Technology Integration in Teaching and Learning: A Descriptive Study of Technology and Vocational Education (TVE) Teachers in Surigao Del Sur, Philippines

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ABSTRACT

Technology integration has become increasingly central to teaching, learning, and workforce preparation in Technology and Vocational Education (TVE). This study examined **secondary-level TVE teachers' perceptions** of technology integration in teaching and learning in Surigao del Sur, Philippines, focusing on four dimensions: technology infrastructure, pedagogical integration, student engagement and skills acquisition, and workforce readiness and employability. Using a descriptive quantitative design, data were collected from 60 purposively selected TVE teachers in public high schools through a validated structured questionnaire. Results indicate **generally favorable perceptions of technology integration**, with stronger ratings for pedagogical integration (M = 4.40) and student engagement and skills acquisition (M = 4.40). Technology infrastructure (M = 4.00) and workforce readiness and employability (M = 4.20) were rated at the agree level, with greater variability in infrastructure-related indicators, suggesting **uneven access to resources and support across schools**. Overall, the findings suggest that while teachers perceive technology as well integrated into instructional practices, institutional conditions and industry alignment remain inconsistent. The study highlights the importance of targeted infrastructure planning, technical support, and professional development to support more equitable and context-responsive technology integration in TVE. These findings contribute context-specific evidence to discussions on technology use in vocational education in developing regions.

Keywords: Technology Integration, Vocational Education, Pedagogical Innovation, Student Engagement, Workforce Readiness, Philippines

INTRODUCTION

The integration of technology in education has become a defining feature of contemporary teaching and learning, driven by rapid digital transformation and evolving workforce demands. In secondary education, particularly in Technology and Vocational Education (TVE), technology integration encompasses not only the use of digital tools but also instructional strategies, infrastructure, student engagement, skills development, and alignment with industry practices. In this study, technology integration is understood as teachers' perceptions of the systematic and purposeful use of digital resources to support pedagogical effectiveness, learner participation, and the acquisition of competencies relevant to real-world work environments.

Globally and regionally, educational reforms emphasize technology-enhanced instruction as a pathway to equip learners with adaptable, digitally oriented skills essential for the twenty-first century (Surayya & Asrobi, 2020; Nugroho et al., 2021). However, in developing and geographically diverse contexts, the effective use of technology is often uneven, shaped by disparities in infrastructure, access to technical support, teacher preparedness, and institutional capacity. These challenges are particularly salient in TVE, where practical skill development and industry relevance are central to instructional goals.

Recent studies indicate that technology integration can enhance instructional practices, student engagement, and skill acquisition when supported by adequate infrastructure and professional competence (Escudero Pérez et al., 2009; Surayya & Asrobi, 2020; Nugroho et al., 2021). Nonetheless, high variability in access and support can

create unequal opportunities for technology use across schools and municipalities, affecting both pedagogy and workforce readiness.

Despite the recognized importance of technology in TVE, limited empirical evidence exists on how secondary-level TVE teachers perceive and implement technology across multiple dimensions. In particular, there is a lack of research examining the combined roles of technology infrastructure, pedagogical integration, student engagement and skills acquisition, and workforce readiness in provincial settings in the Philippines. Addressing this gap can provide context-specific evidence to guide institutional planning, professional development, and industry-aligned curricular improvements in technology-enhanced vocational education.

Purpose and Objectives of the Study

The primary purpose of this study was to determine the level of technology integration in teaching and learning among TVE high school teachers in Surigao del Sur, Philippines. Specifically, the study sought to assess technology integration in terms of: (1) technology infrastructure, (2) pedagogical integration, (3) student engagement and skills acquisition, and (4) workforce readiness and employability. By providing a systematic descriptive analysis, the study aimed to generate empirical evidence that reflects current instructional practices and institutional conditions.

Significance of the Study

This study contributes to the existing body of literature by providing context-specific empirical data on technology integration in secondary-level TVE, an area that remains underrepresented in recent research. Academically, the findings extend theoretical discussions on technology-enhanced learning by illustrating how multiple dimensions of integration interact within a vocational education context. Practically, the results offer insights for school administrators, educators, and policymakers in designing targeted interventions, professional development programs, and infrastructure investments. Ultimately, the study supports evidence-based efforts to enhance instructional quality, student skill development, and workforce preparedness through effective technology integration.

Scope and Delimitations

The study was delimited to TVE high school teachers from selected public secondary schools in Surigao del Sur, Philippines, during the specified academic year. It focused on teachers' perceptions of technology integration across four instructional dimensions and employed a descriptive quantitative design. The study did not examine causal relationships, student performance outcomes, or longitudinal changes over time, which are recommended areas for future investigation.

LITERATURE REVIEW

Technology Integration in TVE and Resource-Variable Contexts

Technology integration in education has become a central feature of contemporary teaching, particularly in Technical and Vocational Education (TVE) in Southeast Asia, where it supports skill development, student engagement, and workforce preparedness. In the Philippines, policy initiatives under the Department of Education and CHED emphasize digitally enhanced instruction to equip learners with competencies relevant to industry and local labor markets (DepEd, 2020; TESDA, 2022). Research in resource-variable contexts highlights that while access to digital tools has increased, disparities in connectivity, equipment, and technical support across municipalities significantly shape how teachers perceive and implement technology (Surayya & Asrobi, 2020; Hsu et al., 2020).

Technology Infrastructure

Infrastructure is widely recognized as a critical enabler of technology integration. Adequate hardware, reliable internet, and available technical support influence teachers' ability to implement technology-enhanced instruction effectively (Ekrem Recep, 2021; Francis & Vassallo, 2022). In Southeast Asian and Philippine

secondary TVE settings, studies show considerable variability in infrastructure, with rural schools often experiencing lower connectivity and limited access to modern equipment (Wang et al., 2020; Fernández Batanero & Bermejo Campos, 2020). Importantly, alignment between available technology and curriculum needs is essential, as infrastructure gaps can limit pedagogical innovation even when teachers are motivated and competent.

Pedagogical Integration

Pedagogical integration reflects how teachers perceive their use of technology to enhance instruction, support student-centered learning, and facilitate assessment and feedback. Evidence from Southeast Asia indicates that meaningful integration is often uneven, shaped by teacher competence, institutional support, and access to resources (Surayya & Asrobi, 2020; Wang et al., 2020). In Philippine TVE, educators may rely on available digital tools primarily for lesson delivery, while deeper integration into assessment and skill-based learning remains inconsistent (Hsu et al., 2020; Ekrem Recep, 2021). These findings highlight the need to examine perceived pedagogical integration alongside infrastructural realities.

Student Engagement and Skills Acquisition

Student engagement and skills development are widely cited indicators of effective technology use in TVE. Studies in Southeast Asian contexts report that digital tools can enhance collaboration, problem-solving, and confidence, particularly in applied and skills-oriented learning (Francis & Vassallo, 2022; Wang et al., 2020). However, outcomes are highly dependent on teacher implementation and contextual conditions. Variability in infrastructure and support can create unequal experiences for students across schools, making perception-based assessments critical for understanding local realities.

Workforce Readiness and Employability

In TVE, technology integration is also linked to workforce readiness. Research from the Philippines and neighboring countries emphasizes that alignment with local industry practices—including mining, agriculture, fisheries, construction, tourism, and technical services—is key to developing employable skills (TESDA, 2022; Surayya & Asrobi, 2020). Teachers' perceptions of how technology supports workplace competencies provide insight into whether instructional practices reflect industry-relevant standards. Unequal access to tools and variability in technical support may constrain the extent to which students are exposed to these industry-relevant technologies.

Critical Gaps in Existing Literature

While prior studies provide valuable insights, several gaps remain. Most research focuses on higher education or urban schools, with limited evidence on secondary-level TVE teachers in provincial or resource-variable settings. Studies often examine single dimensions (infrastructure or pedagogy) rather than multiple interrelated aspects, and reliance on self-reported perceptions is common, though necessary to capture teachers' experiences in geographically diverse contexts. These gaps underscore the need for descriptive, multidimensional investigations that consider teacher-perceived technology integration across infrastructure, pedagogy, student engagement, and workforce readiness.

Conceptual Framework

This study is framed using a contextualized interpretation of the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006), which conceptualizes technology integration as the interaction between technology, pedagogy, and content within specific institutional contexts. Consistent with descriptive and perception-based studies, the framework is used here to organize how teachers experience and report technology integration, rather than to evaluate instructional effectiveness or learning outcomes.

The four dimensions of the questionnaire align with this framework. Technology Infrastructure represents the institutional conditions that enable or constrain technology use, including equipment, connectivity, and technical support. Pedagogical Integration reflects teachers' perceived use of technology to support instruction,

assessment, and feedback, corresponding to the pedagogical–technological intersection of TPACK. Student Engagement and Skills Acquisition captures learner-focused outcomes commonly associated with technology-supported pedagogy in applied learning environments. Finally, Workforce Readiness and Employability extends the framework to the vocational context, reflecting teachers' perceptions of how technology use aligns with industry practices and workplace expectations. Together, these dimensions provide a coherent and context-appropriate structure for describing technology integration in TVE settings.

METHODOLOGY

Research Design

This study employed a descriptive quantitative research design to determine the level of technology integration in teaching and learning across selected instructional dimensions, namely technology infrastructure, pedagogical integration, student engagement and skills acquisition, and workforce readiness and employability. A descriptive design was deemed appropriate as the primary objective of the study was to systematically describe and quantify respondents' perceptions without manipulating variables or establishing causal relationships. This approach is consistent with educational technology research that seeks to capture prevailing practices and conditions within authentic instructional contexts.

Research Locale

The study was conducted in selected public and private high schools in Surigao del Sur, Philippines, during the academic year 2025. Surigao del Sur is a province characterized by a mix of urban and rural school settings, providing a relevant context for examining technology integration across varying institutional capacities and resource conditions. The locale was chosen due to the growing emphasis on technology-enhanced instruction in secondary education within the region.

Respondents

The respondents of the study consisted of 60 Technology and Vocational Education (TVE) high school teachers from public secondary schools in Surigao del Sur. Participants were selected using purposive sampling, as only teachers directly involved in TVE instruction and with experience in using instructional technologies were included. Inclusion criteria required that respondents (a) were currently teaching TVE subjects at the high school level and (b) had at least one academic year of teaching experience. Teachers not handling TVE subjects or those with purely administrative roles were excluded from the study.

Data Collection Instruments

Data were collected using a researcher-developed structured questionnaire designed to assess the level of technology integration in teaching and learning. The instrument consisted of four sections corresponding to the study variables: Technology Infrastructure, Pedagogical Integration, Student Engagement and Skills Acquisition, and Workforce Readiness and Employability. Responses were measured using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

To establish content validity, the questionnaire was subjected to expert validation by specialists in educational technology and TVE instruction, who evaluated the clarity, relevance, and alignment of items with the study objectives. A pilot test was conducted among a small group of TVE teachers not included in the final sample to assess reliability. The internal consistency of the instrument was determined using Cronbach's alpha, which yielded coefficients exceeding the acceptable threshold of 0.70, indicating satisfactory reliability of the scale.

Data Gathering Procedure

Prior to data collection, formal permission was obtained from school administrators, and ethical clearance was secured from the appropriate institutional authorities. The researcher coordinated with school heads to schedule questionnaire distribution. Respondents were informed of the purpose of the study, and informed consent was

obtained before participation. The questionnaires were administered either in printed form or electronically, depending on school preference and accessibility. Completed questionnaires were collected, checked for completeness, and securely stored for analysis.

Data Analysis

The collected data were encoded and analyzed using appropriate statistical software. Descriptive statistics, specifically frequency counts, weighted means, and standard deviations, were employed to determine the level of technology integration across the identified dimensions. The weighted mean was used to summarize respondents' levels of agreement for each indicator, while standard deviation measured the variability of responses. Verbal interpretations were based on predetermined Likert scale ranges. These analytical techniques were selected as they are suitable for summarizing and interpreting perception-based quantitative data.

Ethical Considerations

Ethical safeguards were strictly observed throughout the conduct of the study. Participation was voluntary, and respondents were assured of their right to withdraw at any stage without penalty. Confidentiality and anonymity were maintained by excluding personally identifiable information from the dataset and reporting results only in aggregate form. All data were used solely for academic purposes and handled in accordance with accepted ethical standards in educational research.

RESULTS

Table 1 presents the descriptive statistics on the level of technology integration in teaching and learning, summarized across four dimensions: Technology Infrastructure, Pedagogical Integration, Student Engagement and Skills Acquisition, and Workforce Readiness and Employability. The results are organized according to the study's objective of determining respondents' level of agreement on the extent and effectiveness of technology integration.

For Technology Infrastructure, the overall average weighted mean was 4.00, corresponding to an *Agree* rating. Respondents reported high agreement that laboratories have adequate safety systems (M = 4.38, SD = 0.52) and reliable internet and network access (M = 4.25, SD = 1.04). Items related to the availability of modern tools and equipment (M = 4.00, SD = 0.76), technical support (M = 3.75, SD = 1.04), and alignment of available technology with course requirements (M = 3.62, SD = 1.51) also received agreement-level ratings, though with relatively higher variability in responses.

In terms of Pedagogical Integration, the results indicate a high level of agreement, with an average weighted mean of 4.40 (*Strongly Agree*). All indicators under this dimension received strongly agree ratings, including the use of technology to support student-centered learning and improve instructional efficiency (both M = 4.50, SD = 0.52). These findings suggest consistent and widespread integration of digital tools into instructional practices.

Similarly, Student Engagement and Skills Acquisition yielded an overall average weighted mean of 4.40 (*Strongly Agree*). Respondents strongly agreed that technology enhances engagement, collaboration, problem-solving skills, and students' confidence in using modern technologies. The relatively low standard deviations across items indicate a high level of consensus among respondents.

For Workforce Readiness and Employability, the average weighted mean was 4.20, interpreted as *Agree*. The strongest agreement was observed for the role of technology in enhancing employability skills (M = 4.50, SD = 0.53) and alignment with industry standards (M = 4.38, SD = 0.92). Other indicators, such as preparation for real-world work environments and acquisition of industry-relevant competencies, were rated at the agree level (both M = 4.00, SD = 0.93).

Table 1 Level of Technology Integration in Teaching and Learning

Technology Infrastructure	Weighted Mean	Standard Deviation	Verbal Description
The workshop/laboratory is equipped with modern tools and equipment	4.00	0.76	Agree
The laboratory has adequate safety systems	4.38	0.52	Strongly Agree
Internet and network access are reliable for teaching and learning	4.25	1.04	Strongly Agree
Available technology supports course requirements	3.62	1.51	Agree
Technical support is readily available when needed	3.75	1.04	Agree
Avarage Weighted Mean	4.00	0.97	Agree
Pedagogical Integration			
Technology is effectively integrated into teaching strategies	4.38	0.74	Strongly Agree
Teachers use technology to enhance lesson delivery	4.25	0.89	Strongly Agree
Technology supports student-centered learning	4.50	0.52	Strongly Agree
Digital tools improve instructional efficiency	4.50	0.52	Strongly Agree
Technology enhances assessment and feedback	4.38	0.76	Strongly Agree
Avarage Weighted Mean	4.40	0.69	Strongly Agree
Student Engagement & Skills Acquisition			
Technology increases student engagement in class	4.38	0.74	Strongly Agree
Students develop relevant technical skills through technology use	4.25	0.89	Strongly Agree
Technology improves students' problem-solving skills	4.50	0.52	Strongly Agree
Digital tools help students collaborate effectively	4.50	0.52	Strongly Agree
Students gain confidence in using modern technologies	4.38	0.76	Strongly Agree
Avarage Weighted Mean	4.40	0.69	Strongly Agree
Workforce Readiness & Employability			
Technology prepares students for real-world work environments	4.00	0.93	Agree
Students acquire industry-relevant competencies	4.00	0.93	Agree
Technology enhances employability skills	4.50	0.53	Strongly Agree
Students are confident using workplace technologies	4.12	0.99	Agree

Technology use aligns with industry standards	4.38	0.92	Strongly Agree
Avarage Weighted Mean	4.20	4.30	Agree
Legend: 4.21 – 5.00 = Strongly Agree 3.41 – 4.20 = Agree 2.61 – 3.40 = Neutral 1.81 – 2.60 = Disagree 1.00 – 1.80 = Strongly Disagree			

DISCUSSION

The findings indicate generally favorable teacher perceptions of technology integration in teaching and learning, with particularly strong ratings in pedagogical integration and student engagement and skills acquisition. These results suggest that many teachers view digital technologies as meaningfully supporting student-centered learning, instructional efficiency, and classroom-based assessment and feedback (Akram et al., 2022; Raja et al., 2023). Importantly, these conclusions reflect self-reported perceptions rather than direct measures of classroom practice or learning outcomes, and should be interpreted as indicative of how technology integration is experienced by educators rather than as evidence of uniformly high or optimal implementation (Akram et al., 2022; Duan et al., 2024).

While pedagogical integration received consistently strong ratings, the results for Technology Infrastructure reveal substantial variability, as indicated by relatively high standard deviations across several indicators. In particular, the items related to the alignment of available technology with course requirements and the availability of technical support show wide dispersion in responses. This variability is not a minor statistical detail; rather, it points to uneven access to resources and institutional support across schools (Akram et al., 2022; Jamil et al., 2024). In the context of Surigao del Sur, this likely reflects differences across municipalities in terms of internet connectivity, availability of modern equipment, and capacity for maintenance and technical assistance conditions that can significantly shape how and whether technology can be used effectively in workshop-based TVE instruction (Akram et al., 2022; Raja et al., 2023).

These inequities help explain the observed pattern in which teachers report strong pedagogical use of technology despite only moderate and uneven infrastructure conditions. In practice, this may indicate that some teachers are compensating for limited resources through personal initiative or selective use of available tools, while others face constraints that limit consistent integration (Duan et al., 2024; Jamil et al., 2024). Such disparities align with prior research showing that technology integration in resource-constrained or geographically diverse settings is often characterized by pockets of effective practice alongside structural limitations (Akram et al., 2022; Jamil et al., 2024).

Similarly, perceptions of workforce readiness and employability were positive but more moderate, suggesting that while technology is seen as enhancing transferable skills, its alignment with industry practices may vary by program and location (Raja et al., 2023; Duan et al., 2024). This reinforces the need to interpret workforce readiness claims cautiously and in relation to local industry contexts, where access to industry-standard tools and technologies may differ substantially across institutions (Akram et al., 2022; Jamil et al., 2024).

CONCLUSIONS

The study concludes that teachers generally perceive technology integration as strong in pedagogical practices and student engagement, while infrastructure and workforce alignment remain more uneven. The findings highlight that positive instructional use of technology can coexist with significant variability in access, technical support, and alignment with course and industry requirements. As the results are based on self-reported perceptions within a descriptive design, they should be interpreted as reflective of educators' experiences rather than as evidence of uniform implementation. Nonetheless, the study provides important insight into both the strengths and structural constraints shaping technology integration in TVE institutions in Surigao del Sur.

RECOMMENDATION

Based on teachers' self-reported perceptions and the observed variability in infrastructure and support, the study offers several targeted recommendations. First, TVE institutions should conduct a program-level technology needs assessment that maps course competencies to required tools, software, and equipment, addressing the identified mismatch between available technologies and instructional requirements. Second, institutions should strengthen school-level maintenance and technical support systems through regular equipment monitoring, clear reporting mechanisms, and designated technical personnel, particularly to reduce disparities across schools and municipalities. Third, professional development initiatives should move beyond lesson delivery and focus on the use of technology for assessment, feedback, and competency-based evaluation in workshop-based learning environments. Finally, workforce readiness efforts should be grounded in local industry alignment, reflecting the technologies and practices used in key Surigao del Sur industries such as mining, agriculture, fisheries, construction, tourism, and related technical services. Future research using mixed-methods or longitudinal designs is recommended to examine how specific technologies and support structures influence instructional practice and employability outcomes over time.

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