IJGGSD
ISSN: 3155-7716
International Journal of Global Goals and Sustainable Development
RESEARCH | INNOVATION | INCLUSION | SUSTAINABLE FUTURES
DOI: https://doi.org/10.65339/ijggsd.V1.I1.43

Integration of Digital Tools in TVL Instruction and Its Influence on Students' Skill Development

Babie Jane Revecoy , LPT
Master of Arts in Vocational Education, Cebu Technological University - Main Campus, Cebu City, Philippines

Email: brevecoy@gmail.com

ABSTRACT

This study examined the integration of digital tools in Technical-Vocational-Livelihood (TVL) instruction and its relationship with students' skill development in selected public Senior High Schools in Cebu Province and Cebu City during School Year 2025–2026. A descriptive-correlational research design was employed involving 202 Grade 11 and Grade 12 TVL students from three schools. Data were collected using a researcher-made questionnaire and analyzed through frequency, percentage, weighted mean, and Pearson correlation. Digital tool integration was rated Integrated (M = 3.50), with multimedia presentations obtaining the highest mean (3.56) and online learning platform lowest (3.41). Students' skill development was rated Developed (M = 3.52), with digital literacy ranking highest (3.65) and problem-solving lowest (3.41). Significant positive relationships were reported between interactive digital applications and problem-solving skills (r = 0.5047), multimedia presentations and digital literacy (r = 0.4872), and online learning platforms and problem-solving skills (r = 0.4222). The findings indicate that digital tool integration is associated with specific competencies rather than uniformly across all skill-development dimensions. TVL teachers should prioritize competency-aligned digital applications while maintaining guided hands-on activities through the proposed TVL Digital Integration Enhancement Guide. The study's reliance on self-reported data from three schools and its correlational design limit generalizability and causal interpretation. Nevertheless, the findings provide evidence for improving technology-supported vocational instruction, advancing educational sustainability under SDG 4 (Quality Education), and supporting employability-related competencies aligned with SDG 8 (Decent Work and Economic Growth).

Keywords: *Digital Literacy, Digital Tools, Instructional Integration, Skill Development, Sustainable Education, Technical-Vocational Education*

1. INTRODUCTION

Technical-Vocational-Livelihood (TVL) education prepares Senior High School students for employment, entrepreneurship, and further education through the development of practical and technical competencies. The increasing integration of digital technologies into vocational instruction provides opportunities to enhance instructional delivery, learner engagement, and skill development. The Organization for Economic Co-operation and Development (OECD, 2023a) emphasized that digital technologies, including simulations and interactive learning resources, can support innovation in vocational education when combined with appropriate pedagogical practices. Similarly, UNESCO (2023) recognized the potential of educational technology to improve access to learning resources while emphasizing the importance of equity, relevance, and teacher preparedness. In the Philippines, the Basic Education Development Plan 2030 promotes improvements in educational quality and learning opportunities (Department of Education, 2022). The National Technical Education and Skills Development Plan 2023–2028 likewise emphasizes relevant competencies, lifelong learning, and workforce readiness in response to technological changes (Technical Education and Skills Development Authority [TESDA], 2023). Consistent with these priorities, this study examines the integration of digital tools in TVL instruction and its relationship with students' skill development in selected public Senior High Schools in Cebu Province and Cebu City. The findings serve as the basis for developing a TVL Digital Integration Enhancement Guide.

Research Problem

Teachers Digital technologies have expanded opportunities for instructional demonstrations, collaborative activities, online learning, and competency development. However, their educational value depends on effective implementation and accessibility. Othman et al. (2025) identified digital inequality, curriculum alignment, and inadequate digital competencies among the major challenges affecting digitalization in technical and vocational education. Similarly, Deschênes et al. (2024) emphasized the importance of providing relevant digital learning resources and support for vocational educators. UNESCO (2023) further cautioned that technology integration must be appropriate to learners' needs and educational contexts. Recent studies have examined the relationship between digital technologies and vocational learning. Toroba and Tagadiad (2024) investigated self-directed learning, self-regulation, and digital competence among Filipino Senior High School TVL students. Magdato (2024) examined self-video instruction in food-processing education, illustrating the relevance of digital instructional materials to practical training, although the study did not establish significant pretest-to-posttest performance improvement. Meanwhile, Zhang et al. (2024) identified relationships among digital technology usage, learning experiences, engagement, and satisfaction among higher vocational students. These studies highlight the importance of examining specific learning outcomes rather than assuming that technology use automatically produces better performance. Despite these developments, a localized assessment is needed to determine how digital tools are integrated into TVL instruction and how their use relates to different dimensions of students' skill development. This study addresses this concern by examining multimedia presentations, online learning platforms, digital learning resources, and interactive digital applications in relation to practical skills, problem-solving, creativity and innovation, collaboration and teamwork, and digital literacy among TVL students in selected public Senior High Schools in Cebu Province and Cebu City during School Year 2025–2026.

Assumptions of the Study

The study assumes that digital tools can provide supplementary opportunities for TVL students to access learning materials, observe technical procedures, participate in interactive activities, and develop relevant competencies when appropriately integrated into instruction. This assumption is consistent with OECD (2023a), which identified the potential contribution of digital

technologies to vocational teaching and learning. However, their effectiveness may vary according to instructional design, teacher preparedness, available resources, and learner accessibility (UNESCO, 2023; Othman et al., 2025). The study further assumes that students' reported experiences can provide information about the level of digital tool integration and their perceived skill development. The relationship between these variables is examined through a descriptive-correlational approach. The null hypothesis states that there is no significant relationship between the integration of digital tools in TVL instruction and students' skill development.

Objectives of the Study

The study aimed to determine the integration of digital tools in TVL instruction and its relationship with students' skill development in selected public Senior High Schools in Cebu Province and Cebu City during School Year 2025–2026. Specifically, it sought to describe the respondents' profiles in terms of age, sex, grade level, and school; identify the commonly used digital tools in TVL instruction; determine the level of digital tool integration in terms of multimedia presentations, online learning platforms, digital learning resources, and interactive digital applications; assess students' skill development in terms of practical skills, problem-solving, creativity and innovation, collaboration and teamwork, and digital literacy; and determine whether a significant relationship exists between digital tool integration and students' skill development. The findings were intended to provide the basis for developing a TVL Digital Integration Enhancement Guide.

Theoretical or Conceptual Basis

The study is grounded in three complementary learning theories: Piaget's Constructivist Learning Theory, Vygotsky's Social Constructivism Theory, and Kolb's Experiential Learning Theory. These perspectives explain learning through active knowledge construction, social interaction, and practical experience. Constructivist Learning Theory emphasizes learners' active engagement in developing understanding through interaction with information and prior experiences. In TVL instruction, multimedia presentations, instructional videos, simulations, and interactive applications can provide opportunities to explore technical concepts and observe procedures. The OECD (2023a) recognized the relevance of innovative pedagogical approaches and digital technologies in supporting vocational learning. Social Constructivism emphasizes the importance of interaction, collaboration, feedback, and guided learning. Online platforms and collaborative applications can facilitate communication among students and teachers, creating opportunities for shared learning and problem-solving. Zhang et al. (2024) demonstrated the relevance of learning experiences and engagement in understanding digital technology use among vocational students. Experiential Learning Theory emphasizes learning through experience, reflection, conceptual understanding, and application. This perspective is particularly appropriate for TVL education, where learners must demonstrate practical competencies. Digital tutorials and simulations may supplement actual performance activities by allowing students to observe procedures and review their application. Magdato (2024) examined video-based instruction in food-processing education, highlighting its potential instructional relevance while also demonstrating the need to evaluate actual performance outcomes.The conceptual framework identifies digital tool integration as the independent variable, comprising multimedia presentations, online learning platforms, digital learning resources, and interactive digital applications. Students' skill development serves as the dependent variable, encompassing practical skills, problem-solving, creativity and innovation, collaboration and teamwork, and digital literacy. The latter is also supported by the Digital Competence Framework for Citizens, which identifies essential knowledge, skills, and attitudes for meaningful technology use (Vuorikari et al., 2022). The relationship between these variables provides the basis for the proposed TVL Digital Integration Enhancement Guide.

The study supports Sustainable Development Goal 4 (Quality Education) by promoting accessible, competency-based TVL instruction through digital technologies, consistent with UNESCO (2023). It also aligns with SDG 8 (Decent Work and Economic Growth) by strengthening employability-related skills, including technical proficiency, problem-solving, creativity, teamwork, and digital literacy (OECD, 2023a; TESDA, 2023). The proposed TVL Digital Integration Enhancement Guide contributes to educational and socio-economic sustainability by improving instructional practices and preparing learners for further education, employment, and livelihood opportunities.

2. METHODOLOGY

Research Design

The study utilized a descriptive-correlational research design to determine the level of digital tool integration in TVL instruction and its relationship with students' skill development. Digital tool integration served as the independent variable, while students' skill development was the dependent variable. The design enabled the researcher to describe the variables and examine their statistical relationship without manipulating the learning environment.

Research Locale or Study Setting

The study was conducted during School Year 2025–2026 in three public Senior High Schools in Cebu Province and Cebu City, Philippines: Cebu City Don Carlos A. Gothong Memorial National High School, Liloan National High School, and Bantayan National High School–Senior High School. These institutions provided the educational settings for examining digital tool integration and students' skill development in TVL instruction.

Participants or Data Sources

The respondents consisted of 202 Grade 11 and Grade 12 TVL students from the three participating schools. Of these, 60 students were from Cebu City Don Carlos A. Gothong Memorial National High School, 60 from Liloan National High School, and 82 from Bantayan National High School–Senior High School. Participants were selected from TVL classes involving the use of digital tools, allowing the study to examine their instructional experiences and perceived skill development.

2.4 Research Instruments or Materials

The study utilized a researcher-made questionnaire consisting of two parts. The first assessed digital tool integration through multimedia presentations, online learning platforms, digital learning resources, and interactive digital applications. The second measured students' skill development in practical skills, problem-solving, creativity and innovation, collaboration and teamwork, and digital literacy. Responses were rated using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Higher scores indicated greater perceived digital integration and skill development. The questionnaire was administered in printed and online formats through Google Forms.

2.5 Data Gathering Procedure

The researcher prepared formal requests for permission to conduct the study in the participating schools. Before administering the questionnaires, the study's purpose and instructions were explained to the respondents. Questionnaires were distributed in printed form and through Google Forms, particularly for participants from Bantayan Island. Completed responses were collected, checked, organized, and prepared for statistical analysis. The findings were subsequently interpreted to formulate recommendations for the proposed TVL Digital Integration Enhancement Guide.

2.6 Data Analysis

Data were analyzed using frequency and percentage distributions to describe respondents' demographic profiles and commonly used digital tools. Weighted means determined the levels of digital tool integration and students' skill development. Pearson's product-moment correlation coefficient was employed to examine the relationship between the two variables, using a 0.05 level of significance. Responses were interpreted according to the established five-point scale, with higher mean scores representing greater digital tool integration and perceived skill development.

2.7 Ethical Consideration

The researcher sought permission from the concerned school administrators before conducting the study. Participants were informed about the research purpose and the voluntary nature of their participation. The research correspondence stated that information collected would be treated confidentially, participants' identities would be protected, and the data would be used exclusively for academic and research purposes.

3. RESULTS AND DISCUSSION

3.1 Profile of the Respondents

3.1.1 Age

The findings revealed that most respondents were 17 years old (39.11%), followed by those aged 16 (32.18%) and 18 (21.29%). The remaining respondents were 19 (3.47%), 15 (2.48%), 20 (0.99%), and 22 (0.50%) years old. Overall, 92.58% were between 16 and 18 years old, indicating that the participants predominantly belonged to the typical Senior High School age group. The age distribution provides context for understanding students' experiences with digital learning technologies. Tan et al. (2024) emphasized that digital learning competence among secondary vocational students involves technological proficiency, cognitive processing, thinking skills, and learning management. Thus, students' familiarity with technology should be considered alongside their ability to use digital resources meaningfully in vocational learning.

3.1.2 Sex

The recorded distribution showed that 117 respondents (57.92%) were male and 85 (42.08%) were female. Male students represented the larger proportion of the 202 participants. The inclusion of male and female respondents provided perspectives on digital learning experiences across the participating TVL classes. However, because the study did not examine sex-based differences in digital tool integration or skill development, the distribution serves only as descriptive information and does not establish differences in learning outcomes.

3.1.3 Grade Level and School

Of the 202 respondents, 102 (50.50%) were Grade 12 students, while 100 (49.50%) were in Grade 11. In terms of school representation, 82 students (40.59%) came from Bantayan National High School–Senior High School, while Cebu City Don Carlos A. Gothong Memorial National High School and Liloan National High School contributed 60 respondents (29.70%) each. The nearly equal grade-level distribution provided perspectives from learners with different levels of TVL instructional experience. The Philippine TVL curriculum emphasizes the development of technical competencies for employment, entrepreneurship, and further education (Department of Education, 2023). Moreover, UNESCO (2023) recognized that technology integration varies across educational settings according to available resources, institutional support, and instructional conditions.

3.2 Commonly Used Digital Tools in TVL Instruction

Microsoft PowerPoint was the most commonly reported digital tool, used by 83.17% of respondents, followed by YouTube (51.98%), Canva (41.09%), Google Classroom (30.20%), Quizizz (21.78%), Google Meet (18.81%), mobile applications (9.90%), Kahoot (5.45%), Zoom (4.46%), and other applications (1.98%). These findings indicate that presentation software, instructional videos, and graphic design tools were more commonly used than synchronous communication and game-based applications. The predominance of multimedia resources suggests that TVL instruction frequently uses visual materials to support technical explanations and demonstrations. UNESCO (2023) recognized the potential of educational technology to expand access to learning resources, while OECD (2023) emphasized the importance of digital technologies in improving instructional delivery. Similarly, Chen and Chan (2024) identified blended, simulation-based, and interactive digital pedagogies as approaches that can support vocational learning when appropriately integrated into instructional activities.

3.3 Level of Digital Tool Integration in TVL Instruction

The overall weighted mean for digital tool integration was 3.50, interpreted as Integrated. Among the four dimensions, multimedia presentations obtained the highest mean (3.56), followed by digital learning resources (3.52), interactive digital applications (3.44), and online learning platforms (3.41). All dimensions received favorable overall ratings, although their levels of integration varied. These findings suggest that digital technology was generally incorporated into TVL instruction, particularly through presentation-based and supplementary learning resources. OECD (2023) emphasized that effective digital education requires instructional planning, teacher competence, and appropriate technological resources. Similarly, Chen and Chan (2024) highlighted the importance of aligning digital pedagogies with vocational learning requirements.

3.3.1 Multimedia Presentations

Multimedia presentations obtained an overall weighted mean of 3.56, interpreted as Integrated. The use of PowerPoint and videos during TVL lessons received the highest mean (3.72), while the use of videos to demonstrate practical skills obtained the lowest mean (3.49). Other indicators, including conceptual understanding, instructional engagement, and explanation of complex procedures, received means ranging from 3.50 to 3.54. The results suggest that multimedia presentations were regularly used to illustrate concepts and support technical demonstrations. Setiawaty et al. (2024) reported that instructional videos and tutorials supported students' understanding of learning materials and participation in educational tasks. However, UNESCO (2023) emphasized that the benefits of educational technology depend on instructional relevance, indicating that multimedia presentations should support rather than replace practical TVL activities.

3.3.2 Online Learning Platforms

Online learning platforms obtained an overall weighted mean of 3.41, interpreted as Integrated. Sharing TVL learning materials through online platforms received the highest mean (3.59), followed by reviewing lessons anytime (3.50), organizing learning activities (3.44), and teacher-student communication (3.41). Digital assignment submission obtained the lowest mean (3.13), interpreted as Neutral. These findings indicate that online platforms were used primarily for distributing instructional materials and supporting flexible learning rather than consistently managing assignment submissions. Puniatmaja et al. (2024) found that e-learning and students' digital literacy were associated with differences in vocational learning outcomes. Similarly, Jatmoko et al. (2023) identified online learning, technology exposure, and institutional readiness as relevant factors in vocational students' digital literacy practices.

3.3.3 Digital Learning Resources

Digital learning resources received an overall weighted mean of 3.52, interpreted as Integrated. The use of online tutorials to improve TVL skills obtained the highest mean (3.65), followed by internet-based research on TVL topics (3.61), learning additional skills through online resources (3.53), and improving accessibility (3.51). The use of digital materials such as e-books and modules obtained the lowest mean (3.27). The findings indicate that students commonly used online tutorials and internet-based resources to supplement classroom instruction, while electronic modules were less frequently utilized. Setiawaty et al. (2024) identified instructional videos and online references as useful resources for supporting independent and group learning activities. UNESCO (2023) likewise emphasized that access to appropriate digital resources can broaden learning opportunities, although their educational effectiveness remains dependent on implementation.

3.3.4 Interactive Digital Applications

Interactive digital applications obtained an overall weighted mean of 3.44, interpreted as Integrated. Making TVL lessons more interesting received the highest mean (3.63), followed by practicing TVL skills through applications (3.44), encouraging active participation (3.43), and simulating real-life tasks (3.42). The actual use of digital applications during TVL activities obtained the lowest mean (3.32). The findings suggest that students recognized the instructional value of interactive applications, although their classroom use was less consistent than their perceived usefulness. Nidhom et al. (2024) demonstrated that project-based interactive learning materials increased vocational students' learning interest. Chen and Chan (2024) similarly emphasized the relevance of simulation-based and game-based learning in providing interactive experiences aligned with vocational competencies.

3.4 Level of Students' Skill Development

Students' overall skill development obtained a weighted mean of 3.52, interpreted as Developed. Digital literacy recorded the highest mean (3.65), followed by creativity and innovation (3.54), collaboration and teamwork (3.53), practical skills (3.46), and problem-solving skills (3.41). These findings indicate favorable self-reported development across all five competency areas. The results highlight the multidimensional nature of skill development in vocational education. Tan et al. (2024) identified digital learning competence as encompassing technology use, thinking skills, cognitive processing, and learning management. Similarly, Silor and Silor (2025) demonstrated the relevance of TVET-based instructional approaches to digital competence, critical thinking, creativity, communication, and collaboration.

3.4.1 Practical Skills

Practical skills obtained an overall weighted mean of 3.46, interpreted as Developed. Students rated the contribution of digital tools to improving practical TVL skills highest (3.55), followed by understanding procedures through digital demonstrations (3.50) and practicing skills more efficiently (3.44). Improved task performance after using digital learning tools received the lowest mean (3.35), interpreted as Moderately Developed. The findings suggest that digital resources supported students' understanding of practical procedures, although perceived improvements in actual task performance were less pronounced. Chen and Chan (2024) emphasized the potential of simulation-based learning to support vocational instruction. Similarly, Silor and Silor (2025) reported that TVET-based learning activities supported practical problem-solving and competency development. These findings reinforce the importance of combining digital instruction with guided hands-on practice.

3.4.2 Problem-Solving Skills

Problem-solving skills obtained an overall weighted mean of 3.41, interpreted as Developed. Students agreed that digital tools helped them analyze and solve problems during TVL activities (3.51), while the statement that technology encouraged critical thinking received a lower mean (3.30), interpreted as Moderately Developed. The findings indicate that students perceived digital tools as useful in addressing TVL-related problems, although critical-thinking engagement received a comparatively lower rating. Nidhom et al. (2024) highlighted the value of interactive, project-based instructional materials in engaging vocational learners in meaningful learning tasks. Silor and Silor (2025) likewise demonstrated the relevance of TVET-based activities to higher-order thinking and practical problem-solving.

3.4.3 Creativity and Innovation

Creativity and innovation obtained an overall weighted mean of 3.54, interpreted as Developed. Students rated the use of technology to explore creative ideas highest (3.57), followed by the use of digital tools to create innovative TVL projects (3.51). The results suggest that digital tools provided opportunities for students to explore ideas and produce creative outputs. Silor and Silor (2025) found that instructional approaches integrating technical-vocational competencies supported creativity and other 21st-century skills among prospective educators. In TVL instruction, digital applications may therefore serve as supplementary resources for designing projects, developing concepts, and presenting innovative outputs.

3.4.4 Collaboration and Teamwork

Collaboration and teamwork obtained a weighted mean of 3.53, interpreted as Developed. Students generally agreed that digital tools supported collaboration in completing TVL-related activities and tasks. The result suggests that students perceived digital technologies as useful for group participation and communication. Chen and Chan (2024) identified educational collaboration as an important component of digital pedagogy in vocational education. Similarly, Silor and Silor (2025) highlighted teamwork and communication as competencies supported by TVET-based learning activities. Nevertheless, the descriptive result does not independently establish improvement in collaboration resulting from technology use.

3.4.5 Digital Literacy

Digital literacy obtained the highest weighted mean among the skill-development dimensions at 3.65, interpreted as Developed. Students generally agreed that using digital tools in TVL instruction improved their technology-related skills. The findings suggest favorable perceptions of students' ability to use digital resources for learning. Jatmoko et al. (2023) identified online learning, motivation, and technological exposure as relevant factors in vocational students' digital literacy. Similarly, Mbambo and du Plessis (2025) emphasized the importance of digital skills for academic performance in TVET, while Zubizarreta Pagaldai et al. (2025) identified school-related factors and technology-use practices as predictors of perceived digital competence. These studies support continued attention to digital literacy development in vocational education.

3.5 Relationship Between Digital Tool Integration and Students' Skill Development

3.5.1 Multimedia Presentations and Skill Development

The reported correlation analysis indicated a significant positive relationship between multimedia presentations and digital literacy ($r = 0.4872$, $p < .001$). However, multimedia presentations were reported as not significantly related to practical skills ($r = 0.1822$, $p = 0.1112$) or problem-solving skills ($r = 0.0189$, $p = 0.8382$). The findings suggest that multimedia presentations were more closely associated with students' perceived digital literacy than with their practical and problem-solving competencies. Setiawaty et al. (2024) reported that videos

and digital tutorials supported students' digital literacy and learning activities. UNESCO (2023) likewise emphasized that digital technologies do not automatically improve every learning outcome, supporting the importance of selecting instructional resources according to intended competencies.

3.5.2 Online Learning Platforms and Skill Development

Online learning platforms showed reported significant positive relationships with problem-solving skills ($r = 0.4222$, $p < .001$) and digital literacy ($r = 0.1589$, $p = 0.0007$). However, the relationship with practical skills was reported as not significant ($r = -0.0178$, $p = 0.8608$). The findings indicate that online learning platforms were associated with students' problem-solving abilities and digital literacy but not with their reported practical competencies. Puniatmaja et al. (2024) demonstrated the relevance of e-learning and digital literacy to vocational learning outcomes. Similarly, Jatmoko et al. (2023) emphasized the role of online learning and institutional support in vocational students' digital literacy development. These findings suggest that online platforms can supplement instructional activities but may not substitute for direct practical experience.

3.5.3 Interactive Digital Applications and Skill Development

Interactive digital applications showed reported significant positive relationships with practical skills ($r = 0.3055$, $p = 0.0016$) and problem-solving skills ($r = 0.5047$, $p < .001$). However, no significant relationship was reported with digital literacy ($r = -0.0358$, $p = 0.4129$). The findings indicate that interactive digital applications were more closely associated with students' reported practical and problem-solving competencies than with digital literacy. Nidhom et al. (2024) demonstrated the value of project-based interactive learning materials in increasing vocational students' learning interest. Chen and Chan (2024) likewise identified interactive and simulation-based pedagogies as relevant approaches for supporting vocational education. These findings highlight the importance of aligning interactive activities with specific learning outcomes.

3.5.4 Other Relationships Between Digital Integration and Skill Development

The original analysis also reported no statistically significant relationships between digital learning resources and the identified skill-development variables. Likewise, creativity and innovation and collaboration and teamwork were not reported to have significant relationships with the examined dimensions of digital tool integration. Specific correlation coefficients and probability values for these comparisons were not provided in the detailed results. These findings indicate that favorable perceptions of digital tools and skill development do not necessarily correspond to statistically significant relationships across all competency areas. UNESCO (2023) emphasized that educational technology should be evaluated according to context and actual learning outcomes. Similarly, Zubizarreta Pagaldai et al. (2025) demonstrated that students' digital competence is associated with multiple school-related and individual factors, suggesting that technology use alone may not sufficiently explain differences in student competencies.

3.6 Implications for TVL Instructional Enhancement

The findings indicated that digital tools were generally integrated into TVL instruction, while students reported developed levels of skill development. However, the relationships between digital tool integration and specific competencies varied. Based on these findings, the study developed a TVL Digital Integration Enhancement Guide emphasizing instructional planning, appropriate tool selection, digital integration, guided practice, assessment, and reflection. The proposed guide emphasizes the purposeful alignment of digital tools with TVL learning objectives and practical activities. Chen and Chan (2024) highlighted the importance of digital pedagogical

approaches that respond to vocational learning requirements, while UNESCO (2023) emphasized the need for technology-supported instruction to remain learner-centered. The findings therefore provide a basis for strengthening teacher guidance, hands-on learning opportunities, and competency-aligned digital instruction.

4. CONCLUSIONS AND RECOMMENDATIONS

The study concludes that digital tools were generally integrated into Technical-Vocational-Livelihood (TVL) instruction among 202 Senior High School students in selected public schools in Cebu Province and Cebu City during School Year 2025–2026. Multimedia presentations were the most frequently integrated resources, while students demonstrated generally developed levels of practical skills, problem-solving, creativity and innovation, collaboration and teamwork, and digital literacy. Digital literacy obtained the highest rating, whereas problem-solving skills received the lowest. The reported correlation findings revealed significant positive relationships between interactive digital applications and practical and problem-solving skills, online learning platforms and problem-solving skills and digital literacy, and multimedia presentations and digital literacy. However, other relationships were not statistically significant, indicating that digital tools were associated with specific competencies rather than all skill-development dimensions. These findings support the development of a TVL Digital Integration Enhancement Guide emphasizing purposeful technology integration, competency alignment, and continued hands-on learning experiences.

TVL teachers should strengthen the purposeful integration of digital technologies by selecting instructional tools according to specific competencies and learning objectives. Interactive digital applications should be prioritized for practical exercises and problem-solving activities, while online learning platforms and multimedia presentations should support instructional delivery, communication, and digital literacy development. Teachers should consistently combine digital demonstrations with guided hands-on activities to reinforce practical competencies. School administrators should improve access to appropriate technological resources, reliable internet connectivity, and professional development opportunities that enhance teachers' digital instructional competencies. The proposed TVL Digital Integration Enhancement Guide should be adopted for instructional planning, tool selection, implementation, assessment, and reflection, with its effectiveness periodically evaluated based on students' learning experiences and performance. Future researchers should examine additional factors, including teacher competence, student motivation, digital readiness, and technological resource availability, to provide a more comprehensive understanding of digital tool integration and students' skill development in vocational education.

The study was limited to 202 Grade 11 and Grade 12 TVL students from three selected public Senior High Schools in Cebu Province and Cebu City during School Year 2025–2026, restricting the generalizability of its findings to other educational settings. Data were obtained through a researcher-made, five-point Likert-scale questionnaire measuring students' perceptions of digital tool integration and skill development rather than direct performance assessments. Moreover, the descriptive-correlational design established statistical relationships without demonstrating causality. The analysis was confined to the identified instructional and competency dimensions. Future studies may involve broader samples, additional explanatory variables, and complementary performance-based assessments to strengthen the interpretation and applicability of the findings.

5. REFERENCES

Chen, X., & Chan, S. (2024). Implementing digital pedagogy in TVET: A Connectivist perspective. *Vocation, Technology & Education, 1*(2), Article e15. https://doi.org/10.54844/vte.2024.0595

Department of Education. (2022). *Adoption of the Basic Education Development Plan 2030 (DepEd Order No. 024, s. 2022)*. https://www.deped.gov.ph/wp-content/uploads/2022/05/DO_s2022_024.pdf

Department of Education. (2023). *MATATAG K to 10 curriculum of the K to 12 program: Edukasyong Pantahanan at Pangkabuhayan (EPP)/Technology and Livelihood Education (TLE), grades 4–10*. https://www.deped.gov.ph/wp-content/uploads/MATATAG-EPP_TLE-CG-2023-Grades-4-10-1.pdf

Deschênes, M., Dionne, L., & Parent, S. (2024). Supporting digital competency development for vocational education student teachers in distance education. *Frontiers in Education, 9*, Article 1452445. https://doi.org/10.3389/feduc.2024.1452445

Jatmoko, D., Suyitno, S., Rasul, M. S., Nurtanto, M., Kholifah, N., Masek, A., & Nur, H. R. (2023). The factors influencing digital literacy practice in vocational education: A structural equation modeling approach. *European Journal of Educational Research, 12*(2), 1109–1121. https://doi.org/10.12973/eu-jer.12.2.1109

Magdato, J. R. (2024). Self-video instructions in enhancing food processing skills of TVL students. *Psychology and Education: A Multidisciplinary Journal, 23*(10), 1272–1280. https://doi.org/10.5281/zenodo.13352130

Mbambo, G. P., & du Plessis, E. C. (2025). Evaluating technical vocational education and training college student's digital skills versus throughput rate. *Discover Education, 4*, Article 6. https://doi.org/10.1007/s44217-025-00396-8

Nidhom, A. M., Smaragdina, A. A., Ningrum, G. D. K., Putro, S. C., Yunos, J. M., & Yassin, R. M. (2024). Project-based interactive learning material for vocational students. In *Proceedings of the 5th Vocational Education International Conference (VEIC-5 2023)* (pp. 355–361). Atlantis Press. https://doi.org/10.2991/978-2-38476-198-2_48

Organisation for Economic Co-operation and Development. (2023a). *Building future-ready vocational education and training systems*. OECD Publishing. https://doi.org/10.1787/28551a79-en

Organisation for Economic Co-operation and Development. (2023b). *OECD digital education outlook 2023: Towards an effective digital education ecosystem*. OECD Publishing. https://doi.org/10.1787/c74f03de-en

Othman, N., Omar, M., & Abd Majid, M. Z. (2025). Challenges of digitalisation in TVET: A recent comprehensive structured review. *International Journal of Learning, Teaching and Educational Research, 24*(10), 210–229. https://doi.org/10.26803/ijlter.24.10.10

Puniatmaja, G. A., Parwati, N. N., Tegeh, I. M., & Sudatha, I. G. W. (2024). The effect of e-learning and students' digital literacy towards their learning outcomes. *Pegem Journal of Education and Instruction, 14*(1), 348–356. https://doi.org/10.47750/pegegog.14.01.39

Setiawaty, T., Asrial, A., Messakh, J. J., & Tjahjono, G. (2024). Improving students' digital literacy skills using structured assignments. In *Proceedings of the 5th Vocational Education International Conference (VEIC-5 2023)* (pp. 1527–1533). Atlantis Press. https://doi.org/10.2991/978-2-38476-198-2_217

Silor, A. C., & Silor, F. S. C. (2025). Harnessing TVET for new literacies: An experimental study on enhancing 21st century competencies. *International Journal of Learning, Teaching and Educational Research, 24*(11), 144–160. https://doi.org/10.26803/ijlter.24.11.7

Tan, X., Lin, X., & Zhuang, R. (2024). Development and validation of a secondary vocational school students' digital learning competence scale. *Smart Learning Environments, 11*, Article 37. https://doi.org/10.1186/s40561-024-00325-6

Technical Education and Skills Development Authority. (2023). *National Technical Education and Skills Development Plan 2023–2028: MaGaling at MakaBagong TVET para sa Bagong Pilipinas—TVET as a pathway to recovery and socio-economic transformation*. https://tesda.gov.ph/About/TESDA/47

Toroba, R. M. S., & Tagadiad, C. L. (2024). The mediating effect of self-regulation on the relationship between self-directed learning and digital competence. *International Journal of Research and Innovation in Applied Science,* 9(1), 26–40. https://doi.org/10.51584/IJRIAS.2024.90103

UNESCO. (2023). *Global education monitoring report 2023: Technology in education—A tool on whose terms?* https://doi.org/10.54676/UZQV8501

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2: The digital competence framework for citizens—With new examples of knowledge, skills and attitudes*. Publications Office of the European Union. https://doi.org/10.2760/115376

Zhang, X., Qian, W., & Chen, C. (2024). The effect of digital technology usage on higher vocational student satisfaction: The mediating role of learning experience and learning engagement. *Frontiers in Education, 9*, Article 1508119. https://doi.org/10.3389/feduc.2024.1508119

Zubizarreta Pagaldai, A., Cattaneo, A., Imaz Agirre, A., & Marín, V. I. (2025). Factors influencing the digital competence of students in basic vocational education training. *Empirical Research in Vocational Education and Training, 17*, Article 19. https://doi.org/10.1186/s40461-025-00198-0