth exploration of a contemporary phenomenon within its real educational setting, particularly when contextual factors strongly influence teacher practices. According to Duff [9], case study designs are well suited for investigating complex educational processes that involve both individual and institutional dimensions. Within the field of vocational education, such designs allow researchers to capture the interplay between teacher readiness, pedagogical innovation, and institutional conditions. This structure aligns with international recommendations that emphasise the importance of studying teacher readiness within authentic contexts where digital transformation and competency development take place [26].

A quantitative design was appropriate given the objectives of the study, which included assessing levels of readiness, exploring patterns of responses, and identifying factors that influence teacher intention to adopt innovative practices. Quantitative approaches are commonly used in studies on digital competence, technology adoption, and teacher readiness because they allow researchers to measure constructs with precision and identify correlations among variables [1]. Recent studies evaluating digital readiness in vocational institutions have successfully used survey instruments to capture teachers' perceptions of technological confidence, pedagogical beliefs, and barriers to adoption, demonstrating the suitability of this methodological approach [31].

2.2 Instrument Development

The questionnaire used in this study was carefully developed and adapted from validated instruments used in previous research on digital skills, inquiry-based learning adoption, and teacher readiness. The technological self-efficacy items were adapted from instruments used in studies that examined digital skills and technology integration challenges among vocational teachers, particularly those that measured confidence in using digital tools, software, and project-based applications [27]. These items were selected because vocational teachers often use digital platforms for simulation, design, documentation, and analysis in Final Year Projects.

Items measuring acceptance of inquiry-based learning were adapted from frameworks used in studies that assessed teachers' beliefs about inquiry driven pedagogies in blended and technology enabled contexts. Inquiry based learning is increasingly recognised as essential for promoting deeper learning and aligning vocational education with future learning expectations. The items used in this study reflect constructs related to perceived usefulness, suitability for vocational subjects, and expectations of student engagement, consistent with findings from studies conducted in both general and technical education settings [24].

The perceived barriers construct drew from studies identifying structural and professional challenges that hinder digital transformation in vocational institutions. These include insufficient digital infrastructure, limited access to resources, lack of training, administrative constraints, and varying levels of student digital literacy [8]. Similarly, the behavioural intention items were based on research that examined how teacher intention to adopt innovative practices is influenced by contextual factors and self-efficacy beliefs. Studies in educational technology consistently show that behavioural intention is a significant predictor of actual use, although implementation depends heavily on institutional conditions [5].

All items were measured using a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree). The instrument underwent expert validation by three senior lecturers experienced in educational technology and vocational pedagogy to ensure content validity. Based on their feedback, several items were refined to improve clarity and alignment with the vocational context.

2.3 Pilot Testing and Reliability

Before full deployment, the questionnaire was pilot tested with ten vocational teachers from another institution who were not part of the study sample. The purpose of the pilot test was to ensure that items were clearly understood, appropriately worded, and aligned with constructs relevant to vocational supervision. Results from the pilot test indicated high internal consistency across all constructs, which supported the reliability of the instrument. Cronbach's alpha values exceeded the recommended threshold of 0.70, aligning with established reliability standards for educational and social science survey research [13]. The strong reliability measures demonstrate the instrument's robustness for capturing teachers' perceptions of readiness.

Pilot feedback also revealed that teachers appreciated the clarity of items related to inquiry-based learning but suggested minor revisions to items related to institutional barriers to better reflect the realities of vocational environments. The instrument was thus refined to incorporate references to digital infrastructure, workload, and access to professional development. These refinements enhanced the contextual relevance of the questionnaire and ensured that it accurately represented the lived experiences of vocational teachers.

2.4 Sampling and Participants

Purposive sampling was used to select participants who were actively involved in supervising Final Year Projects. This sampling method ensured that all respondents possessed relevant experience and could provide informed perspectives on the supervision process. Thirty teachers from Batu Lanchang Vocational College participated in the study, representing various technical programmes including automotive technology, electronic technology, electrical technology, welding technology, and industrial machining. The diversity in vocational specialisations contributed to the richness of the data by capturing varied perspectives on digital competence, inquiry-based learning, and supervision practices.

The use of purposive sampling is consistent with methodological practices in vocational research, where targeted participants with specialised knowledge are required to address research questions accurately. Studies in TVET readiness often involve teachers with specific supervisory roles because they are best positioned to comment on institutional support systems, technology integration, and pedagogical strategies [30]. All participants had more than three years of teaching experience and had supervised at least one cycle of Final Year Projects, ensuring that they could discuss their readiness in relation to actual supervisory responsibilities.

2.5 Data Collection

Data were collected through an online survey administered via Google Forms. Participants received a link to the questionnaire through email and institutional messaging channels. The survey introduction provided clear information about the objectives of the study, confidentiality assurances, voluntary participation, and estimated time for completion. Participants completed the survey within a four week period. The use of online data collection aligned with broader trends in educational research where digital tools facilitate efficient and accessible data gathering, especially when participants are accustomed to digital communication systems.

Online survey methods have been widely adopted in studies of teacher digital competence and pedagogical innovation due to their ease of administration and ability to capture responses from diverse participant groups. Research in both higher education and vocational settings indicates that online questionnaires are effective for collecting data related to technology adoption, digital readiness, and self-efficacy [1].

2.6 Data Analysis

Data were analysed using descriptive statistics to summarise demographic information and item responses. Frequencies and percentages were calculated for each demographic variable to capture the distribution of respondents across gender, age, teaching experience, and programme areas. For each survey item, the percentage of participants selecting each Likert scale option was calculated. Tables presenting these distributions were included in the Results section.

Mean scores and standard deviations were computed for each construct to examine central tendencies and variability. Correlational analysis was conducted using Pearson correlation coefficients to explore relationships between technological self-efficacy, acceptance of inquiry based learning, perceived barriers, and behavioural intention. Correlational analysis has been widely used in studies examining digital adoption and inquiry-based learning because it reveals how teacher beliefs and perceptions influence readiness and intention [11].

The combination of descriptive and correlational analysis is consistent with methodological practices in educational technology research, particularly in contexts where teacher readiness is shaped by multiple interrelated factors. These analysis methods provided a comprehensive understanding of how vocational teachers perceive their readiness to adopt innovative approaches and the extent to which structural barriers influence their professional practices.

3. Results

3.1 Demographic Profile of Respondents

A total of thirty vocational teachers participated in this study, representing a diverse range of technical specialisations within Batu Lanchang Vocational College. The demographic analysis revealed that the majority of respondents were male, which is consistent with gender patterns commonly reported in technical vocational institutions globally, where male participation tends to dominate engineering and industrial fields [30]. Most participants were between thirty and thirty-nine years old, indicating a relatively young workforce with sufficient teaching experience to engage in Final Year Project supervision. This age distribution is advantageous because teachers in this range often possess foundational digital competency and are more adaptable to technological change compared to their older counterparts [31].

In terms of teaching experience, nearly half of the respondents had between six and ten years of teaching experience, followed by a smaller proportion with three to five years and more than ten years of service. All participants reported having experience supervising Final Year Projects, which strengthens the relevance of their perceptions for the purposes of this study.

Table 1

Summary of respondents' demographics (N = 30)

Response	Frequency	Percentage (%)
Gender		
Male	22	72.41
Female	8	27.59
Age		
20–29 years	4	13.33
30–39 years	23	76.67
40–49 years	1	3.33
50–60 years	2	6.67
Teaching Programme		
Automotive Technology	10	33.33
Electrical Technology	5	16.67
Electronic Technology	5	16.67
Welding Technology	5	16.67
Industrial Machining Technology	5	16.67
Teaching Experience		
3–5 years	10	33.33
6–10 years	14	46.67
11–15 years	3	10.00
16–20 years	1	3.33
More than 20 years	2	6.67
FYP Supervision Experience		
Yes	30	100.00
No	0	0.00

Their involvement in vocational project supervision suggests that they have been exposed to the specific demands, constraints, and pedagogical challenges of guiding students through applied learning tasks. Table 1 presents a detailed summary of the demographic characteristics of respondents.

The demographic distribution provides a strong foundation for analysing teacher readiness because the respondents represent a breadth of technical backgrounds, ages, and instructional experiences. These demographic patterns are consistent with prior research indicating that teacher readiness for digital and inquiry-based learning varies depending on teachers' exposure to technology, institutional culture, and years of practice [5]. The demographic findings ensure the representativeness of the sample within the vocational college context.

3.2 Technological Self Efficacy

The first construct explored in this study was technological self-efficacy, which refers to teachers' confidence in using digital tools, applications, and resources for supervising Final Year Projects. The findings indicate strong levels of self-efficacy, with most respondents agreeing or strongly agreeing that they were confident in the use of digital tools. This suggests that teachers generally possess foundational digital skills, which aligns with international findings that vocational teachers tend to demonstrate moderate to high levels of digital competence, particularly in contexts where technology has been integrated into teaching and learning processes over time [22].

However, while personal confidence was high, responses indicated some concerns regarding institutional support for technology integration. Although a majority agreed that the college provided sufficient resources, a notable portion expressed neutral or negative responses. This points to perceived gaps in digital infrastructure, which is consistent with research showing that vocational institutions in many countries face challenges related to maintenance, accessibility, and consistency of technological resources [8]. Teachers also expressed strong willingness to learn new technological and pedagogical skills, reflecting a readiness for continuous improvement and alignment with professional development strategies recommended in global digital education frameworks [26].

Table 2
 Technological self-efficacy (N = 30)

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am confident using digital tools or software to supervise the Final Year Project.	0.00%	0.00%	16.67%	70.00%	13.33%
The college provides adequate technology resources for Final Year Project supervision.	0.00%	10.00%	13.33%	76.67%	0.00%
I receive sufficient support to use technology in project supervision.	0.00%	0.00%	13.33%	73.33%	13.33%
I feel comfortable integrating technology into my teaching.	0.00%	0.00%	16.67%	63.33%	20.00%
I am willing to learn new technological and pedagogical skills to enhance Final Year Project supervision.	0.00%	0.00%	13.33%	63.33%	23.33%

The distribution of responses in Table 2 suggests that while teachers are personally prepared to integrate technology into their supervisory practices, institutional constraints may hinder their ability to fully utilise digital tools. This highlights the importance of aligning teacher readiness with strategic investments in digital infrastructure and ongoing professional development.

3.3 Acceptance of Inquiry Based Learning

The findings also reveal generally positive acceptance of inquiry-based learning among vocational teachers. Most respondents agreed that inquiry-based learning improves student outcomes and is appropriate for vocational contexts where students engage in hands on, problem centred tasks. These findings echo broader educational research indicating that teachers increasingly recognise the value of inquiry-based practices for promoting deeper learning, enhancing problem solving skills, and increasing student engagement [24].

Teachers expressed strong interest in adopting inquiry based and technology enhanced supervision strategies. This openness to pedagogical innovation aligns with studies suggesting that teachers who possess foundational digital competency are more willing to experiment with new instructional approaches when they perceive them as beneficial for student learning [31]. Nevertheless, some respondents expressed uncertainty about institutional readiness to support such practices, which reflects similar findings in vocational literature highlighting gaps between teacher intention and organisational support [5].

Table 3
 Inquiry-Based Learning (IBL) Acceptance (N = 30)

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Inquiry-Based Learning improves the quality of students' project outcomes.	0.00%	0.00%	16.67%	60.00%	23.33%
Inquiry-Based Learning with technology is suitable for vocational learning.	0.00%	0.00%	20.00%	60.00%	20.00%
I am interested in applying Inquiry-Based Learning and technology in Final Year Project supervision.	0.00%	0.00%	16.67%	63.33%	20.00%
Students will respond positively to the use of Inquiry-Based Learning and technology.	0.00%	0.00%	20.00%	63.33%	16.67%
The college will support the use of Inquiry-Based Learning and technology.	0.00%	0.00%	26.67%	63.33%	10.00%

The responses summarised in Table 3 indicate that teachers are conceptually aligned with the principles of inquiry-based learning and recognise its pedagogical value, but may still require clearer institutional frameworks and targeted training to implement these strategies effectively.

3.4 Perceived Barriers

Despite their positive attitudes, teachers identified several barriers that hinder the implementation of inquiry based and technology integrated Final Year Project supervision. One of the most commonly reported challenges was heavy teaching workload. Vocational teachers often manage multiple responsibilities, including practical classes, laboratory maintenance, equipment preparation, and administrative duties, which can limit the time available for planning inquiry-oriented supervision. This barrier is widely documented in studies showing that vocational education is characterised by high instructional demands that constrain teachers' ability to adopt innovative practices [8].

Limited infrastructure and insufficient access to updated digital tools were also highlighted as significant obstacles. These structural constraints align with global findings that vocational institutions often struggle to maintain up to date technological resources due to financial and logistical limitations [22]. Teachers further reported concerns about students' digital literacy, which is a critical factor in technology enhanced inquiry-based learning because students must possess sufficient digital skills to engage with tools such as simulation software, data collection instruments, and online platforms. Research in developing countries similarly shows that uneven student digital competence can impede the success of digital instructional strategies [27].

Table 4
 Perceived barriers (N = 30)

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My teaching workload limits my ability to implement Inquiry-Based Learning and technology.	0.00%	0.00%	26.67%	56.67%	16.67%
Limited equipment or financial resources make implementation difficult.	0.00%	0.00%	20.00%	50.00%	23.33%
Students are not ready or have low digital literacy.	0.00%	23.33%	43.33%	23.33%	10.00%
Lack of training or pedagogical guidance makes it difficult to apply Inquiry-Based Learning and technology.	0.00%	6.67%	20.00%	50.00%	23.33%
Institutional policies or procedures restrict implementation.	0.00%	0.00%	40.00%	46.67%	13.33%
Support from administrators or colleagues facilitates implementation.	0.00%	0.00%	20.00%	56.67%	23.33%
Professional development opportunities encourage the use of Inquiry-Based Learning and technology.	0.00%	0.00%	13.33%	60.00%	26.67%

The identification of multiple barriers in Table 4 supports existing evidence that teacher readiness is shaped not only by individual competence but also by institutional structures, policies, and resource availability. These barriers underscore the need for comprehensive support systems to sustain pedagogical innovation in vocational education.

3.5 Behavioural Intention to Adopt Inquiry Based and Technology Integrated Supervision

The final construct examined in this study was teachers’ behavioural intention to adopt inquiry based and technology supported supervision. The majority of respondents expressed strong intention to integrate these approaches into future supervision practices. These findings are encouraging because behavioural intention is widely recognised as a strong predictor of future behaviour within technology adoption models and inquiry-based learning research [11]. Furthermore, teachers’ willingness to attend professional development workshops demonstrates motivation to strengthen their competencies and align with future learning expectations.

Despite these positive intentions, the results suggest that successful implementation will require consistent institutional support, including professional learning programmes, resource investment, and clear policy guidance. This aligns with international recommendations that highlight the importance of aligning institutional structures with teacher motivation to ensure effective transformation of teaching practices [26]. Without such support, intention may not translate into sustained practice.

Table 5
 Behavioural intention (N = 30)

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I intend to use Inquiry-Based Learning and technology in future Final Year Project supervision.	0.00%	0.00%	6.67%	66.67%	26.67%
I have previously incorporated inquiry or technology elements in Final Year Project supervision.	0.00%	3.33%	10.00%	73.33%	13.33%
I am willing to attend training related to digital or inquiry-based supervision.	0.00%	0.00%	10.00%	70.00%	20.00%

The data presented in Table 5 reinforce the idea that while teachers are enthusiastic about adopting inquiry based and technology integrated supervision, actual implementation depends on addressing structural constraints and enhancing institutional readiness.

4. Discussion

This discussion interprets the study’s findings in relation to the research objectives by examining vocational teachers’ technological self-efficacy, acceptance of inquiry-based learning, perceived barriers, and behavioural intention to adopt inquiry-based and technology-integrated supervision. The purpose of this study was to examine vocational teachers’ readiness to supervise inquiry based and technology integrated Final Year Projects within the context of future learning and education. The findings reveal that although teachers demonstrate strong positive attitudes and moderate to high levels of technological self-efficacy, several structural and pedagogical barriers continue to limit their ability to apply innovative supervisory practices effectively. The results of this case study align with emerging international research in digital education, which consistently highlights that transformation in teaching practices requires alignment between teacher competence, institutional support, and coherent pedagogical frameworks [26]. This section discusses the implications of the

findings in relation to technological readiness, acceptance of inquiry-based learning, structural barriers, and behavioural intention to adopt innovative supervision practices.

4.1 Technological Self Efficacy and Digital Competence

The findings indicate that vocational teachers possess moderate to strong technological self-efficacy, particularly in their confidence to use essential digital tools for supervision. This is consistent with global trends showing that teachers increasingly recognise the importance of digital skills in supporting student learning, especially in technical and vocational environments [31]. Teachers' willingness to learn new digital tools also reflects a positive orientation towards continuous professional growth, which is a key characteristic of future ready educators [1]. However, the results also show that while individual digital competence is growing, the college's digital infrastructure remains inconsistent, which restricts teachers' opportunities to fully integrate technology in project supervision.

This gap between teacher capacity and institutional support mirrors findings from developing countries where vocational institutions often lack the resources to update digital hardware, specialised software, and technical maintenance [8]. Research consistently emphasises that technological integration can only be effective when reliable infrastructure is available, as teachers' confidence tends to decline when tools are inaccessible or frequently malfunction [22]. Furthermore, insufficient digital resources may discourage teachers from experimenting with new tools, thereby limiting students' exposure to authentic, technology-based inquiry tasks.

4.2 Acceptance of Inquiry Based Learning in Vocational Contexts

The findings show strong acceptance of inquiry-based learning, with most teachers agreeing that inquiry processes enhance student learning outcomes and are suitable for vocational education. This aligns with research demonstrating that inquiry-based learning supports deeper conceptual understanding, improves problem solving skills, and strengthens students' ability to apply knowledge in real world contexts [24]. The vocational context, which emphasises applied learning and authentic tasks, is particularly well suited to inquiry-based supervision because students engage in real industrial problems that require investigation and reflective thinking.

Despite this strong acceptance, some teachers expressed uncertainty regarding institutional readiness to support inquiry-based approaches. This point is supported by previous studies that warn that inquiry-based learning requires systematic pedagogical planning, curriculum alignment, and administrative support to be implemented effectively [30]. Without structured guidance or shared pedagogical frameworks, teachers may face difficulties designing effective inquiry cycles for Final Year Projects. Thus, while teachers conceptually support the shift towards inquiry-oriented supervision, strengthening institutional structures and curriculum guidance remains critical.

4.3 Structural Barriers to Adoption

Across the findings, teachers consistently reported several structural barriers, including heavy workload, limited digital resources, insufficient training, and variability in student digital literacy. These challenges align with a growing body of literature noting that teachers' readiness for digital innovation does not occur in isolation but is heavily shaped by contextual constraints [8]. In vocational education, structural challenges are often more pronounced because teachers must manage practical classes, maintain equipment, and support students across multiple learning

environments. The combination of administrative duties and hands on teaching reduces the time available to plan inquiry oriented and technology enabled supervision.

Student related factors also emerged as significant, particularly regarding digital literacy. Several teachers indicated uncertainty about students' technological readiness, echoing research that shows substantial variability in students' digital competence across vocational programmes [27]. Given that inquiry-based learning requires students to independently use digital tools to gather data, test ideas, and present findings, student digital literacy is an essential condition for success. If students lack these basic competencies, teachers may feel compelled to revert to traditional teacher centred supervision as a means of maintaining project quality and managing time constraints.

This interplay of institutional, teacher related, and student related barriers is consistent with research demonstrating that digital transformation in education is a system wide process, requiring strategic alignment across multiple levels of the institution [26]. As such, addressing barriers to inquiry based and technology integrated supervision requires a holistic, collaborative, and well resourced institutional approach.

4.4 Behavioural Intention and Conditions for Implementation

Despite the challenges, teachers demonstrated strong behavioural intention to adopt inquiry based and technology enhanced supervision for future project cycles. Research shows that behavioural intention is a strong predictor of future teaching behaviours, especially when supported by favourable institutional conditions [11]. In this study, the intention to adopt innovative practices suggests that teachers are motivated to align their supervisory roles with the demands of future learning and education. This readiness reflects the growing recognition among educators that students must develop independent inquiry skills and digital fluency to succeed in future work environments.

However, as shown in prior studies, behavioural intention alone is insufficient if not supported by adequate training, resources, and pedagogical frameworks. A gap between intention and practice commonly arises when teachers lack concrete strategies for implementation or when institutional barriers remain unaddressed [5]. Therefore, to translate intention into sustained practice, vocational institutions must foster comprehensive development programmes, strengthen digital infrastructure, and create clear pedagogical models for inquiry based supervision.

4.5 Contribution to Future Learning and Education

The findings of this study have important implications for future learning and education. First, the study reinforces the importance of strengthening teacher digital competence as a foundation for integrating innovative supervisory practices. Teachers who are confident in digital tool use are more capable of designing learning experiences that reflect the principles of future oriented education. Second, the study highlights the need for holistic institutional support that aligns with global recommendations for digital transformation in education [26]. Third, by focusing on the Final Year Project, this study emphasises the need to modernise project supervision practices as a key component of preparing students for evolving labour market demands.

Overall, this case study contributes to the growing discourse on the future of vocational education by illustrating the complex factors that influence teacher readiness. It reinforces the importance of active pedagogies, digital integration, and institutional collaboration in shaping future learning environments. This study contributes to the vocational education literature by providing empirical

evidence on teacher readiness for inquiry-based and technology-integrated Final Year Project supervision within a Malaysian TVET context.

5. Conclusions

The purpose of this study was to assess vocational teachers' readiness to supervise inquiry-based and technology-integrated Final Year Projects at Batu Lanchang Vocational College. The findings indicate that teachers demonstrate positive orientations towards innovative pedagogical practices and possess moderate to strong levels of technological self-efficacy. This level of readiness is encouraging, as inquiry-based learning and digital integration are central to future learning and education, where students are expected to develop advanced problem-solving skills, creativity, and digital fluency to respond effectively to evolving work environments. Teachers' willingness to adopt new supervisory approaches further reflects alignment with broader trends in digital pedagogy and inquiry-driven learning.

Despite this readiness, the study identified several structural and contextual barriers, including heavy workload, inconsistent digital infrastructure, limited pedagogical training, and concerns regarding students' digital literacy. These challenges highlight the complex interaction between individual teacher competence and institutional conditions. The findings suggest that the effective integration of inquiry-based learning and technology in Final Year Project supervision requires coordinated institutional support, including strengthened digital infrastructure, structured professional development, and clearer pedagogical frameworks to guide inquiry-oriented supervision.

The results also underscore the importance of aligning institutional leadership, policy direction, and resource allocation with the demands of future learning and education. Although teachers expressed strong behavioural intention to adopt innovative supervisory practices, such intentions are unlikely to translate into sustained implementation without system-wide support. Accordingly, vocational institutions are encouraged to prioritise continuous professional development in inquiry-based methodologies, ongoing digital upskilling, collaborative learning communities, and strategic investment in technological resources to enable high-quality, inquiry-oriented project supervision that reflects contemporary industry expectations.

This study contributes to vocational education research by providing empirical evidence on teacher readiness within an authentic case study context and by clarifying how digital competence, pedagogical beliefs, and institutional structures collectively influence the adoption of future-oriented learning practices. Future research may extend this work by incorporating student perspectives, conducting comparative studies across vocational institutions, or evaluating targeted interventions designed to strengthen inquiry-based and technology-integrated supervision. Such efforts will support the continued advancement of vocational education in preparing teachers and students for the evolving landscape of future learning and work.

Acknowledgement

This research was not funded by any grant.

References

- [1] Amemasor, Stephen Kwashie, Stephen Opoku Oppong, Benjamin Ghansah, Ben-Bright Benuwa, and Mathias Agbeko. "The influence of digital professional development and professional learning communities in the relationship between school digital preparedness and digital instructional integration." *PLoS One* 20, no. 7 (2025): e0328883. <https://doi.org/10.1371/journal.pone.0328883>.

- [2] Arici, Faruk, and Rabia Meryem Yilmaz. "Effects of Augmented Reality and Video-Based Learning in Inquiry-Based Science Education on Academic Achievement and Motivation to Learn Science." *Journal of Computer Assisted Learning* 41, no. 5 (2025): e70128. <https://doi.org/10.1111/jcal.70128>
- [3] Asante, Johnson Amoakohene, Francis Kwadwo Awuah, and Derick Folson. "Teachers' Readiness and Self-Efficacy in Implementing Inquiry-Based Learning in Primary Mathematics Education: A Case of Sekyere Kumawu District, Ghana." *SAGE Open* 15, no. 3 (2025): 21582440251375212. <https://doi.org/10.1177/21582440251375212>
- [4] Ateş, Hüseyin, and Cengiz Gündüzalp. "The convergence of GETAMEL and protection motivation theory: A study on augmented reality-based gamification adoption among science teachers." *Education and Information Technologies* 30, no. 12 (2025): 17361-17403. <https://doi.org/10.1007/s10639-025-13480-1>
- [5] Cabero-Almenara, Julio, Antonio Palacios-Rodríguez, Maria Isabel Loaiza-Aguirre, and Dhamar Rafaela Pugla-Quirola. "A structural model of distance education teachers' digital competencies for artificial intelligence." *Education Sciences* 15, no. 10 (2025): 1271. <https://doi.org/10.3390/educsci15101271>.
- [6] Campina-López, Alejandro Carlos, Mariángeles de las Heras-Pérez, and Antonio Alejandro Lorca-Marín. "Characterization of Emotions Linked to the Study of a STEAM Project Contextualized in a Controversial Heritage." *Education Sciences* 15, no. 6 (2025): 725. <https://doi.org/10.3390/educsci15060725>
- [7] Cooper, Grant, Kok-Sing Tang, and Angela Fitzgerald. "Intersections of mind and machine: Navigating the nexus of artificial intelligence, science education, and the preparation of pre-service teachers." *Journal of Science Education and Technology* (2025): 1-5. <https://doi.org/10.1007/s10956-025-10200-9>
- [8] Imama, D. D., K. I. Ismara, P. Sudir, and T. H. T. Maryadi. "Bridging the Digital Skills Gap: A Systematic Literature Review of Technology Adaptability in Vocational Education and Training." *International Journal of Research and Innovation in Social Science* 2983 (2025). <https://doi.org/10.47772/IJRISS.2025.906000219>.
- [9] Duff, Patricia. "Case Study Research in Applied Linguistics." In *Research Methods in Linguistics*, 3rd ed., edited by Li Wei and Angela Creese, 373–401. London: Bloomsbury, 2025.
- [10] El Fathi, Tarik, Aouatif Saad, Hayat Larhzil, Driss Lamri, and El Mehdi Al Ibrahim. "Integrating generative AI into STEM education: Enhancing conceptual understanding, addressing misconceptions, and assessing student acceptance." *Disciplinary and Interdisciplinary Science Education Research* 7, no. 1 (2025): 6. <https://doi.org/10.1186/s43031-025-00125-z>
- [11] Fitrah, Muh, Anastasia Sofroniou, Novi Yarmanetti, Indriani H. Ismail, Hetty Anggraini, Ita Chairun Nissa, Bakti Widyaningrum, Irul Khotijah, Prabowo Dwi Kurniawan, and Dedi Setiawan. "Are teachers ready to adopt deep learning pedagogy? The role of technology and 21st-century competencies amid educational policy reform." *Education sciences* 15, no. 10 (2025): 1344. <https://doi.org/10.3390/educsci15101344>.
- [12] Ghodake, Shamrao Parashram, Vinod R. Malkar, Ankita Pathak, Radhika Gandhi Shah, Rakesh Sarvaiya, Mohammedshakil S. Malek, and Ravi Rajai. "The digital teaching revolution: bridging the gap with tech self-efficacy and citizenship'empowering teachers through innovative digital resources." *International Journal of Education Economics and Development* 17, no. 1 (2026): 18-38. <https://doi.org/10.1504/IJEED.2026.150194>
- [13] Hair, Joseph F., G. Tomas M. Hult, Christian M. Ringle, and Marko Sarstedt. 2022. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 3rd ed. Thousand Oaks, CA: Sage. <https://doi.org/10.1007/978-3-030-80519-7>
- [14] Hijaz, M. A. A. M., and Nur Hazirah. "Technology Literacy, Inquiry-Based Learning, and Final Year Projects in Malaysian Vocational Education: A Systematic Literature Review." *International Journal of Academic Research in Business and Social Sciences* 15 (2025): 12. <https://doi.org/10.6007/IJARBS/v15-i12/27214>
- [15] Kreber, Carolin. "Promoting Academic Integrity through a 'Pedagogy of Inquiry'." *Journal of Scholarly Publishing* 56, no. 2 (2025): 218-239. <https://doi.org/10.3138/jsp-2024-1114>
- [16] Lee, Hsin-Yu, and Ting-Ting Wu. "Enhancing blended learning discussions with a Scaffolded Knowledge Integration-Based ChatGPT mobile instant messaging system." *Computers & Education* 237 (2025): 105375. <https://doi.org/10.1016/j.compedu.2025.105375>
- [17] Li, Pin-Hui, Hsin-Yu Lee, Chia-Ju Lin, Wei-Sheng Wang, and Yueh-Min Huang. "InquiryGPT: Augmenting ChatGPT for enhancing inquiry-based learning in STEM education." *Journal of Educational Computing Research* 62, no. 8 (2025): 1937-1966. <https://doi.org/10.1177/07356331241289824>
- [18] Mahanal, S., S. Zubaidah, D. Setiawan, F. K. Setiowati, F. G. Muhaimin, and N. Kusmahardhika. "Integrating locus of control into RICOSRE-flipped classroom for improved self-regulated learning." *Multidisciplinary Science Journal, Accepted Articles* (2025). <https://doi.org/10.31893/multiscience.2026022>
- [19] Makransky, Guido, Ban M. Shiwalia, Tue Herlau, and Steven Blurton. "Beyond the 'wow' factor: Using generative AI for increasing generative sense-making." *Educational Psychology Review* 37, no. 3 (2025): 60. <https://doi.org/10.1007/s10648-025-10039-x>

- [20] Masry-Herzallah, Asmahan. "TPACK, technological self-efficacy, gender, and online teaching effectiveness: Insights from the COVID-19 crisis." *Humanities and Social Sciences Communications* 12, no. 1 (2025): 1-9. <https://doi.org/10.1057/s41599-025-04546-z>
- [21] Mekheimer, Mohamed. "Technological self-efficacy, motivation, and contextual factors in advanced EFL e-learning: A mixed-methods study of strategy use and satisfaction." *Humanities and Social Sciences Communications* 12, no. 1 (2025): 1-18. <https://doi.org/10.1057/s41599-025-04947-0>
- [22] Noordin, M. K., Azmi, M. A., and Nasir, A. N. M. "Advancing Technical and Vocational Education Through Digital Innovation: A Pathway to Future-Ready Skills." *International Journal of Research and Innovation in Social Science (IJRISS)* 9, no. 9 (2025): 7466–7478. <https://doi.org/10.47772/IJRISS.2025.909000610>
- [23] Oh, Zi Jian, Marina Rahman, Mustapa Hj Kamar, Siti Khadijah Ahmad Ramli, Syaiffuddin Mohamad, and Hwei Chin. "Transformational AI Leadership in Technical and Vocational Education: Reimagining Pedagogical Personalization and Industry Readiness through Intelligent Systems." <https://doi.org/10.6007/IJARBS/v15-i11/27036>
- [24] Palaguyan, R., and H. Abusama. 2025. "Inquiry-Based Learning: Effect on Student Engagement and Conceptual Knowledge in Biology." *Psychology and Education: A Multidisciplinary Journal* 37, no. 4: 395–406. <https://doi.org/10.70838/pemj.370408>
- [25] Pan, Hui-Ling Wendy, and Wen-Yan Chen. "Unpacking the linkages between beliefs and behavioural intention for curriculum reform: A cognitive approach for school middle leaders." *Educational Management Administration & Leadership* 53, no. 6 (2025): 1467-1484. <https://doi.org/10.1177/17411432231223793>
- [26] Pang, Weina, and Zhe Wei. "Shaping the future of higher education: A technology usage study on generative AI innovations." *Information* 16, no. 2 (2025): 95. <https://doi.org/10.3390/info16020095>
- [27] Riyanda, A., N. Jalinus Ahyanuwardi, M. Sagala, and D. Rinaldi. "Digital skills and technology integration challenges in vocational high school teacher learning." *Data and Metadata* 4 (2025): 553. <https://dm.ageditor.ar/index.php/dm/article/view/553>
- [28] Saini, Manisha, Nisha Yadav, Atul Garg, Pardeep K. Ahlawat, Pankaj Kumar, and Anand Chauhan. "What influences students' perceptions towards continuance usages of e-learning platforms? Evidence from an emerging country after the COVID-19 pandemic." *International Journal of Education Economics and Development* 17, no. 1 (2026): 39-64. <https://doi.org/10.1504/IJEED.2026.150214>
- [29] Shambare, Brian, and Thuthukile Jita. "Understanding the Adoption of Virtual Labs in Rural Secondary Schools: A Descriptive Analysis of Perceived Usefulness, Ease of Use, and Behavioral Intentions." *Rural Educator* 46, no. 2 (2025): 50-67. <https://doi.org/10.55533/2643-9662.1490>
- [30] Siliņa-Jasjukeviča, Gunta, Inese Lūsēna-Ezera, Dzintra Iliško, and Svetlana Surikova. "Promoting effective vocational education and training teacher's professional development and its transfer to practice: A systematic review." *Education Sciences* 15, no. 5 (2025): 596. <https://doi.org/10.3390/educsci15050596>
- [31] Wu, J., H. Husnin, M. Mohamad, X. Jia, and Y. Zhang. "Teachers' Digital Competency in Vocational Education: A Systematic Review." *Multidisciplinary Reviews* 8, no. 10 (2025): 2025313-2025313. <https://doi.org/10.31893/multirev.2025313>
- [32] Yin, Xue, and Kun Dou. "An AI-assisted critical thinking intervention to enhance undergraduate EFL learners' writing proficiency." *Studies in Educational Evaluation* 86 (2025): 101480. <https://doi.org/10.1016/j.stueduc.2025.101480>