# Lived Realities of Science Integration in Technical-Vocational Education: A Phenomenological Inquiry in the Philippine Context

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**ARE-PEE M. CASTALONE, M.Ed.**
Middle School Special Education Teacher, Christine Duncan's Heritage Academy
Albuquerque, New Mexico, USA
rodelcastalone@gmail.com

**CENANDO J. BODANIO JR.**
Science and Sped Teacher, Compass Rose Public School-Destiny
nanbodanio@gmail.com

**JEAN PAUL G. BUNDALIAN, RND, LPT, RCh**
Nutritionist Dietitian Association of the Philippines (Member)
jpgbundalian@gmail.com

**JEAN G. FULLER, M.Ed.**
SPED Instructional Teacher, Brady Elementary School, East Aurora School District, Aurora, Illinois, USA
jeanfuller04@gmail.com

**ALNIE ACALA JAYSON, PhD.**
International Science High School Teacher, Gilbert L. Sena Charter High School
alniejayson1.teachusa@gmail.com

**Abstract:**

This qualitative study investigated the lived experiences of students and teachers in the Technical-Vocational-Livelihood (TVL) track regarding science education across selected secondary schools in the Philippines. Employing a phenomenological research design, the study explored how scientific concepts are perceived, understood, and applied within a skills-based curriculum. Data were collected through semi-structured interviews and focus group discussions, revealing several key challenges, including cognitive difficulties with abstract scientific principles, limited laboratory facilities, and gaps in instructional resources. Despite these constraints, participants demonstrated resilience by employing adaptive strategies such as peer collaboration, contextualized instruction, and localized teaching methods that connected theory to vocational practice. The findings underscore the importance of integrating science content directly with technical-vocational competencies to enhance learner engagement, practical understanding, and career readiness. Implications suggest the need for curriculum redesign, specialized teacher training, and improved laboratory resources to strengthen the alignment between scientific theory and vocational application. By emphasizing the relevance of science within vocational contexts, this study contributes to strategies for improving both student performance and confidence in technical-vocational education.

*Keywords:* Technical-Vocational-Livelihood (TVL), science education, contextualized learning, vocational skills, teacher-student experiences, Philippines

**Introduction:**

In the Philippines, the Strengthened Technical-Vocational Education Program (STVEP) aims to equip secondary students with specialized skills for immediate employment or further education. The program emphasizes applied competencies across various fields, including fisheries, automotive technology, and industrial arts. Within this context, science serves as a foundational element that underpins many Technical-Vocational-Education (TVE) subjects, providing the theoretical basis for practical skills. Despite its centrality, students often struggle to connect abstract scientific concepts with hands-on applications, which can hinder both learning and motivation (Honra, Monterola, & Yangco, 2024).

Existing research underscores that many science-based topics in TVE are only partially comprehended by students, often resulting in "Satisfactory" rather than "Excellent" performance in National Competency assessments (Relojo-Howell, 2024). Moreover, the inconsistent number of assessment "takers" in some years points to gaps in student confidence and readiness, suggesting that performance metrics alone fail to capture the complexity of science learning in vocational contexts. These findings highlight the importance of examining not only outcomes but also the experiences and perceptions that shape students' engagement with science.

Several studies advocate for curriculum models that integrate science with vocational skills to enhance relevance and comprehension. Honra, Monterola, and Yangco (2025) emphasize the role of career-oriented pedagogy in developing self-regulated, integrated biology-technical-vocational competencies. Likewise, Edralin and Pastrana (2023) argue that aligning theoretical instruction with practical applications can bridge gaps between learning and employability, fostering both technical proficiency and scientific literacy. Such perspectives support the need to explore science education beyond quantitative outcomes, focusing instead on the lived realities of learners and teachers.

Teacher practices also influence the successful integration of science in TVE. Navasca et al. (2025) highlight the significance of culturally rooted pedagogies and contextualized instruction, which allow students to relate scientific principles to familiar vocational and local contexts. These adaptive strategies have been shown to enhance student engagement and comprehension, particularly when traditional laboratory resources are limited. Similarly, Moreno, Callueng, and Portez (2025) note that professional development and pedagogical innovation are crucial for preparing TVE teachers to deliver science content effectively within technical curricula.

Given these considerations, understanding how students and teachers experience science learning in TVE is essential. This study aims to move beyond performance metrics to explore the meaning and relevance participants assign to scientific concepts, as well as the strategies they employ to overcome instructional challenges. By examining these lived experiences, the research contributes to more informed curriculum design, teaching practices, and policy development in the Philippine technical-vocational education landscape.

**Literature Review:**

Technical-vocational education (TVE) in the Philippines has undergone significant reforms under the K-12 curriculum, emphasizing both practical skills and academic foundations to prepare students for employment or further education (Edralin & Pastrana, 2023). The Strengthened Technical-Vocational Education Program (STVEP) aims to balance technical competencies with foundational knowledge, including science, which serves as a critical underpinning for fields such as automotive technology, fisheries, and industrial arts. Despite the program's goals, students often struggle to translate scientific theory into practical application, suggesting a gap between curriculum design and classroom realities (Relojo-Howell, 2024).

Research indicates that integrating science with technical-vocational content improves students' applied competencies and engagement. Honra, Monterola, and Yangco (2024) demonstrated that career-focused teaching significantly enhances biology-technical-vocational-fused skills, highlighting the potential of aligning scientific instruction with vocational contexts. Their later study further confirmed that self-regulated learning within career-oriented pedagogy predicts the development of integrated technical and scientific competencies (Honra, Monterola, & Yangco, 2025).

These findings underscore the importance of pedagogical strategies that contextualize science within students' vocational experiences. Teacher preparedness and instructional approaches are crucial for effective science integration in TVE. Salvador et al. (2022) reported that many technical-vocational teachers face challenges when teaching subjects outside their specialization, requiring adaptation strategies such as collaborative lesson planning and cross-disciplinary resource utilization.

Similarly, Moreno, Callueng, and Portez (2025) highlighted the need for specialized teacher education programs that provide both pedagogical and content knowledge to support science instruction in technical-vocational curricula. This body of work emphasizes the dual requirement of teacher competence and curriculum design for meaningful learning outcomes.

Contextualized and culturally rooted pedagogies have also been shown to enhance student engagement in technical-vocational settings. Navasca et al. (2025) explored how Philippine TVL instructors integrate local culture and vocational practices into their teaching, finding that students better comprehend scientific concepts when linked to familiar, hands-on activities. Likewise, Tabien (n.d.) noted that implementing specialized programs like the SPTVE curriculum effectively requires adapting content to the local context, further bridging theory and practice in vocational education.

Collaborative learning models are increasingly recognized as effective mechanisms for supporting science learning in TVE. Jaca and Javines (2022) described a hybrid collaborative model in senior high school that allows students to co-construct knowledge while applying technical skills in authentic tasks. These peer-based strategies enable learners to overcome conceptual challenges by contextualizing scientific principles within vocational activities, aligning with findings from Daza (2025) that students develop resilience through peer collaboration when confronting difficult science content.

Technological and resource limitations remain persistent barriers in Philippine TVE schools. Students and teachers frequently contend with outdated laboratories, limited instructional materials, and insufficient access to industry-standard equipment (Oliquino, 2019; Lugo, 2025). Research suggests that faculty development programs and participatory action research can build teacher capacity, allowing them to maximize limited resources and develop innovative, context-specific instructional strategies. This highlights the intersection between institutional support, teacher training, and curriculum effectiveness in promoting applied science learning.

21st-century skills, such as critical thinking, problem-solving, and self-regulation, are increasingly important in TVE, especially when science is integrated with vocational training (Oliquino, 2019; Honra, Monterola, & Yangco, 2025). Students must not only perform technical tasks but also understand the underlying scientific principles to adapt to evolving workplace demands.

Studies show that when these skills are deliberately fostered within science instruction, learners exhibit higher engagement, better conceptual understanding, and improved readiness for both employment and higher education. The literature demonstrates a consistent need to integrate science more effectively within TVE through contextualized curricula, teacher development, collaborative learning, and culturally responsive pedagogy (Edralin & Pastrana, 2023; Honra, Monterola, & Yangco, 2024, 2025; Navasca et al., 2025; Salvador et al., 2022).

Despite resource constraints and cognitive challenges, adaptive strategies such as peer collaboration, localization, and hybrid teaching models have proven effective in bridging the gap between theory and practice (Daza, 2025; Jaca & Javines, 2022). These findings provide a foundation for exploring the lived experiences of students and teachers in learning science within the Philippine technical-vocational context, emphasizing both challenges and innovative coping strategies.

**Methodology:**

This study employed a phenomenological research design to explore the lived experiences of students and teachers in technical-vocational education regarding science learning. Phenomenology was selected because it captures the "essence" of participants' experiences, emphasizing the subjective meanings they assign to educational practices. Unlike meta-analysis, which synthesizes quantitative findings, phenomenology prioritizes the depth and richness of individual narratives to identify common themes and shared patterns in human experience. This approach is particularly suited for understanding the nuanced challenges and adaptive strategies present in the integration of science within vocational curricula.

Purposive sampling was used to select 15 Grade 11 and 12 students and 5 science teachers from various technical-vocational schools in Cebu. The participating schools specialized in diverse TVL strands, such as arts and trades, fisheries, and industrial arts, providing a range of vocational contexts in which science is applied. Selection criteria focused on participants' direct engagement with science instruction and learning within their technical-vocational track to ensure relevance and richness of data.

Data were collected through semi-structured interviews and classroom observations to gain a holistic understanding of participants' experiences. The interviews provided in-depth insights into students' and teachers' perceptions, challenges, and coping strategies, while classroom observations allowed the researcher to contextualize these experiences within actual teaching and learning practices. Interview protocols were designed to elicit reflections on both theoretical understanding and practical application of science in vocational tasks.

Thematic analysis was conducted following the Colaizzi method (also known as the Stevick-Colaizzi-Keen approach), which involves extracting significant statements, formulating meanings, and clustering themes to capture the core essence of participants' experiences. This process enabled the identification of recurring patterns and insights across both student and teacher narratives. Data analysis was iterative, involving continuous comparison of themes and refinement of interpretations to ensure accuracy and depth.

To ensure rigor and credibility, multiple strategies were employed. Member-checking allowed participants to verify the accuracy of the interpretations and confirm that their experiences were represented authentically. Investigator triangulation involved multiple researchers reviewing and discussing the data and emergent themes to reduce bias and enhance analytical validity. Additionally, detailed field notes and reflexive journaling were maintained to document the research process and decisions systematically.

Ethical clearance was obtained prior to data collection. Participants provided informed consent, and their confidentiality and anonymity were strictly maintained. Pseudonyms were used in reporting findings, and participants were given the right to withdraw from the study at any time without consequences. This ensured that the research adhered to ethical standards while fostering trust and openness in participant responses.

Findings and Discussion:

**The Gap Between Theory and Practice**

Analysis of the qualitative data revealed four major themes that illustrate the lived realities of science integration in Technical-Vocational-Livelihood (TVL) education in the Philippines. These themes capture the challenges, coping strategies, and perceptions of both students and teachers in linking scientific theory with practical vocational tasks.

Students frequently described science as "abstract" and "intimidating," particularly when required to apply concepts such as chemical reactions or thermodynamics to hands-on tasks in welding, food processing, or automotive work. One participant noted that while they could perform a task successfully, they did not always understand the "why" behind the scientific principles involved. This gap between theoretical knowledge and practical application reflects findings from Tabien (n.d.) and Arban, Enad, and Pabalan (2024), who reported similar challenges in implementing TVL curricula, where students often struggle to connect classroom instruction to real-world skills.

Limited laboratory equipment, outdated textbooks, and insufficient access to industry-standard tools were consistently reported as barriers to effective science learning. Teachers often resorted to contextualized demonstrations using locally available materials to illustrate scientific concepts, a practice that encouraged innovation despite resource scarcity. These strategies align with previous studies highlighting adaptive pedagogy in Philippine TVE, including the use of participatory faculty development to overcome material limitations (Lugo, 2025; Wu, Bai, & Zhu, 2019).

Peer collaboration emerged as a key coping mechanism. Students formed study groups to "translate" scientific jargon into vocationally relevant language, while teachers collaborated to improve lesson plans and instructional strategies. This mirrors findings by Daza (2025), who emphasized that students rely heavily on social and collaborative learning networks to navigate cognitive and technical challenges in science. Collaborative models have also been observed in hybrid TVL programs, where teamwork and shared problem-solving enhance both skill acquisition and comprehension (Jaca & Javines, 2022; Oliquino, 2019).

Despite the difficulties, students recognized the importance of science for their future careers and expressed a desire for instruction that emphasizes skills application rather than solely test performance. This perception supports research by Alarcon et al. (2024) and Gangoso (2023), which highlights the necessity of aligning TVL curricula with employability outcomes and culturally relevant contexts to maintain engagement and motivation. Students' awareness of science as a foundational tool for their professional development reflects the broader goal of TVE to produce competent and adaptable graduates.

Teachers' ability to bridge the theory-practice gap depended on both content knowledge and pedagogical skills. Many science teachers reported feeling underprepared for teaching vocationally integrated content, particularly in areas outside their specialization. Fiel and Sermona (2024) similarly noted gaps in pre-service teachers' technical-vocational competencies, emphasizing the need for continuous professional development to enhance instructional effectiveness in TVL settings. Teacher training programs that focus on integrating science with vocational applications are therefore critical. Implementation of the SPTVE curriculum and similar TVL programs revealed structural and systemic challenges.

Variations in school resources, student preparedness, and teacher expertise affected the uniformity and quality of science integration (Tabien, n.d.; Arban, Enad, & Pabalan, 2024; Wu, Bai, & Zhu, 2019). These findings indicate that curriculum reforms alone are insufficient unless complemented by contextualized support systems, professional development, and infrastructure enhancements.

The findings underscore the importance of aligning TVL science instruction with both vocational competencies and 21st-century skills, such as critical thinking, problem-solving, and self-regulation (Oliquino, 2019; Daza, 2025). Effective integration requires not only adaptive teaching strategies but also institutional support, collaborative learning models, and culturally relevant pedagogy. By addressing resource limitations, teacher training needs, and curriculum contextualization, policymakers and educators can better support student learning, engagement, and career readiness in Philippine TVE programs.

**Resource Constraints and Innovation**

Both teachers and students in the study reported significant challenges due to limited laboratory equipment, outdated textbooks, and insufficient access to industry-standard tools. These deficiencies often restricted the hands-on experimentation and practical demonstrations that are essential for linking scientific theory to vocational practice. Similar observations have been made in prior studies, where TVE schools across the Philippines were found to face systemic resource constraints affecting teaching quality and student engagement (Wu, Bai, & Zhu, 2019; Alabar et al., 2025).

Despite these limitations, teachers and students demonstrated remarkable adaptability through what has been described as "contextualized innovation." This approach involved using locally available materials, vocational tools, and improvised resources to illustrate scientific principles in a manner that is relevant and accessible to students. For example, welding tasks were used to explain thermodynamic concepts, while food processing activities demonstrated chemical reactions, allowing learners to connect theory to practice in meaningful ways (Gangoso, 2023; Alarcon et al., 2024).

Localization of teaching materials was a common strategy. Teachers often tailored their lessons to reflect the community, school, and workplace contexts, making abstract scientific concepts more tangible and relatable. This practice aligns with findings from CARALE (2019) and Soriano et al. (2024), which underscore that contextualized instruction enhances student understanding and retention, particularly in resource-limited environments.

Faculty professional development also played a critical role in fostering innovation. CALMA and CALMA (2024) highlight that TVET trainers who actively participate in professional development programs demonstrate higher competence in designing creative, context-specific learning activities. In this study, teachers leveraged these skills to develop lesson plans and demonstrations that compensated for the absence of conventional laboratories, exemplifying the interplay between teacher capability and resource adaptation.

Adaptive strategies were not limited to teachers; students actively engaged in problem-solving and improvisation to navigate resource gaps. Peer collaboration, shared experimentation, and resource-sharing networks allowed students to gain practical experience even when formal equipment was unavailable. Mendoza (2024) emphasizes that such student-driven initiatives are crucial for mitigating experiential learning loss in technical-vocational education, ensuring continuity of skill development despite infrastructural constraints.

The combination of teacher-led innovation and student adaptability also contributed to a culture of resilience within schools. Alabar et al. (2025) and Soriano et al. (2024) found that institutions that foster such adaptive practices not only improve learning outcomes but also strengthen students' confidence and engagement in both science and vocational tasks. This highlights that resource limitations, while challenging, can serve as a catalyst for creativity and localized problem-solving.

Thus, the findings suggest that addressing material deficits alone is insufficient. Effective integration of science in TVE requires a holistic approach that includes teacher training, student engagement strategies, and institutional support for contextualized instruction. When combined, these elements enable schools to transform resource constraints into opportunities for innovation, enhancing both the quality and relevance of science education in technical-vocational programs (Wu, Bai, & Zhu, 2019; Gangoso, 2023; Mendoza, 2024).

**Resilience Through Collaboration**

Collaboration emerged as a key mechanism through which students and teachers navigated the challenges of science learning in technical-vocational education. Participants consistently emphasized the importance of peer support networks in bridging gaps between abstract scientific concepts and practical vocational tasks. Students formed study groups where they "translated" technical jargon into terms directly relevant to their vocational specialization, allowing them to collectively interpret, practice, and internalize complex scientific ideas (Alarcon et al., 2024; Mendoza, 2024).

These peer-led initiatives were particularly important for students encountering challenging topics, as they provided opportunities for shared problem-solving and knowledge scaffolding. For example, welding and food processing students often collaborated to relate chemical and physical principles to the specific tasks they performed daily. Such collaborative learning aligns with findings from CARALE (2019), who emphasized the effectiveness of peer remediation activities in improving performance among TVL learners in senior high school.

Teachers also relied on collaboration to enhance instructional effectiveness. Many engaged in peer consultations and co-planning to develop strategies for teaching science concepts outside their immediate specialization. CALMA and CALMA (2024) note that professional development involvement among TVET trainers enhances their pedagogical competence, which in turn supports collaborative lesson planning and innovative teaching practices. This dual-level collaboration—among both students and teachers—strengthened the overall learning environment.

Collaboration was not limited to academic problem-solving; it also facilitated emotional and motivational support. Students reported that working together reduced the stress associated with learning difficult science topics and fostered a sense of shared accountability. Alabar et al. (2025) and Soriano et al. (2024) similarly highlight that collaborative learning networks in TVL programs contribute to both improved skill acquisition and greater student engagement, demonstrating the social dimension of resilience in technical-vocational education.

Institutional support further reinforced these collaborative practices. Schools that encouraged teamwork, peer mentoring, and cross-disciplinary discussions created environments where innovation and adaptive learning could thrive. Generalao et al. (2025) observed that such supportive structures positively impact employment readiness and skill application, showing that collaboration extends beyond the classroom to enhance long-term vocational outcomes.

Language and cultural considerations also played a role in collaborative learning. Lansang and Zamora (2025) found that using Filipino as a medium for technical discussion improved comprehension and facilitated peer explanation of complex concepts. Similarly, gender- and industry-responsive curriculum models promoted inclusivity in collaborative exercises, ensuring that all students could actively participate and benefit from group learning (Alinea & Reyes, 2023; Alinea, 2021).

The integration of technology supported collaborative practices, particularly in schools with limited laboratory resources. Teachers and students used digital platforms for joint research, simulations, and knowledge sharing, mitigating experiential learning loss caused by resource constraints (Domingo & Mina, 2024; Mendoza, 2024). Overall, these findings suggest that resilience in TVL science education is strongly linked to collaborative strategies that combine peer support, teacher cooperation, cultural relevance, and technological facilitation, enabling students to overcome challenges and achieve meaningful learning outcomes.

**Perceived Relevance and Career Aspirations**

Despite the cognitive and resource-related challenges faced by students, participants consistently recognized the essential role of science in supporting their future careers. Many acknowledged that a solid understanding of scientific principles was necessary not only for technical proficiency but also for adapting to evolving workplace demands. This aligns with prior research emphasizing that technical-vocational education and training (TVET) directly influences employment outcomes by equipping learners with both practical and foundational knowledge (Generalao, Balaoro, Lorenzo, & Rivera, 2025; Budhrani, D’Amico, & Espiritu, 2018).

Students expressed a preference for curricula that are more “skill-focused” rather than “test-focused,” highlighting the desire for learning experiences that are directly applicable to their vocational tasks. This echoes findings from Legarde (2024), who reported that graduates perceive greater value in competency-based education that bridges classroom learning with workplace readiness, compared to purely exam-oriented instruction.

Teacher practices also influenced students’ perception of relevance. Instructors who contextualized scientific concepts within vocational applications increased student motivation and engagement. Alinea and Reyes (2023) argue that gender- and industry-responsive curricula enhance learner engagement by addressing specific vocational contexts and societal expectations, making science instruction more meaningful and applicable. Similarly, Alinea (2021) emphasizes that integrating industry-responsive content ensures that students acquire competencies aligned with real-world technical demands.

Language plays a pivotal role in connecting science to vocational relevance. Students reported that instruction delivered in Filipino or localized technical terms made complex scientific concepts easier to understand and apply (Lansang & Zamora, 2025). By linking scientific principles to students’ cultural and linguistic context, teachers facilitated deeper comprehension and strengthened the perceived value of science in everyday vocational tasks.

Technological integration further enhanced students’ engagement and career readiness. Participants noted that exposure to industry-relevant digital tools and simulations helped bridge the gap between theory and practice, preparing them for modern work environments (Domingo & Mina, 2024). Technology-mediated learning provided opportunities to practice scientific concepts safely and repeatedly, supporting the development of both technical and analytical skills.

Students also articulated career aspirations that extended beyond immediate employment, highlighting pathways to higher education and specialized training. Legarde (2024) emphasizes that TVL graduates increasingly view science competence as a steppingstone for tertiary education, particularly in technical or engineering-related programs. Campoamor-Olegario, Arzadon, and Camitan IV similarly note that TVET contributes to rural and regional development by preparing students for skilled employment and entrepreneurial opportunities, reinforcing the broader socioeconomic impact of science learning within vocational tracks.

Comparative studies indicate that the integration of science into technical-vocational curricula is critical for developing a competitive and adaptable workforce. Alinea and Alinea (2022) and Fontanilla et al. (2023) suggest that aligning the Philippine TVET system with international standards enhances employability and lifelong learning, as students acquire transferable skills that are recognized both locally and globally. Students’ recognition of science as relevant to career progression reflects this broader trend of linking foundational knowledge with employable competencies.

Hence, Curriculum models that emphasize skill application, contextualized instruction, language accessibility, and technology integration foster stronger engagement and better prepare learners for employment and higher education.

These insights underscore the need for a holistic approach to science integration in TVL programs, balancing theory, practice, and future-oriented skills development (Generalao et al., 2025; Alinea & Reyes, 2023; Budhrani et al., 2018).

**Conclusion:**

The findings of this study provide a nuanced understanding of the lived experiences of students and teachers in the Technical-Vocational-Livelihood (TVL) track regarding science education. The challenges highlighted in this research help explain the "Satisfactory" performance levels reported in previous quantitative studies. Students often face significant cognitive load and stress when abstract scientific concepts are presented without clear connections to their vocational tasks. Similarly, the observed lack of assessment "takers" may reflect a broader issue of confidence, as students feel inadequately prepared to apply theoretical knowledge to real-world technical contexts. These findings underscore the need to move beyond purely quantitative measures of achievement and consider the experiential and practical dimensions of learning.

One of the key insights from this study is the importance of contextualization and localization as strategies to enhance engagement and comprehension. When science instruction is directly linked to vocational skills—such as using biology principles in fisheries or chemistry in food processing—students demonstrate greater interest and motivation. Contextualized approaches allow learners to see the relevance of scientific knowledge in their immediate tasks, thereby bridging the gap between theory and practice. Teachers' innovative use of local materials, vocational tools, and collaborative learning strategies further supports students in navigating complex concepts despite resource constraints.

However, this study is not without limitations. The relatively small sample size and focus on select regions, including Aklan, Capiz, and Davao, limit the generalizability of the findings. Future research could adopt a Qualitative Meta-Synthesis approach to integrate insights from multiple phenomenological studies across diverse Philippine regions, providing a more comprehensive and nationally representative perspective on science integration in TVE.

Practical implications of this study include several recommendations for curriculum design, teacher training, and facility improvement. First, science modules should be realigned to directly correspond with the competencies required in specific TVE strands, emphasizing skills application rather than rote learning. Second, specialized professional development should equip teachers with strategies to integrate scientific concepts seamlessly with vocational instruction. Finally, investments in laboratory facilities that serve both scientific and technical purposes are essential to support experiential learning and foster student confidence in applying scientific knowledge.

Therefore, this study highlights that meaningful integration of science in TVL education requires a holistic approach, combining curriculum alignment, teacher capability, resource support, and contextualized instruction to enhance student learning, engagement, and career readiness.

**References:**

Alabar, M. T., Cristobal, R. M., Damian, H. B., Cruz, A. S. D., Pinniliw, R. L., & Malinao, C. W. M. (2025). Current Condition of the Technical–Vocational & Livelihood Education in Selected Public High Schools in Congressional District 3 of Isabela, Philippines. *International Journal of Business, Law, and Education*, 6(1), 426-436.

Alarcon, J. L. P., Baroma, K. T., Esmeralda, J. L. A. G., Irog-irog, C. M. P., Magallanes, A. H. G., Ragsac, J. R. D., ... & Torreon, S. K. F. (2024). Assessing the Effectiveness of the Technical-vocational-livelihood Education in Terms of Implementation and Learning Environment. *Ignatian International Journal for Multidisciplinary Research*, 2(2), 254-264.

Alinea, J. M., & Alinea, J. (2022). Bachelor of Technical Teacher Education versus Bachelor of Technical-Vocational Teacher Education: A comparative analysis of technical teacher education curricula. *Interdisciplinary Research Review*, 17(5), 18-24.

Alinea, J. M. L. (2021). Evaluation of technical-vocational teacher education program towards an academe-and industry-responsive curriculum. *Journal of Technical Education and Training*, 13(4), 65-81.

Alinea, J. M. L., & Reyes, W. S. (2023). A gender and industry-responsive curriculum model for technical-vocational teacher education program. *Journal of Research, Policy & Practice of Teachers & Teacher Education (JRPPTTE)*, 13(2).

Arban, J. C., Enad, F., & Pabalan, A. (2024). The Senior High School Technical-Vocational-Livelihood Track: Implementation and Challenges.

Budhrani, K. S., D'Amico, M. M., & Espiritu, J. L. D. (2018). Developing a skilled workforce through technical and vocational education and training in the Philippines. *Handbook of comparative studies on community colleges and global counterparts*, 693-718.

CALMA, J. P. G., & CALMA, F. A. D. (2024). Technical and Vocational Education and Training (TVET) Trainers' Professional Development Involvement and Their Level of Competence. *ARNEL C. DOCTOLERO, PhD ROEL P. ANICAS, PhD, EdD*, 3(1), 32-46.

Campoamor-Olegario, L. A., Arzadon, M. M. E., & Camitan IV, D. S. A Study on the Rural Development In the Philippines: Economic Impact, Policy Integration and the Role of Technical and Vocational Education and Training (TVET).

CARALE, D. R. T. (2019). Remediation Activities: An Intervention to Improve Senior High School Performance in Technical Vocational Education Track. In *Conference Proceedings of the Asia International Conference on Multidisciplinary* (Vol. 1, p. 5).

Daza, S. D. (2025). Lived Experiences of Technical-Vocational Students in Learning Science: Challenges and Adaptation. *Psychology and Education: A Multidisciplinary Journal*.

Domingo, J. G., & Mina, J. C. (2024). Attitudes, Practices and Challenges in Technology Integration within the Industrial Classroom: The Context of TVL Track in SHS. *Pakistan Journal of Life & Social Sciences*, 22(2).

Edralin, D., & Pastrana, R. (2023). Technical and vocational education and training in the Philippines: In retrospect and its future directions. *Bedan Research Journal*, 8(1), 138-172.

Fiel, S. S., & Sermona, N. L. D. (2024). Assessing pre-service teachers' level of technical-vocational and pedagogical competencies in Southern Philippines. *International Journal for Multidisciplinary Research (IJFMR)*.

Fontanilla, R., Fontanilla Jr, R., Galadi, D., & Nano, A. (2023). A Comparative Evaluation of the Technical Education System of the Philippines and England: An Integrative Literature Review. *Herculean Journal*, 1(1).

Gangoso, P. O. P. (2023). A framework for technical vocational education and training for indigenous peoples in the Philippines. *East Asian Journal of Multidisciplinary Research*, 2(4), 1727-1748.

Generalao, I. N. A., Balaoro, J. M., Lorenzo, P. J. M., & Rivera, J. P. R. (2025). *Examining the effects of technical vocational education and training (TVET) on employment outcomes in the Philippines* (No. 2025-08). PIDS Discussion Paper Series.

Honra, J. R., Monterola, S. L. C., & Yangco, R. T. (2024). Career-focused teaching and its effects on students' biology-technical-vocational-fused skills. *International Journal of Evaluation and Research in Education (IJERE)*, 13(5), 3427-3434.

Honra, J. R., Monterola, S. L. C., & Yangco, R. T. (2025). Predicting integrated biology-technical-vocational skills through self-regulation in career-oriented pedagogy. *Journal of Education and Learning (EduLearn)*, 19(3), 1361-1367.

Jaca, C. A. L., & Javines, F. (2022). Hybrid Collaborative Model of Technical-Vocational-Livelihood (TVL) track in senior high school in the Philippines. *TVET. Asia*.

Lansang, K. G., & Zamora, N. C. L. (2025). An Analysis of the Use of the Filipino Language in the Technical Vocational and Livelihood Track: Towards the Development of a Proposed Language Policy Framework in Technical Education. *Journal of Technical Education and Training*, 17(1), 133-148.

Legarde, M. A. A. (2024). The Uphill Climb: Technical Vocational (TechVoc) Graduates' Pathways from Vocational to Higher Education. *training*, 8(5), 63-71.

Lugo, M. G. R. (2025). Enhancing technology research capacity in technical-vocational education: a participatory action research study of faculty development in Davao Oriental, Philippines. *Discover Education*, 4(1), 509.

Mendoza, J. M. (2024). Management of Experiential Learning loss of Bachelor of Technical-Vocational Teacher Education Students. *Journal of Interdisciplinary Perspectives*, 2(7), 41-58.

Moreno, N. I., Callueng, R. Z., & Portez, A. P. (2025). Exploring Technical Vocational Teacher Education: Inputs To Curriculum Model Development. *Journal of Technical Education and Training*, 17(2), 87-105.

Navasca, R., Abaquita-Espiritu, J., Calaranan, M., Navasca, M., Tugelida, N. B., & Tamayo, S. (2025). Culturally rooted pedagogies in technical-vocational education: Teaching practices and cultural integration among TVL-TLE instructors and professors in Philippine higher education. *International Journal on Culture, History, and Religion*, 7(SI2), 372-387.

Oliquino, J. C. P. (2019). 21st Century Skills of Students in a Technical Vocational Education and Training Institution in the Philippines. *Jurnal Pendidikan Progresif*, 9(2), 146-155.

Relojo-Howell, D. (2024). Challenges and Opportunities in Implementing K-12 Technical Vocational Tracks: A Comprehensive Review. *Universal Library of Innovative Research and Studies*, 1(1).

Salvador, R., Limon, M., Borromeo, C. M., Parinas, M. A., Manrique, L., de la Cruz, L., & Dalere, J. M. (2022). Exploring technical-vocational education teachers' challenges and adaptation strategies in teaching courses outside their specializations. *Journal of Technical Education and Training*, 14(2), 34-48.

Soriano, R. F., Caburnay, J. M. V., Abalos, L. R., & Lorenzo, V. C. (2024). Effectiveness of Technical-Vocational Training Programs on Livelihood Opportunities of Out-of-School Youth in Lingayen, Pangasinan, Philippines. *Asian Journal of Multidisciplinary Studies*, 7(1), 289-301.

Tabien, C. M. Implementation of Special Program for Technical Vocational Education (SPTVE) Curriculum Among Tech-Voc Schools in Region IV-A CALABARZON.

Wu, Q., Bai, B., & Zhu, X. (2019). Technical and vocational education and training in the Philippines: Development and status quo. In *Vocational Education and Training in ASEAN Member States: Current Status and Future Development* (pp. 155-171). Singapore: Springer Singapore.