

Teaching in the Digital Age: Perspectives of Technical-Vocational Livelihood Senior High School Teachers

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Publication Date: 2026/08/03

Abstract: This phenomenological study explored the experiences, coping mechanisms, and educational management insights of Senior High School teachers who integrate technology into the delivery of Technical-Vocational Livelihood (TVL) education in the digital age. Using a qualitative approach, the study employed purposive sampling in selecting ten (10) Senior High School teachers assigned to teach the Technical -Vocational-Livelihood (TVL) strand in the Sta. Maria West District, Division of Davao Occidental. Three major themes emerged regarding teachers' experiences: emphasizing learners' autonomy and the application of skills, adopting a contextualized, practical approach to learning delivery, and integrating industry-based technologies. Coping mechanisms included engaging in peer mentoring and collaborative learning communities, accessing self-directed online learning, and fostering a resilient growth mindset. Meanwhile, educational management insights highlighted the importance of intensifying infrastructure support, strengthening teacher capacity building, and implementing effective monitoring and evaluation systems. The findings underscore the transformative potential of educational technology to enhance technical-vocational education when supported by adequate infrastructure, continuous professional development, and strategic leadership. This study offered a foundation for more inclusive, adaptive, and future-ready TVL education in the Philippines.

Keywords: Digital Age; Perspectives; Technical-Vocational Livelihood; Senior High School Teachers.

How to Cite: Rodel M. Ladeza (2026) Teaching in the Digital Age: Perspectives of Technical-Vocational Livelihood Senior High School Teachers. *International Journal of Innovative Science and Research Technology*, 11(7), 1193-1211. <https://doi.org/10.38124/ijisrt/26jul1547>

I. INTRODUCTION

➤ Background of the Study

In today's fast-paced and technology-driven world, integrating digital tools into education has become essential, particularly for Technical-Vocational Livelihood (TVL) teachers who prepare learners for the modern workforce. As industries continue to adopt advanced technologies, TVL education must also evolve to remain relevant. Although digital tools can improve vocational learning and student engagement, many teachers continue to face challenges such as limited resources, inadequate training, and insufficient infrastructure. Addressing these concerns is vital to ensure that TVL graduates are equipped with the skills needed for future employment and to prevent a growing gap between education and industry demands.

Globally, TVL educators encounter similar barriers in technology integration. In the United States, limited professional development reduces teachers' ability to effectively use digital tools in vocational instruction (Johnson et al., 2021). Australia continues to experience disparities in technology access between urban and rural schools (Smith & Watson, 2022), while outdated infrastructure limits digital

integration in vocational institutions in the United Kingdom (Thompson & Green, 2023). In the Philippines, insufficient government funding, institutional support, and the persistent digital divide further hinder the effective integration of technology into technical-vocational education (Cruz, 2024).

Despite increasing attention to technology integration, several research gaps remain. Existing studies often treat the TVL track as a single group, overlooking the unique technological needs of specific strands and the realities of rural and remote schools. Research also highlights differences in teachers' digital competence, with older educators generally requiring greater training and support than younger teachers (Dioquino & Paglinawan, 2024; Culajara et al., 2023; Abella & Dela Rosa, 2023). Moreover, there is a lack of longitudinal studies examining the long-term effects of technology integration on students' vocational skills and employment readiness.

Current implementation issues further emphasize these gaps. The digital divide affects both teachers and learners, while studies such as Ayson et al. (2024) focus primarily on experienced educators in Ilocos Sur, limiting their applicability to other regions, particularly underserved areas

like Mindanao. Additionally, existing research gives limited attention to institutional factors, including leadership, policy implementation, resource allocation, and students' responses to technology. Many schools also continue to use outdated equipment, and resistance to technological change among some educators remains a challenge (Cabaron, 2023). Although initiatives such as DepEd's Digital Rise Program promote ICT integration, implementation remains inconsistent across regions.

In Davao Occidental, technology integration has shown progress but continues to face significant challenges. Arellano and Lumogdang (2025) found that while schools commonly use laptops, desktop computers, printers, USB drives, and speakers, these technologies have not yet produced the expected improvements in instructional practices. Although the Department of Education continues to pursue digital transformation, sustained investment in infrastructure, teacher training, and curriculum alignment with industry standards remains necessary. This study therefore seeks to examine how TVL teachers integrate technology into their teaching, identify the challenges they encounter, and generate evidence that can guide context-specific policies and interventions to strengthen TVL education and workforce readiness in Davao Occidental.

➤ Research Questions

In line with the purpose of exploring the strategies of teachers integrating technology on teaching technical-vocational livelihood in the classroom including the coping mechanisms with the challenges that they encountered, this study specifically sought answers to the following research questions:

- What are the experiences of teachers integrating technology in teaching technical-vocational livelihood in the classroom?
- How do teachers cope with the challenges integrating technology in teaching technical-vocational livelihood in the classroom?
- What insights can be drawn on integrating technology in teaching technical-vocational livelihood in the classroom?

➤ Theoretical Lens

This study was anchored on the Technological Pedagogical Content Knowledge (TPACK) Framework of Mishra and Koehler (2006), which explains that effective technology integration requires teachers to combine Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). For TLE educators, balancing these three domains enables the meaningful use of digital tools to enhance teaching, student engagement, and learning outcomes rather than complicate instruction (Koehler & Mishra, 2009). The study was also supported by Vygotsky's (1978) Social Constructivism, which emphasizes collaborative and hands-on learning, allowing students to build knowledge through technology such as virtual simulations and augmented reality while receiving appropriate guidance within the Zone of Proximal Development (ZPD).

Additionally, Kolb's (1984) Experiential Learning Theory reinforces the importance of learning through experience, a core principle of vocational education. Technology supports this approach by providing simulated learning environments, AI-powered feedback, and digital portfolios that allow students to safely develop practical skills before applying them in real-world settings. Together, these theories provide a comprehensive framework for understanding and improving technology integration in TLE education while preparing students with the competencies required for the modern workforce.

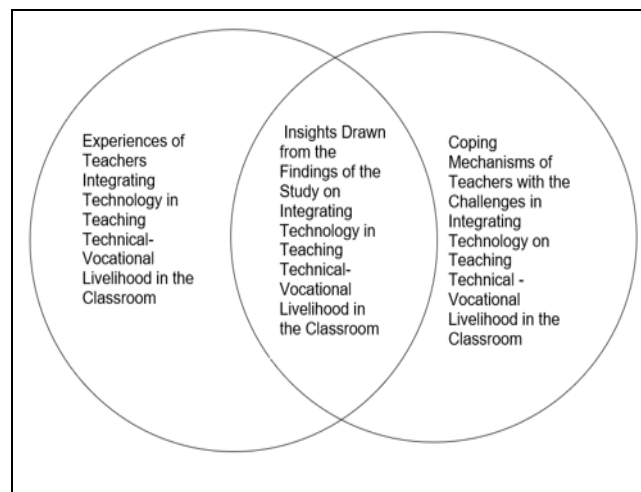


Fig 1 Conceptual Framework of the Study

II. METHOD

➤ Design and Procedure

This study employed a qualitative phenomenological research design to explore the lived experiences of Senior High School TVL teachers in integrating technology into their teaching practices. Phenomenology focuses on understanding participants' subjective experiences and how they make sense of a phenomenon (Qutoshi, 2021). Data were gathered primarily through in-depth interviews, guided by open-ended questions that explored teachers' perceptions, challenges, benefits, and strategies in using digital tools. Where necessary, structured questionnaires with open-ended responses were also utilized to collect rich qualitative data from participants who were difficult to reach (Delve & Limpaecher, 2022).

The data were analyzed using the phenomenological process of horizontalization, where significant statements were identified, coded, and organized into themes to develop textual and structural descriptions of teachers' experiences. This interpretive approach emphasizes depth over breadth, considering not only participants' responses but also their expressions and perspectives. Through systematic coding and thematic analysis, the study aimed to provide a comprehensive understanding of how TVL teachers experience, interpret, and implement technology in their instructional practices.

➤ Research Participants

This study involved ten (10) purposively selected Senior High School TVL teachers from the Sta. Maria West District, Division of Davao Occidental. Participants met the following criteria: at least three (3) years of service in the Department of Education (DepEd), a Teacher I–III plantilla position, a Very Satisfactory performance rating for the past three consecutive years, and openness to both male and female teachers. Purposive sampling was used to select teachers with relevant experience in integrating technology into TVL instruction, enabling the collection of rich and meaningful data (Nikolopoulou, 2023).

Among the participants, six (6) were engaged in in-depth interviews (IDI), while four (4) participated in a focus group discussion (FGD). They were selected based on their teaching experience and demonstrated use of digital tools and strategies in the classroom. This sampling approach is widely recognized for generating in-depth qualitative insights (Albacete & Banhaw, 2019; Nikolopoulou, 2023) and enabled the study to examine the opportunities and challenges of technology integration in TVL education, providing evidence to support improved teaching practices, school support systems, and policy development.

➤ Research Instrument

To ensure the credibility, transferability, and dependability of the study, multiple qualitative data collection methods were employed, including audiotaped in-depth interviews (IDIs), focus group discussions (FGDs), peer debriefing, and field notes. Six participants took part in non-structured IDIs guided by open-ended questions, while four participated in FGDs to encourage shared and diverse perspectives on technology integration in TVL instruction. The data were triangulated through peer debriefing and field notes to strengthen the trustworthiness of the findings. These methods are supported by Fuster-Guillén (2019), Stewart and Shamdasani (2019), and Krueger and Casey (2020), who emphasize their effectiveness in capturing participants' lived experiences and collective insights.

➤ Data Analysis

The qualitative data gathered from Senior High School TVL teachers were analyzed using thematic analysis following Creswell's (2012, as cited in Chali, Eshete, & Debela, 2022) theme-identification approach. The process began with familiarization through repeated reading of interview and focus group discussion transcripts, followed by systematic coding of meaningful responses. Related codes were then grouped into themes that reflected the teachers' experiences, challenges, and perspectives on technology integration in TVL instruction.

The identified themes were reviewed, refined, clearly defined, and supported with participants' direct quotations and relevant literature to ensure accuracy and coherence. This rigorous analytical process provided a comprehensive understanding of technology integration in the Sta. Maria West District and generated findings that can inform instructional improvement, policy development, and future research in TVL education.

➤ Framework Analysis

This study employed framework analysis to examine the qualitative data gathered from Senior High School TVL teachers in the Sta. Maria West District, Division of Davao Occidental. As an approach designed for applied research, framework analysis provides a systematic yet flexible process for identifying themes and generating findings that can inform educational practice and policy. Guided by the stages outlined by Fuchs (2023) and Goldsmith (2021), the analysis involved organizing interview and focus group discussion data, coding significant ideas, and grouping related concepts into overarching themes.

The identified themes were reviewed for credibility through data triangulation, peer debriefing, and validation against existing literature. Finally, participants' narratives were integrated with relevant studies and presented through thematic summaries, matrices, and diagrams to clearly illustrate the opportunities and challenges of technology integration in TVL instruction. As emphasized by Ritchie and Spencer (1994, as cited in Goldsmith, 2021), framework analysis requires systematic, reflective, and rigorous engagement with qualitative data to ensure trustworthy findings.

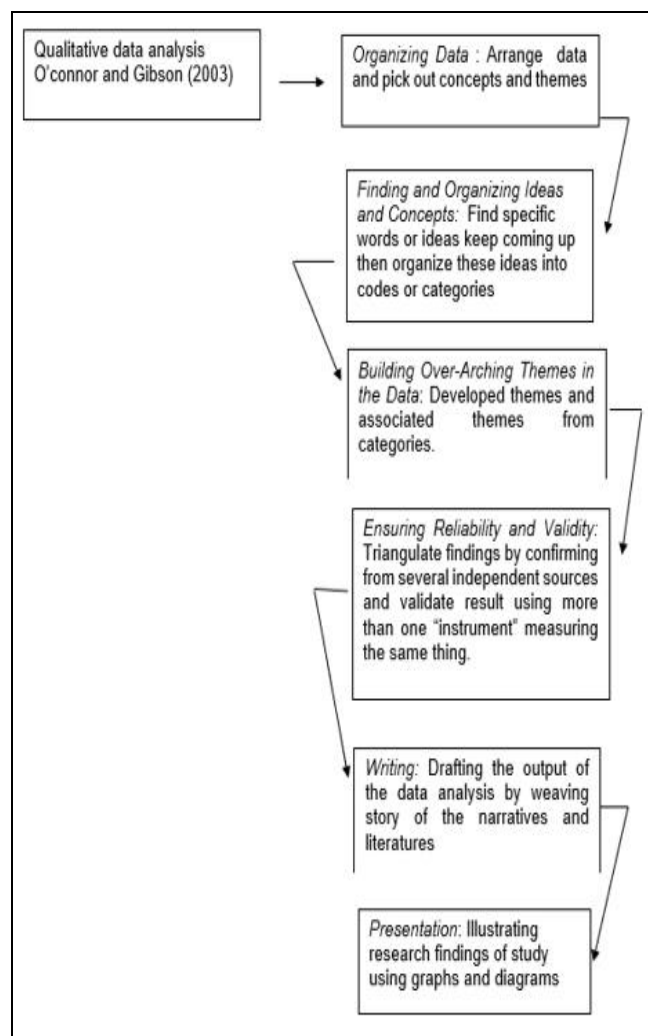


Fig 2 Analytical Framework of the Study

III. RESULTS AND DISCUSSION

➤ *Experiences of Teachers Integrating Technology in Teaching Technical-Vocational Livelihood in the Classroom*

- *Emphasizing Learners' Autonomy and Skills Application*

The findings highlight that integrating technology into the teaching of Technical-Vocational Livelihood (TVL) subjects strengthens learner autonomy and the practical application of skills. TVL teachers emphasized that digital tools enable students to take greater responsibility for their learning, complete tasks independently, and apply acquired competencies in authentic, real-world contexts. These findings are consistent with Velasco and Abad (2023), who reported that video tutorials, online simulations, and digital assessment tools promote self-paced learning, mastery, and skill retention. Similarly, Gonzales and Javier (2022) found that asynchronous digital platforms, such as learning management systems and simulation applications, provide learners with opportunities for repeated practice, which is essential in technical-vocational fields. These insights were reflected in the teachers' narratives on promoting learner autonomy and skills application.

"Sa aking pagtuturo ng TVL gamit ang teknolohiya, binibigyan ko ang mga estudyante ng mas maraming kontrol sa kanilang pag-aaral. Halimbawa, sa halip na sundin lang ang isang step-by-step na tutorial, hinahayaan ko silang magsaliksik ng iba't ibang paraan para makumpleto ang isang gawain gamit ang mga online resources. Ang pagbibigay sa kanila ng autonomy na ito ay nakakatulong para maging mas responsable sila sa kanilang pagkatuto at mahasa ang kanilang problem-solving skills." (*"In my TVL teaching using technology, I give students more control over their learning. For example, instead of just following a step-by-step tutorial, I let them research different ways to complete a task using online resources. Giving them this autonomy helps them become more responsible for their learning and sharpens their problem-solving skills."*) (P1)

"Nakita ko na mas natututo ang mga estudyante kapag nakikita nila ang direktang aplikasyon ng kanilang mga natutunan sa tunay na mundo. Kaya naman, gumagamit ako ng mga online platforms kung saan pwede silang bumuo ng kanilang sariling mga proyekto na may practical na gamit, tulad ng paggawa ng e-commerce site para sa kanilang small business simulation o kaya ay pagdidisenyo ng layout ng isang bahay gamit ang software. Ang pagbibigay sa kanila ng pagkakataong i-apply ang kanilang skills sa mga makatotohanang proyekto ay nagpapalakas ng kanilang motivation at pag-unawa." (*"I've seen that students learn better when they see the direct application of what they've learned in the real world. That's why I use online platforms where they can develop their own projects with practical uses, such as creating an e-commerce site for their small business simulation or designing a house layout using software. Giving them the opportunity to apply their skills in realistic projects boosts their motivation and understanding."*) (P8)

As I analyzed the narration from the experiences of teachers, Teacher P1 emphasized student autonomy by allowing them to explore diverse methods using online resources, fostering responsibility and problem-solving skills. In contrast, Teacher P8 focused on enhancing learning through practical applications, utilizing online platforms for real-world projects like e-commerce sites and architectural design, which boosted motivation and deeper understanding.

The participants' responses during the discussion inferred the same theme. Participants quoted:

"Para mas mahasa ang kanilang critical thinking at decision making skills, binibigyan ko sila ng mga open-ended na mga problema o case studies na may kaugnayan sa kanilang TVL specialization at hinahayaan ko silang gumamit ng teknolohiya para maghanap ng solusyon. Halimbawa, sa culinary arts, pwede silang mag-research ng iba't ibang recipe at mag-analyze kung alin ang pinaka-angkop para sa isang tiyak na okasyon. Ang ganitong uri ng gawain ay nagtuturo sa kanila kung paano maging independent thinkers at kung paano gamitin ang teknolohiya bilang kasangkapan sa paglutas ng problema." (*"To further hone their critical thinking and decision-making skills, I give them open-ended problems or case studies related to their TVL specialization and let them use technology to find solutions. For example, in culinary arts, they can research different recipes and analyze which one is most suitable for a specific occasion. This kind of activity teaches them how to be independent thinkers and how to use technology as a tool for problem-solving."*) (P9)

It could be gleaned from the responses of the teachers' realization that technology held significant value in cultivating critical thinking and decision-making skills among TVL students. By presenting open-ended problems and case studies relevant to their specializations, and by encouraging the use of technology for research and solution-finding, students were empowered to become independent thinkers.

This corroborates Dela Cruz and Molina (2023) found that TVL teachers who used industry-aligned performance tasks saw marked improvement in students' problem-solving and independent thinking skills.

Teachers also noted that digital learning has made it easier to implement competency-based assessment, where students demonstrate mastery through skill application rather than traditional tests (Villanueva & Ramos, 2020). This shift fosters deeper understanding and prepares learners for national certifications like TESDA NC II.

- *Adopting Contextualized and Practical Learning Delivery*

The findings indicate that Senior High School TVL teachers increasingly adopt contextualized and practical learning by aligning instruction with students' real-life experiences, local contexts, and future employment needs. Lessons are contextualized using local labor market demands and community resources, making learning more relevant and applicable (Santos & Dela Cruz, 2022). In addition, digital technologies such as AutoCAD, TinkerCAD, and

virtual kitchen simulations enable students to develop technical skills despite limited access to physical laboratories (Alvarez & Mendoza, 2023). These practices were reflected in the participants' responses during the interviews.

"Kapag gumagamit ako ng teknolohiya sa TVL, palagi kong tinitiyak na ang mga aktibidad ay konektado sa realidad ng aming komunidad at sa mga industriya. Halimbawa, kung nagtuturo ako ng welding, pinapakita ko ang mga video ng mga aktuwal na proyekto sa mga local construction sites o kaya ay iniimbitahan ko ang mga eksperto mula sa mga welding shops dito para magbahagi ng kanilang karanasan gamit ang video conferencing. Ang pag-uugnay ng teknolohiya sa aming lokal na konteksto ay nagpapamalas sa mga estudyante ng tunay na aplikasyon ng kanilang mga pinag-aaralan." (*"When I use technology in TVL, I always make sure that the activities are connected to the reality of our community and the industries. For example, if I'm teaching welding, I show videos of actual projects in local construction sites or I invite experts from welding shops here to share their experiences via video conferencing. Connecting technology to our local context shows the students the real-world application of what they're learning."*) (P2)

"Para mas maging praktikal ang pag-aaral, gumagamit ako ng mga online platforms na nagbibigay ng virtual work experience o kaya ay mga simulation ng mga real-world na trabaho sa TVL. Halimbawa, sa tourism operations, maaaring silang gumamit ng virtual tour software para 'makapagtrabaho' bilang isang tour guide. Ang ganitong uri ng teknolohiya ay nagbibigay sa kanila ng hands-on na karanasan kahit nasa loob lang sila ng classroom, na naghahanda sa kanila para sa aktwal na trabaho." (*"To make learning more practical, I use online platforms that provide virtual work experience or simulations of real-world jobs in TVL. For example, in tourism operations, they might use virtual tour software to 'work' as a tour guide. This kind of technology gives them hands-on experience even while they're just inside the classroom, which prepares them for actual work."*) (P3)

Analysis of the teachers' narratives revealed that both Teacher P2 and Teacher P3 emphasized connecting technology-integrated TVL instruction with real-world applications. Teacher P2 contextualized learning by showcasing local projects and engaging industry experts through video conferencing, while Teacher P3 provided authentic learning experiences through virtual work simulations and online platforms that replicated real workplace environments. These practices align with Rivera and Castillo (2021), who emphasized the value of industry partnerships in contextualizing learning, and Domingo and Navarro (2020), who highlighted the effectiveness of blended learning in enabling students to apply technical skills through flexible and technology-supported instruction. Another participant expressed a similar perspective.

"Ang paghahanap ng mga learning resources online na akma sa aming kultura at mga lokal na materyales ang isa sa aking mga estratehiya. Kung nagtuturo ako ng food

processing, hinahanap ko ang mga online recipes na gumagamit ng mga lokal na prutas o gulay at pinapagawa ko sila ng digital recipe book. Ang pagsasama ng teknolohiya sa paggamit ng aming sariling mga produkto at kultura ay nagpapatibay ng kanilang pagmamalaki sa aming heritage habang natututo ng mga bagong skills." (*"Finding learning resources online that are relevant to our culture and local materials is one of my strategies. If I'm teaching food processing, I look for online recipes that use local fruits or vegetables and have them create a digital recipe book. Integrating technology with the use of our own products and culture strengthens their pride in our heritage while learning new skills."*) (P5)

The findings showed that teachers strategically use technology to connect TVL learning with local culture and community resources. By incorporating online materials featuring indigenous ingredients and local products into activities such as digital recipe books, teachers enhanced students' practical skills while fostering cultural appreciation. This approach is complemented by capstone projects that require learners to apply multiple competencies in developing functional products or services, preparing them for entrepreneurial and workplace settings (Lim & Torres, 2023). Furthermore, practical learning activities are aligned with TESDA NC II assessment standards to strengthen students' competencies and improve their employability (Lorenzo & Mercado, 2021).

• Integrating Industry-Based Technologies

The findings indicate that integrating industry-based technologies has become an essential practice in Senior High School TVL instruction, ensuring that learning remains aligned with current labor market demands and industry standards. TVL teachers increasingly utilize tools such as CNC simulators, 3D printing technologies, automotive diagnostic software, Adobe Creative Suite, AutoCAD, and Microsoft Office Specialist (MOS) applications to provide authentic, skills-based learning experiences and improve students' employability (Santos & Magtibay, 2021; Reyes & Bautista, 2022). These findings were further supported by the participants' responses during the in-depth interviews.

"Mahalagang maipakita sa mga estudyante ang mga teknolohiyang ginagamit sa aktwal na industriya. Kaya naman, gumagamit ako ng mga video mula sa mga lokal na kumpanya na nagpapakita ng kanilang mga proseso at kagamitan, tulad ng mga modernong makinarya sa food processing plants o kaya ay ang pinakabagong software sa mga graphic design studios dito sa lungsod. Ang pagpapakita ng mga ito ay nagbibigay sa kanila ng ideya kung ano talaga ang naghahintay sa kanila pagkatapos nilang magtapos." (*"In my TVL teaching, it's important to show students the technologies used in the actual industries. That's why I use videos from local companies showing their processes and equipment, such as modern machinery in food processing plants or the latest software in graphic design studios here in the city. Showing these gives them an idea of what really awaits them after they graduate."*) (P4)

"Para mas maging pamilyar ang mga estudyante sa mga kasangkapang ginagamit sa industriya, sinisikap kong gumamit ng mga simulation software o kaya ay mga virtual reality applications na gayang-gaya ang mga ito. Halimbawa, sa automotive servicing, maaaring silang gumamit ng VR para 'makapag-assemble' ng isang makina. Ang ganitong uri ng teknolohiya ay nagbibigay sa kanila ng hands-on na karanasan sa paggamit ng mga komplikadong kagamitan nang hindi nangangailangan ng aktuwal na hardware sa simula." (*"To make students more familiar with the tools used in the industry, I try to use simulation software or virtual reality applications that closely resemble them. For example, in automotive servicing, they might use VR to 'assemble' an engine. This kind of technology gives them hands-on experience in using complex equipment without needing the actual hardware at the beginning."*) (P6)

Upon analyzing the participants' narratives, it became evident that both teachers intentionally incorporated industry-relevant technologies to narrow the gap between classroom instruction and actual workplace practices. One teacher introduced students to authentic industry processes and equipment through visual resources obtained from local businesses, while the other enhanced learning through virtual tools and digital simulations that replicated real work environments. These findings are consistent with Lopez and Mariano (2023), who reported that virtual simulations in welding, electronics, and cosmetology effectively compensate for limited access to physical equipment. Likewise, Torres and Dela Peña (2020) emphasized that partnerships with local industries help teachers update training modules based on current industry standards, while Fernandez and Yu (2023) highlighted that blended and asynchronous learning resources further strengthen TVL instruction by providing students with flexible access to industry-based skills training. Another participant shared a similar perspective.

"Ang isa sa mga paraan ko para maisama ang industry-based technologies ay ang pag-imbata ng mga guest speakers mula sa iba't ibang industriya na magbahagi ng kanilang kaalaman at ipakita ang mga teknolohiyang ginagamit nila sa kanilang trabaho gamit ang online platforms. Ang direktang pakikinig mula sa mga propesyonal ay nagbibigay sa mga estudyante ng mas malalim na pag-unawa sa kahalagahan ng mga skills na kanilang pinag-aaralan at kung paano ito ginagamit sa totoong mundo." (*"One of my ways to integrate industry-based technologies is by inviting guest speakers from different industries to share their knowledge and showcase the technologies they use in their work using online platforms. Hearing directly from professionals gives students a deeper understanding of the importance of the skills they are learning and how they are used in the real world."*) (P7)

"Para mas maging relevant ang kanilang pag-aaral, pinapagawa ko sa mga estudyante ang paggawa ng mga proyekto na kahawig ng mga aktuwal na produkto o serbisyo sa industriya. Halimbawa, sa graphic design, maaaring silang gumawa ng mock-up ng isang marketing campaign para sa isang lokal na negosyo. Ang paggamit ng mga digital tools

na karaniwang ginagamit sa industriya sa mga ganitong proyekto ay naghahanda sa kanila para sa mga kahilingan ng kanilang propesyon sa hinaharap." (*"To make their learning more relevant, I have students create projects that resemble actual products or services in the industry. For example, in graphic design, they might create a mock-up of a marketing campaign for a local business. Using digital tools commonly used in the industry for these projects prepares them for the demands of their future professions."*) (P10)

The analysis of the narratives of Teacher P7 and Teacher P10 revealed a shared goal of aligning TVL instruction with current industry practices through different instructional approaches. Teacher P7 enriched learning by inviting industry professionals to conduct virtual talks and demonstrations, giving students direct exposure to workplace technologies and practices. In contrast, Teacher P10 emphasized experiential learning by engaging students in industry-based projects, such as developing marketing campaigns for local businesses using professional digital tools. These practices are supported by Villanueva and Santos (2021), who highlighted the role of public-private partnerships in strengthening teachers' competencies in emerging technologies, and by Garcia and Lim (2024), who noted that specialized training in technologies such as programmable logic controllers (PLC) and the Internet of Things (IoT) broadens teachers' technical capabilities.

Overall, the findings revealed three major themes: (1) *emphasizing learners' autonomy and skills application*, (2) *adopting contextualized and practical learning delivery*, and (3) *integrating industry-based technologies*. The first theme demonstrates how technology promotes independent, hands-on learning through simulations and virtual environments, allowing students to practice skills safely and repeatedly (Domingo, 2024). The second highlights the importance of contextualizing instruction through digital tools that reflect authentic workplace situations, supported by continuous teacher training (Arban et al., 2024). The third theme underscores the value of exposing students to industry-standard technologies, with interactive digital tools improving technical competencies and preparing learners for employment in modern industries (Alarcon et al., 2024).

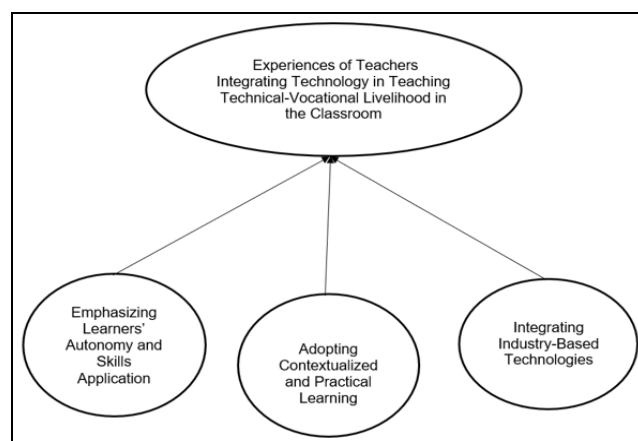


Fig 3 Emerging Themes on the Experiences of Teachers Integrating Technology in Teaching Technical-Vocational Livelihood in the Classroom

➤ *Coping Mechanisms with the Challenges of Teachers Encountered in Integrating Technology in Teaching Technical-Vocational Livelihood in the Classroom*

• *Using Peer Mentoring and Collaborative Learning Communities*

One of the key coping strategies adopted by TVL teachers is peer mentoring and participation in collaborative learning communities, which provide technical support, practical demonstrations, and opportunities to exchange effective digital teaching practices. These informal support systems help teachers develop instructional materials, solve technology-related challenges, and strengthen their readiness to integrate digital tools, particularly in schools with limited formal training and resources (Santos & Dela Cruz, 2020; Reyes & Tamayo, 2021). The importance of peer mentoring and collaborative learning was consistently reflected in the participants' interview responses.

"Isa sa mga unang hamon ko ay ang kakulangan ng sapat na kaalaman sa ilang mga digital tools na kailangan sa TVL. Ang ginawa ko, nakipag-partner ako sa isang mas batang guro sa ICT na mas bihasa sa mga ito. Nagkaroon kami ng peer mentoring sessions kung saan tinuruan niya ako ng mga basics at advanced techniques. Bukod dito, sumali rin ako sa isang online community ng mga TVL teachers sa buong Pilipinas kung saan kami nagbabahagi ng mga tips at resources sa paggamit ng teknolohiya sa aming mga klase. Malaking tulong ang collaborative learning na ito para malampasan ko ang aking mga kakulangan." (*"One of my initial challenges was the lack of sufficient knowledge in some digital tools needed for TVL. What I did was partner with a younger ICT teacher who is more skilled in these. We had peer mentoring sessions where he taught me the basics and advanced techniques. Aside from that, I also joined an online community of TVL teachers across the Philippines where we share tips and resources on using technology in our classes. This collaborative learning was a big help in overcoming my shortcomings."*) (P1)

"Ang iba't ibang antas ng digital literacy ng aking mga estudyante. Ang ginawa ko, bumuo ako ng mga peer mentoring groups sa loob ng klase. Ang mga estudyanteng mas marunong sa teknolohiya ay tinutulongan ang kanilang mga kaklaseng nahihirapan. Nagbibigay din ako ng blended learning activities kung saan may mga online tasks na pwedeng gawin sa bahay at face-to-face sessions para sa mga praktikal na skills. Ang pagtutulongan ng mga estudyante at ang pagkakaroon ng iba't ibang paraan ng pag-aaral ay nakatulong para mas maging inclusive ang paggamit ng teknolohiya." (*"The varying levels of digital literacy among my students. What I did was form peer mentoring groups within the class. Students who are more knowledgeable in technology help their classmates who are struggling. I also provide blended learning activities where there are online tasks that can be done at home and face-to-face sessions for practical skills. The collaboration among students and having different learning modalities helped make the use of technology more inclusive."*) (P6)

The participants' narratives revealed that Participant 1 enhanced his digital teaching skills by seeking guidance from a younger ICT teacher and actively participating in an online community of TVL educators to exchange knowledge and best practices. Meanwhile, Participant 6 addressed differences in students' digital literacy by organizing peer mentoring groups and integrating blended learning activities that encouraged collaboration and inclusive participation. These experiences highlight the value of peer support and collaborative learning in strengthening digital competence among both teachers and learners. These findings are supported by Delos Santos and Yu (2023), who found that collaborative learning communities help reduce the stress associated with adopting new technologies, and by Torres and Mejia (2023), who emphasized that peer-led learning sessions foster reflective practice, resource sharing, and the effective implementation of blended learning. A similar pattern was evident in the succeeding participants' responses.

"Minsan, mahirap humanap ng mga digital resources na direktang akma sa aming TVL specialization, lalo na yung may kinalaman sa mga lokal na industriya. Ang ginawa ko, nakipag-ugnayan ako sa ibang mga TVL teachers sa mga kalapit na paaralan dito sa rehiyon. Nagbuo kami ng isang collaborative learning community kung saan kami nagbabahagi ng mga links, learning materials, at kahit mga sarili naming ginawang digital content na relevant sa aming konteksto. Ang pagtutulongan namin ay nakatulong nang malaki sa pagpapayaman ng aming mga resources." (*"Sometimes, it's hard to find digital resources that directly fit our TVL specialization, especially those related to local industries. What I did was connect with other TVL teachers in nearby schools here in the region. We formed a collaborative learning community where we share links, learning materials, and even our own created digital content that is relevant to our context. Our collaboration has greatly helped in enriching our resources."*) (P10)

The responses above revealed that the challenge of finding relevant digital resources for their TVL specialization, particularly those related to local industries in the region, was addressed by proactively connecting with other TVL teachers in nearby schools to form a collaborative learning community for sharing links, materials, and self-created digital content.

Furthermore, Garcia and Lazo (2022) highlighted that these learning communities often lead to the development of grassroots innovation, where teachers co-create solutions such as low-cost alternatives to industry-based technologies or contextualized modules aligned with technological standards.

In many schools, peer mentors emerge as "tech champions" who guide colleagues through digital transitions, thus fostering sustainability in tech integration (Lopez & Mendoza, 2023).

• *Accessing Self-Directed Online Learning*

The findings revealed that self-directed online learning is a key coping strategy adopted by TVL teachers to keep

pace with technological advancements. Teachers actively enroll in free or low-cost online courses through platforms such as Coursera, DepEd Commons, and the TESDA Online Program to enhance their knowledge of industry-based technologies, including AutoCAD, Adobe Suite, and learning management systems. These findings are consistent with Santos and Rivera (2021), who reported that many TVL teachers independently develop their technological and pedagogical competencies through MOOCs, webinars, video tutorials, and other online learning platforms due to limited formal training opportunities. Likewise, Garcia and Martinez (2022) emphasized that this practice reflects a shift toward self-directed professional growth, with teachers taking greater responsibility for continuously improving their digital competencies. This theme was evident in the participants' interview responses.

"Nakitang hamon ay ang pananatiliing interesado at motivated ang mga estudyante sa online learning, lalo na kapag may mga technical issues o kaya ay distractions sa bahay. Ang ginawa ko, nag-design ako ng mga learning modules na may malinaw na layunin at may choice sila sa kung paano nila gustong kumpletuhin ang mga gawain. Binibigyan ko rin sila ng regular feedback at kinikilala ko ang kanilang progreso para mapanatili ang kanilang engagement." (*"I encountered was keeping students interested and motivated in online learning, especially when there are technical issues or distractions at home. What I did was design learning modules with clear objectives and give them a choice in how they want to complete the tasks. I also provide regular feedback and acknowledge their progress to maintain their engagement."*) (P2)

"Ang iba't ibang bilis ng pagkatuto ng mga estudyante ay isa ring konsiderasyon sa online learning. Para matugunan ito, gumamit ako ng mga online resources na may iba't ibang antas ng kahirapan at nagbigay ako ng mga optional enrichment activities para sa mga gustong mas matuto pa. Hinikayat ko rin silang magtakda ng sarili nilang learning goals at subaybayan ang kanilang progreso gamit ang digital tools. Ang pagbibigay sa kanila ng kontrol sa kanilang learning pace ay nakatulong para mas maging epektibo ang kanilang pag-aaral." (*"The different learning paces of students are also a consideration in online learning. To address this, I used online resources with varying levels of difficulty and provided optional enrichment activities for those who want to learn more. I also encouraged them to set their own learning goals and track their progress using digital tools. Giving them control over their learning pace helped make their learning more effective."*) (P3)

Analysis of the participants' narratives showed that Participant 2 sustained students' interest in online learning by designing modules with clear objectives, providing learners with task options, and offering regular feedback and recognition of their progress. Meanwhile, Participant 3 addressed differences in students' learning pace by using online resources with varying levels of difficulty and providing optional enrichment activities. These practices demonstrate how teachers foster self-directed learning while accommodating learners' diverse needs. These findings are

consistent with Lopez and Tan (2023), who noted that platforms such as Coursera, DepEd Commons, and Google Workspace for Education enable teachers to access digital simulations, design software, and industry-specific applications. Likewise, Morales and Bautista (2023) emphasized that these platforms provide practical, strand-specific learning opportunities for TVL teachers. The participants' responses further illustrate how self-directed online learning serves as an effective strategy for addressing the challenges of technology integration.

"Ang kakulangan ng face-to-face interaction ay isa pang hamon. Para dito, regular akong nag-schedule ng online synchronous sessions para sa mga discussions at Q&A. Gumamit din ako ng collaborative online platforms kung saan pwede silang magtulungan sa mga proyekto at magbahagi ng kanilang mga ideya. Ang pagpapalakas ng kanilang online interaction ay nakatulong para mabawasan ang pakiramdam ng pagiging isolated at mapahusay ang kanilang communication skills." (*"The lack of face-to-face interaction is another challenge. For this, I regularly scheduled online synchronous sessions for discussions and Q&A. I also used collaborative online platforms where they could help each other with projects and share their ideas. Strengthening their online interaction helped reduce feelings of isolation and enhance their communication skills."*) (P5)

"Ang pagtiyak na may access ang lahat sa teknolohiya at internet ay isang malaking isyu dito sa Davao. Ang ginawa ko, naghanap ako ng mga alternative learning modalities tulad ng offline resources at printed materials para sa mga walang stable internet. Para sa mga may access, hinimok ko silang gamitin ang mga online resources nang responsable at maging proactive sa paghahanap ng mga karagdagang materyales na makakatulong sa kanilang pag-aaral. Ang pagiging adaptable at resourceful ay mahalaga para matiyak na walang maiiwan sa online learning." (*"Ensuring that everyone has access to technology and the internet is a big issue here in Davao. What I did was look for alternative learning modalities such as offline resources and printed materials for those without stable internet. For those with access, I encouraged them to use online resources responsibly and be proactive in finding additional materials that can help their learning. Being adaptable and resourceful is important to ensure that no one is left behind in online learning."*) (P7)

Participant 5 addressed the challenge of limited face-to-face interaction in online learning by regularly scheduling synchronous online sessions for discussions and Q&A, and by utilizing collaborative online platforms to facilitate teamwork and idea sharing. Participant 7, acknowledging the significant issue of unequal access to technology and internet in Davao City, coped by seeking alternative learning modalities such as offline resources and printed materials for those with unstable internet.

This deals with the idea of According to Almonte and Yu (2020), self-directed online learning fosters reflective teaching practices and empowers teachers to troubleshoot

their own technical challenges, which is particularly vital in remote or hybrid learning environments.

Many teachers report that engaging in online tutorials and tech forums enhances their confidence in using applications like Canva, Arduino, or TLE-related design tools (Villanueva & Ramos, 2021).

- *Fostering Resilient Growth Mindset*

A resilient growth mindset has emerged as a critical coping mechanism for Technical-Vocational Livelihood (TVL) teachers as they navigate the challenges of integrating technology in the classroom.

The foregoing results of the study were consistent with the findings of the study made by according teachers who exhibit a growth mindset defined by the belief that abilities can be developed through dedication and effort are more likely to persist in the face of technological difficulties and continuously seek ways to improve their instruction (Dweck, 2020; Reyes & Alipio, 2022).

This mindset fosters resilience, enabling educators to overcome limited digital infrastructure, lack of formal training, and resistance to change (Santos & De Leon, 2021).

- ✓ *The Participants Revealed:*

"Noong una akong nagsimulang gumamit ng teknolohiya sa TVL, maraming beses akong nahirapan. May mga pagkakataong hindi gumana ang software o kaya ay nagkaroon ng technical issues sa gitna ng klase. Imbes na panghinaan ng loob, itinuring ko ang bawat pagkabigo bilang isang pagkakataon para matuto. Nag-research ako online, nagtanong sa mga kasamahan, at sinubukan ko ulit hanggang sa magawa ko. Ang mindset ko ay 'hindi pa ako marunong nito ngayon, pero matututunan ko rin.'" (*"When I first started using technology in TVL, I struggled many times. There were instances when the software wouldn't work or there were technical issues in the middle of class. Instead of getting discouraged, I treated each failure as an opportunity to learn. I researched online, asked colleagues, and tried again until I succeeded. My mindset is 'I don't know how to do this yet, but I will learn.'"*) (P4)

"Ang mabilis na pagbabago ng teknolohiya ay isa talagang hamon. Parang kailangan mong palaging mag-aral ng mga bagong apps at platforms. Ang paraan ko para makayanan ito ay ang pagiging open-minded at pagtanggap sa ideya na ang pag-aaral ay isang tuloy-tuloy na proseso. Regular akong naghahanap ng mga libreng online courses at webinars para manatiling updated. Ang mindset ko ay 'hindi ako dapat matakot sa bago; dapat ko itong yakapin para mas mapabuti ang aking pagtuturo.'" (*"The rapid change in technology is a real challenge. It feels like you always need to learn new apps and platforms. My way of coping with this is by being open-minded and accepting the idea that learning is a continuous process. I regularly look for free online courses and webinars to stay updated. My mindset is 'I shouldn't be afraid of the new; I should embrace it to further improve my teaching.'"*) (P8)

Both Participants 4 and 8 demonstrated a growth mindset in addressing technological challenges in TVL teaching. Participant 4 viewed technical difficulties as learning opportunities through research and collaboration, while Participant 8 emphasized open-mindedness and continuous learning to adapt to technological changes. This supports Manalo and Guevarra (2023) and Baluyot and Domingo (2022), who noted that teachers with a growth mindset actively explore digital tools, engage in self-training, attend webinars, and collaborate with peers to strengthen their digital skills. The same theme emerged as participants highlighted the importance of fostering a growth mindset in overcoming technological challenges. One participant stated:

"Ang kakulangan ng sapat na resources o kaya ay ang mabagal na internet connection ay talagang nakakapagod minsan. Pero ang natutunan ko, kailangan kong maging mapamaraan at mag-focus sa kung ano ang kaya kong kontrolin. Nag-explore ako ng mga offline apps at alternative ways para magamit ang teknolohiya kahit limitado ang resources. Ang mindset ko ay 'may mga hadlang, pero hahanap ako ng paraan para malampasan ito. Ang mahalaga ay patuloy kaming natututo.'" (*"The lack of sufficient resources or the slow internet can be really tiring sometimes. But what I've learned is that I need to be resourceful and focus on what I can control. I explored offline apps and alternative ways to use technology even with limited resources. My mindset is 'there are obstacles, but I will find a way to overcome them. What's important is that we continue learning.'"*) (P9)

Insufficient resources and slow internet connectivity challenge technology integration; however, teachers demonstrate a resilient growth mindset by exploring offline applications, alternative strategies, and resourceful approaches. Navarro and Tan (2023) emphasized that teachers' belief in their ability to adapt plays a vital role in successful technology integration, while Villanueva and Ramos (2024) noted that embracing failure as a learning opportunity helps teachers manage challenges and create engaging technology-based lessons.

The identified coping mechanisms include peer mentoring and collaborative learning communities, self-directed online learning, and fostering a resilient growth mindset. Peer collaboration allows teachers to share expertise and address technology-related concerns, supported by Bhat (2023) and Lim (2021), who highlighted the value of professional development and communities of practice. Self-directed online learning reflects teachers' initiative to enhance their digital skills through accessible resources, tutorials, and courses. Meanwhile, a resilient growth mindset enables teachers to view technological challenges as opportunities for continuous improvement, fostering flexibility and adaptability in technology integration (Flores & Mendoza, 2023).

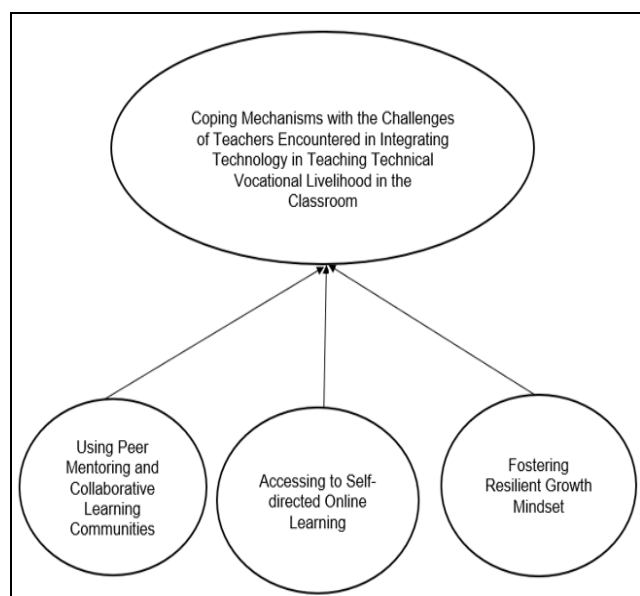


Fig 4 Emerging Themes on the Coping Mechanisms with the Challenges of Teachers Encountered in Integrating Technology in Teaching Technical-Vocational Livelihood in the Classroom

➤ *Educational Management Insights Drawn from the Findings of the Study on Integrating Technology in Teaching Technical-Vocational Livelihood*

• *Intensifying Infrastructure Support*

A critical insight highlights the need for educational managers to strengthen digital infrastructure and provide accessible technological resources for teachers and learners. Limited internet connectivity, outdated equipment, insufficient hardware, and unstable power supply continue to hinder effective technology integration in TVL education. Studies revealed that the lack of industry-aligned tools, such as laptops, smart devices, and specialized equipment, restricts teachers' ability to create authentic digital learning experiences (Cruz & Malabanan, 2020; Pascual & Reyes, 2021). Furthermore, inadequate internet access and unreliable power supply affect synchronous learning and technology-based instruction, especially in remote schools (Tolentino & Perez, 2022; Rivera & San Pedro, 2020; De Vera & Santiago, 2023). Some participants emphasized the importance of strengthening infrastructure support, stating that:

"Ang isa sa pinakamalaking realisasyon ko habang isinasama ang teknolohiya sa TVL ay ang kritikal na papel ng imprastruktura. Sa aming paaralan, limitado ang access sa maaasahang internet at hindi lahat ng estudyante ay may sariling device. Natanto ko na hindi sapat na basta ipakilala ang mga digital tools; kailangan ding tiyakin na mayroong sapat na suporta sa imprastruktura para magamit ito nang epektibo ng lahat." ("One of my biggest realizations while integrating technology in TVL is the critical role of infrastructure. In our school, access to reliable internet is limited and not all students have their own devices. I realized that it's not enough to just introduce digital tools; we also need to ensure that there is sufficient infrastructure support for everyone to use them effectively.") (P1)

"Napansin ko na kapag mas may kumpiyansa at kaalaman ang mga guro sa paggamit ng teknolohiya, mas nagiging malikhain sila sa kanilang pagtuturo at mas nakakapagdisenyo sila ng mga engaging learning activities. Halimbawa, kung marunong ang guro gumamit ng video editing software, makakapagpagawa siya sa mga estudyante ng mga instructional videos para sa kanilang mga proyekto sa TVL. Ang resulta, mas nagiging hands-on at mas natututo ang mga estudyante sa pamamagitan ng paggawa mismo. Ang competence ng guro sa teknolohiya ay direktang nakakaapekto sa kalidad ng pagtuturo at sa learning outcomes ng mga estudyante." ("I've noticed that when teachers are more confident and knowledgeable in using technology, they become more creative in their teaching and can design more engaging learning activities. For example, if a teacher knows how to use video editing software, they can have students create instructional videos for their TVL projects. As a result, students become more hands-on and learn better by doing. The teacher's competence in technology directly affects the quality of teaching and the learning outcomes of the students.") (P8)

P1 emphasized that adequate infrastructure, including reliable internet connectivity and sufficient devices, is essential for effective technology integration in TVL education. Meanwhile, P8 highlighted the importance of teachers' technological competence and confidence in developing creative instructional strategies, engaging activities, and meaningful hands-on learning experiences for students.

However, even with available infrastructure, the absence of ICT personnel and technical support services remains a challenge, as teachers often handle both teaching and technical responsibilities, causing stress and reduced efficiency (Garcia & Almonte, 2021). Therefore, educational leaders must prioritize sustainable infrastructure planning, budget allocation, laboratory upgrades, and the establishment of e-learning support systems to strengthen technology integration (Lorenzo & Salazar, 2023). The need for stronger infrastructure support was further emphasized by participants during the discussion, as reflected in the following remarks:

"Ang pangangailangan para sa patuloy na professional development para sa mga guro sa TVL tungkol sa teknolohiya. Mabilis ang pagbabago ng teknolohiya, at kung hindi tayo magsasabay, maiiwan tayo. Ang pagkakaroon ng regular na training at workshops tungkol sa mga bagong digital tools at kung paano ito isasama sa aming mga TVL specialization ay mahalaga para mapahusay ang aming kakayahan." ("The need for continuous professional development for TVL teachers regarding technology. Technology changes rapidly, and if we don't keep up, we'll be left behind. Having regular training and workshops about new digital tools and how to integrate them into our TVL specializations is crucial to enhance our skills.") (P9)

The participant emphasized the importance of continuous professional development for TVL teachers to keep pace with rapid technological advancements. Regular training and workshops on emerging digital tools and their

application in TVL specializations are essential in strengthening teachers' technological competence. Additionally, school leaders should promote digital equity by ensuring students have access to learning technologies at home or through community learning centers (Velasco & Domingo, 2024). Building partnerships with industries and technology providers can also help address resource gaps by providing equipment and digital platforms relevant to vocational education (Alcantara & Ramos, 2022).

- *Strengthening Teacher Capacity Building*

The study highlighted the importance of continuous professional development that addresses the digital needs of TVL teachers. Since many teachers encounter challenges in using advanced software and technology tools, sustained training, coaching, and hands-on learning opportunities are necessary to strengthen their competence. Findings align with Cruz and Dela Peña (2021) and Aquino and Salazar (2022), who emphasized that effective training should extend beyond basic ICT skills to include digital pedagogy and specialization-specific applications. Without targeted capacity building, available technologies may remain underutilized. Moreover, integrating blended learning, simulations, and industry-based technologies can promote innovative teaching practices and enhance student engagement (Reyes & Medina, 2020; Lorenzo & Tan, 2023). Participants further emphasized the importance of teacher capacity building, as reflected in the following statements:

"Ang isa sa pangunahing realisasyon ko sa paggamit ng teknolohiya sa TVL ay ang pangangailangan para sa tuloy-tuloy na paglinang ng aming sariling kakayahan bilang mga guro. Hindi sapat na alam lang namin ang aming specialization; kailangan din naming maging bihasa sa iba't ibang digital tools at platforms. Napagtanto ko na kapag mas may kumpiyansa ako sa paggamit ng teknolohiya." (*"One of my main realizations in using technology in TVL is the need for continuous capacity building for us teachers. It's not enough that we just know our specialization; we also need to be skilled in various digital tools and platforms. I realized that when I am more confident in using technology."*) (P2)

"Nakita ko na ang kakayahan ng guro sa paggamit ng teknolohiya ay direktang nakakaapekto sa kung gaano kahanda ang mga estudyante para sa kanilang propesyon pagkatapos ng senior high. Kung tinuturuan namin sila gamit ang mga napapanahong software at online resources na ginagamit din sa industriya, mas nagiging kompetitive sila at mas madali silang makakahanap ng trabaho o makakapagsimula ng sarili nilang negosyo." (*"I've seen that the teacher's ability to use technology directly affects how prepared students are for their profession after senior high. If we teach them using up-to-date software and online resources that are also used in industries, they become more competitive and can find jobs or start their own businesses more easily."*) (P3)

Participant 2 emphasized the continuous need for teachers to enhance their digital skills beyond their TVL specialization, highlighting that technological confidence promotes more innovative and effective teaching practices.

Meanwhile, Participant 3 stressed that teachers' technological competence directly influences students' career readiness by enabling them to use industry-relevant software and online resources, making graduates more competitive in employment and entrepreneurship.

The use of micro-credentialing platforms, webinars, and online professional learning communities further strengthens teacher capacity, particularly in areas with limited access to face-to-face training (Velasco & Jimenez, 2023; Miranda & Chavez, 2021). Educational leaders should support these initiatives by providing time, resources, and opportunities for continuous learning. Furthermore, capacity-building programs should be data-driven, utilizing classroom observations, teacher feedback, and student performance results to develop responsive and personalized professional growth plans (Bautista & Mallari, 2020). The same theme emerged during the FGD as participants shared the following insights:

"Ang isa pang realisasyon ko ay ang pagiging mahalaga ng suporta mula sa school administration sa pagpapalakas ng kapasidad ng mga guro sa teknolohiya. Ang pagkakaroon ng regular na training, access sa mga technical support, at pagbibigay ng mga kinakailangang kagamitan ay malaking tulong para sa amin. Kapag suportado kami, mas nagiging motivated kaming mag-explore at mag-integrate ng teknolohiya sa aming pagtuturo, na siyang nagpapabuti sa learning experience ng mga estudyante sa TVL." (*"Another realization I had is the importance of support from the school administration in strengthening teachers' capacity in technology. Having regular training, access to technical support, and the provision of necessary equipment are a big help for us. When we are supported, we become more motivated to explore and integrate technology in our teaching, which in turn improves the learning experience of TVL students."*) (P7)

"Napagtanto ko rin na ang pagbabahagi ng kaalaman at best practices sa paggamit ng teknolohiya sa pagitan ng mga guro sa TVL ay napakahalaga. Sa pamamagitan ng mga learning action cell (LAC) sessions o kaya ay mga online communities, natututo kami sa isa't isa kung paano mas epektibong magagamit ang iba't ibang digital tools sa aming mga specific na specialization. Ang pagtutulungan naming ito ay nakakatulong para mas mapataas ang pangkalahatang competence namin sa teknolohiya at mas mapabuti ang learning outcomes ng aming mga estudyante." (*"I also realized that sharing knowledge and best practices in using technology among TVL teachers is very important. Through learning action cell (LAC) sessions or online communities, we learn from each other on how to use different digital tools more effectively in our specific specializations. This collaboration helps to increase our overall competence in technology and further improve the learning outcomes of our students."*) (P10)

Participant 7 emphasized the vital role of school administration support through regular training, technical assistance, and necessary equipment in empowering teachers to effectively integrate technology. Conversely, Participant

10 highlighted the significant value of peer collaboration and knowledge sharing among TVL teachers via platforms like LAC sessions or online communities as a means to collectively improve their technological competence and, consequently, student learning outcomes.

Educational managers are encouraged to institutionalize mentorship programs and communities of practice that support peer learning and experience-sharing among TVL educators (Santos & Rivera, 2022). These systems foster a collaborative culture and improve teacher confidence in adopting emerging tools.

Teacher participation in digital training should be reinforced through incentives, career progression opportunities, and formal recognition (Gonzales & Torres, 2024). A well-supported teacher is more likely to sustain innovation in the classroom.

• *Implementing Monitoring and Evaluation Systems*

Educational leaders should establish effective monitoring and evaluation systems to assess the impact of technology integration in TVL education. These systems should measure teacher competency development and student learning outcomes through digital assessments and feedback mechanisms. Data-driven evaluation allows school heads to identify gaps, improve programs, and provide targeted support. Santos and Ilagan (2021) emphasized that regular monitoring of classroom technology use helps administrators align strategies with teachers' actual needs, while learning analytics tools can further identify student and teacher development needs (Delos Reyes & Ubaldo, 2023). Some participants shared their insights regarding the importance of monitoring and evaluation:

"Ang pangangailangan ng maayos na sistema para masubaybayan at matasa ang epekto ng teknolohiya sa pag-aaral ng mga estudyante sa TVL. Hindi sapat na basta gamitin ang teknolohiya; kailangan nating malaman kung talagang nakakatulong ba ito sa kanilang pag-unawa at paglinang ng skills. Sa pamamagitan ng regular na online quizzes, digital portfolios, at feedback surveys, mas nakikita namin kung saan sila nahihirapan at kung anong mga teknolohiya ang pinaka-epektibo sa pagtuturo ng aming mga TVL specialization." (*"One important realization I had is the need for a good system to monitor and evaluate the impact of technology on the learning of TVL students. It's not enough to just use technology; we need to know if it's really helping their understanding and skill development. Through regular online quizzes, digital portfolios, and feedback surveys, we can better see where they are struggling, and which technologies are most effective in teaching our TVL specializations."*) (P4)

"Napansin ko na kapag mayroon kaming structured na paraan para sukatin ang competence ng mga guro sa paggamit ng teknolohiya, mas nagiging motivated silang pagbutihin ang kanilang mga kasanayan. Ang pagkakaroon ng rubrics para sa pagtatasa ng kanilang paggamit ng digital tools sa pagtuturo at ang pagbibigay ng constructive feedback ay nakakatulong sa kanila na matukoy ang kanilang

strengths at areas for improvement." (*"I've noticed that when we have a structured way to measure teachers' competence in using technology, they become more motivated to improve their skills. Having rubrics for assessing their use of digital tools in teaching and providing constructive feedback helps them identify their strengths and areas for improvement."*) (P5)

The responses emphasized the importance of monitoring and evaluation systems in assessing the effectiveness of technology integration in TVL education. Participant 4 highlighted the need for systematic evaluation tools, such as online quizzes, digital portfolios, and feedback surveys, to measure the impact of technology on students' learning and skills development. Participant 5 stressed that structured assessments of teachers' technological competence through rubrics and constructive feedback encourage continuous improvement.

Effective monitoring systems should also incorporate feedback from teachers, students, and school leaders to guide policy improvement and resource allocation (Fernandez & Lopez, 2020). Additionally, digital platforms such as Google Classroom, Moodle, and LMS dashboards provide real-time data on participation, submissions, and content engagement, supporting timely instructional interventions in TVL classes (Dela Cruz & Ramos, 2022). One participant stated:

"Ang kahalagahan ng pagkakaroon ng mekanismo para mangolekta ng feedback mula sa mga estudyante tungkol sa kanilang karanasan sa paggamit ng teknolohiya sa TVL. Ang kanilang mga pananaw ay mahalaga para malaman kung ano ang gumagana at kung ano ang hindi. Sa pamamagitan ng online surveys at open forums, nakakakuha kami ng mahalagang impormasyon na tumutulong sa amin na i-adjust ang aming mga estratehiya sa pagtuturo gamit ang teknolohiya para mas matugunan ang kanilang mga pangangailangan." (*"The importance of having a mechanism to collect feedback from students about their experience using technology in TVL. Their perspectives are valuable in knowing what works and what doesn't. Through online surveys and open forums, we get important information that helps us adjust our teaching strategies using technology to better meet their needs."*) (P6)

The study highlighted the importance of gathering feedback from TVL students regarding their experiences with technology integration. Through online surveys and open forums, teachers can identify effective practices and areas for improvement, allowing them to refine technology-enhanced instruction based on students' needs. Aligning monitoring and evaluation (M&E) systems with national standards and performance indicators also improves the reliability of data, while standardized rubrics and documentation help track progress and guide teacher development (Morales & Aquino, 2020; Padilla & Vega, 2021).

Based on the participants' responses, three major themes emerged: intensifying infrastructure support, strengthening teacher capacity building, and implementing

monitoring and evaluation systems. Infrastructure support serves as the foundation for successful technology integration by ensuring reliable internet connectivity, functional devices, and appropriate digital platforms. Without adequate resources, innovative approaches such as blended and modular learning may face significant limitations (Flores & Mendoza, 2023).

Strengthening teacher capacity building addresses the need for continuous professional development in technology use and pedagogical integration. Teachers must be equipped with skills in using digital tools, creating technology-based learning materials, and assessing student performance in technology-enhanced environments. Adequate support services and training opportunities help teachers become more confident and effective in delivering TVL instruction (Alarcon et al., 2024).

Lastly, implementing monitoring and evaluation systems ensures that technology integration is effective and sustainable. Regular assessment of technology use, student outcomes, and teacher challenges enables educational leaders to make informed decisions, improve programs, and allocate resources strategically. These systems ensure that technology investments contribute to meaningful improvements in TVL education (Lim, 2021).

delivery, and integrating industry-based technologies. These themes are supported by TPACK, Constructivist Learning Theory, and Kolb's Experiential Learning Theory, emphasizing the importance of purposeful technology use, authentic learning experiences, and exposure to real-world tools to enhance students' technical skills and career readiness.

The study also identified three coping mechanisms used by teachers in addressing technology integration challenges: peer mentoring and collaborative learning communities, self-directed online learning, and fostering a resilient growth mindset. These strategies allow teachers to strengthen their technological competence, learn from shared experiences, continuously improve their practices, and adapt to technological changes through reflection and experimentation.

Furthermore, three educational management insights emerged: intensifying infrastructure support, strengthening teacher capacity building, and implementing monitoring and evaluation systems. Adequate resources enable effective technology integration, continuous professional development enhances teacher competence, and systematic evaluation ensures that technology initiatives remain responsive, sustainable, and aligned with the needs of TVL education.

➤ Future Directions

Drawing from the findings of this study on technology integration in TVL education, several future directions are proposed to strengthen digital learning practices and provide sustainable support for teachers and learners. These recommendations are anchored on the experiences, coping strategies, and insights of TVL teachers in overcoming challenges and maximizing the benefits of technology-enhanced instruction.

Learners should actively engage with industry-based technologies and digital resources to develop workplace-ready skills. They are encouraged to practice independent learning, utilize available online tools, and provide feedback to help improve technology-supported learning experiences.

Teachers should pursue continuous professional development focused on emerging technologies, digital pedagogy, and industry-aligned applications. Collaboration through peer mentoring, learning communities, and a resilient growth mindset can help teachers overcome challenges and enhance their technological competence.

Parents and school administrators should work together to support students' digital learning needs. Administrators must prioritize infrastructure development, provide updated resources, strengthen teacher capacity-building programs, and establish monitoring systems to ensure effective technology integration in TVL classrooms.

DepEd officials should create flexible policies, increase support for TVL technology infrastructure, and strengthen partnerships with industries to align learning experiences with workplace demands. Meanwhile, future researchers

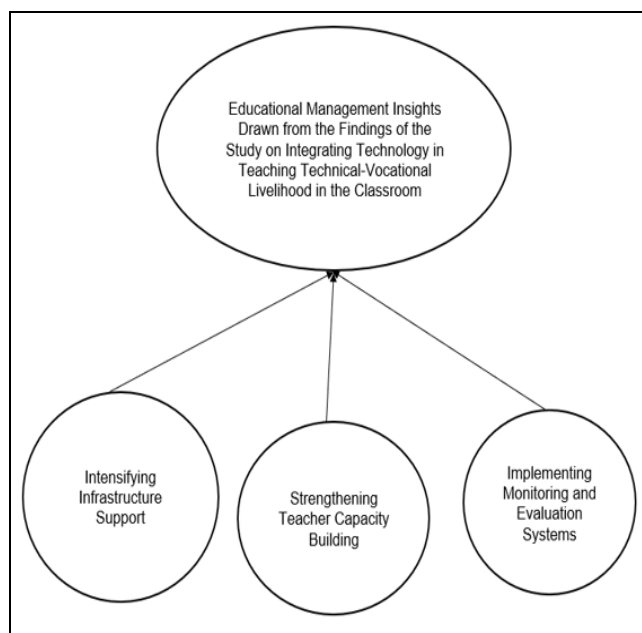


Fig 5 Emerging Themes on the Educational Management Insights Drawn from the Findings of the Study on Integrating Technology in Teaching Technical-Vocational Livelihood in the Classroom

IV. IMPLICATIONS AND FUTURE DIRECTIONS

➤ Implications

The study revealed three major themes regarding teachers' experiences in integrating technology in TVL classrooms: promoting learner autonomy and skills application, adopting contextualized and practical learning

should further examine the long-term effects of technology integration on students' employability, skills development, and sustainable practices in TVL education.

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