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RESEARCH ARTICLE

Attitudes, Practices and Challenges in Technology Integration within the Industrial Classroom: The Context of TVL Track in SHS

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ABSTRACT

This study investigates the attitudes, practices, and challenges of technology integration within the Technical-Vocational-Livelihood (TVL) track of Philippine Senior High Schools. Through a quantitative approach, data was collected from 61 TVL teachers using validated instruments. The findings reveal that educators generally hold positive attitudes towards technology integration, perceiving it as useful and easy to use. Pedagogical practices often involve multimedia resources and practical projects, yet challenges such as infrastructure limitations and insufficient technological pedagogical content knowledge (TPACK) hinder effective integration. Correlation analysis suggests that age and rank influence educators' perceptions and challenges. To address these issues, investments in infrastructure, comprehensive professional development, and tailored support for educators are recommended to enhance technology integration in TVL classrooms.

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INTRODUCTION

The rapid advancement of technology has profoundly influenced various sectors, including education (Mina et al., . In the Philippines, the implementation of the Senior High School (SHS) curriculum under the K-12 program has placed significant emphasis on the Technical-Vocational-Livelihood (TVL) track, aimed at equipping students with practical skills relevant to the workforce. However, the integration of technology in the industrial classroom, particularly within the TVL track, presents unique challenges and opportunities. This study examines the attitudes, practices, and challenges faced in technology integration within this context.

The Philippine educational system is undergoing a transformation with the integration of modern technologies aimed at enhancing learning outcomes and aligning educational practices with global standards. The Department of Education (DepEd) has been proactive in promoting ICT integration across various educational tracks, including TVL (Tomaro, 2018). Various schools have adopted different technological tools and platforms to facilitate instruction, yet the extent and effectiveness of this integration vary widely (Nuncio, 2020; Daling, 2018).

Despite these efforts, there remains a significant gap in understanding the specific attitudes and practices of educators towards technology integration in the TVL track. Previous studies have largely focused on general ICT integration in education (Marcial & Rama, 2015; Hero, 2019) but have not delved deeply into the TVL track's unique requirements and challenges. Additionally, there is limited empirical evidence on how these technological advancements are being utilized in industrial classrooms and the specific barriers educators and students face in this context (Dotong et al., 2016).

Addressing this research gap is crucial for several reasons. First, the TVL track is pivotal in preparing students for technical and vocational careers, where proficiency in modern technology is essential. Understanding educators' attitudes towards technology can inform targeted professional development programs, ensuring teachers are adequately prepared to integrate these tools effectively (Abarra et al., 2020). Furthermore, identifying the challenges and best practices in technology integration can guide policy makers and educational leaders in creating supportive environments that enhance the learning experience and outcomes for TVL students.

In response, this study seeks to provide a comprehensive understanding of the current state of technology integration within the industrial classrooms of the TVL track in Philippine SHS. By exploring educators' attitudes, practices, and the challenges they encounter, the research aims to contribute valuable insights that can inform future educational strategies and policies, ultimately supporting the successful integration of technology in vocational education. Specifically, the study aimed to achieve the following objectives: first, to describe the respondents based on their age, sex, years in teaching, and ranks. Second, to assess their attitudes towards technology integration within the Technical-Vocational-Livelihood (TVL) classroom, focusing on perceived usefulness and ease of use. Third, to examine the respondents' pedagogical practices involving technology integration in the TVL classroom. Fourth, to identify the challenges they face in integrating technology, particularly concerning infrastructure and accessibility, and Technological Pedagogical Content Knowledge (TPACK). Finally, the study aims to determine the relationship between the respondents' profiles and their attitudes, practices, and challenges related to technology integration in the TVL classroom.

REVIEW OF RELATED STUDIES

The attitudes of educators towards technology integration play a crucial role in the successful implementation of ICT in classrooms. Positive attitudes are often associated with higher levels of technology use (Kim & Lee, 2022). Teachers' beliefs about the benefits of technology can significantly influence their willingness to adopt new tools and methods in their teaching practices (Khlaif, 2018). However, research also highlights that many educators, particularly in technical-vocational education, may feel apprehensive due to a lack of confidence and skills (Delgado et al., 2015).

Effective technology integration involves more than just the use of digital tools; it encompasses the alignment of technology with pedagogical practices to enhance learning (Paracuelles et al., 2024). Studies indicate that in the TVL track, educators often utilize a range of technologies, from basic computer applications to more specialized software relevant to vocational subjects (Arinto, 2016). However, the extent of integration varies, with some teachers employing technology extensively, while others do so minimally, often due to varying levels of training and access to resources (Selwyn, 2016).

Several challenges impede the effective integration of technology in the industrial classroom. One significant barrier is the lack of adequate infrastructure, such as reliable internet access and up-to-date hardware (Enrique-Hinostroza, 2018). Additionally, insufficient professional development opportunities for teachers limit their ability to effectively integrate technology into their teaching (Suárez-Rodríguez et al., 2018). Moreover, resistance to change among educators, often rooted in a lack of confidence or fear of the unknown, further complicates technology adoption (Tondeur et al., 2017).

METHODOLOGY

This research adopts a quantitative approach, employing a descriptive research design to investigate the attitudes, practices, and challenges related to technology integration in the TVL classroom among TVL teachers. The study respondents consisted of 61 TVL teachers from the three anonymized Philippine mega-secondary schools offering the academic track, selected through total enumeration and purposive sampling to ensure representation from the target population. Three researcher-made instruments were utilized to collect data, focusing on the attitude, practices and challenges encountered in relation to technology integration in the academic track classroom setting. Prior to data collection, the instruments underwent rigorous validation and pilot testing to ensure their reliability and validity. The reliability coefficients for all three instruments were found to be not lower than 0.70, indicating satisfactory internal consistency among the items (George & Mallery,

2003). For statistical analyses, the results were analyzed using descriptive statistics such as frequency counts and percentage, mean and the corresponding verbal description and correlation analyses utilizing Pearson for and Spearman correlation coefficients for continuous and dichotomous and ordinal-treated profile variables, respectively.

RESULTS AND DISCUSSION

This section outlines the results derived from the main instrument utilized in this research.

1. Respondents' profile

The profile of the respondents provides a comprehensive overview of the demographic and professional characteristics of the educators involved in the study on technology integration within the industrial classroom of the TVL track in Philippine Senior High Schools.

The majority of the respondents fall within the young adulthood category (20-40 years old), accounting for 59.70% (n=40) of the sample. This suggests a relatively young teaching workforce, which may be more open to adopting new technologies in their teaching practices compared to older counterparts (Venkatesh et al., 2007). Middle adulthood respondents (41-65 years old) constitute 31.34% (n=21) of the sample, indicating a substantial presence of more experienced educators who may provide a balance of traditional and modern teaching methods (Borko et al., 2009). This demographic distribution shows the potential for a dynamic and adaptable teaching environment, with younger educators driving technological adoption and older educators ensuring the integration of tried-and-true pedagogical approaches (Hensley, n.d.).

In terms of gender distribution, the sample is predominantly male, with 58.21% (n=39) compared to 32.84% (n=22) female respondents. This male dominance may reflect broader trends within the technical-vocational education sector, which traditionally attracts more male educators due to the nature of the subjects taught (Adams and Baddianaah, 2023). Studies suggest that the subjects taught within the technical-vocational track, such as engineering, automotive technology, and other manual trades, are often perceived as male-dominated fields (Gillingham, 2014). The gender disparity highlights the need for initiatives to encourage more female participation in technical-vocational education, both as students and educators (Ngugi and Muthima, 2017).

Regarding educational qualifications, a significant proportion of the respondents hold a baccalaureate degree (58.21%, n=39), while 25.37% (n=17) possess a master's degree, and 7.46% (n=5) have attained a doctorate degree. This distribution indicates that while a majority have the minimum required qualifications, there is a substantial number of educators who have pursued advanced studies, potentially enhancing their capacity to integrate technology effectively (Ertmer et al., 2012). This only implies that majority of educators meet the minimum required qualifications, a substantial number have pursued advanced studies (Early et al., 2007). Research suggests that educators with higher academic qualifications are often better equipped to incorporate innovative teaching methods and technologies into their classrooms (Kotrlik and Redmann, n.d.). Additionally, advanced degrees are associated with a deeper understanding of pedagogical theories and practices, which can facilitate more effective technology integration (Ertmer et al., 2012). These findings accentuate the importance of encouraging continuous professional development and advanced education among technical-vocational educators to enhance the overall quality of education (Njenga, 2022).

The respondents' teaching experience varies, with 34.33% (n=23) having 5 years or less of teaching experience, 29.85% (n=20) having 6-10 years, and 26.87% (n=18) having more than 10 years of experience. This diversity in teaching tenure suggests a blend of fresh perspectives and seasoned expertise within the sample, which can influence attitudes and practices in technology integration (Caron, 2020). This suggests a blend of fresh perspectives and seasoned expertise, which can significantly impact the adoption and implementation of technology in the classroom (Mong, 2015). Research indicates that less experienced teachers may bring innovative ideas and a greater willingness to experiment with new technologies, while more experienced educators provide stability and a deep understanding of pedagogical methods (Trevino et al., 2008). The amalgamation of these varied experiences is advantageous for establishing a dynamic and flexible educational

milieu (LaFave, 2020). Moreover, experienced teachers can mentor younger colleagues, facilitating a culture of continuous improvement and collaborative learning (Aderibigbe et al., 2014).

In terms of professional rank, the largest group of respondents are Teacher I (35.82%, n=24), followed by Teacher II (25.37%, n=17) and Teacher III (22.39%, n=15). Higher ranks such as Master Teacher I and II are less represented, at 4.48% (n=3) and 2.99% (n=2) respectively. The predominance of lower-ranked teachers might indicate a greater need for professional development opportunities aimed at enhancing their technological competencies (James Jacob, 2015). This predominance of lower-ranked teachers suggests a significant need for professional development opportunities to enhance their technological competencies (Plair, 2008). Research indicates that lower-ranked teachers often have less access to advanced training and professional development resources, which can impede their ability to effectively integrate technology into their teaching practices (Ross, 2019). Providing targeted professional development for these educators can help bridge this gap, fostering improved technology integration and enhancing overall teaching quality (Fernández-Batanero et al., 2022).

2. Respondents' attitude towards technology integration within TVL classroom

The study's findings reveal that educators within the TVL track of Philippine Senior High Schools exhibit a highly positive attitude towards technology integration, as evidenced by the strong agreement on perceived usefulness and ease of use of technology in their classrooms.

Overall, the respondents strongly agree with the perceived usefulness of technology integration, with a mean score of 3.47. Specifically, educators believe that integrating technology significantly enhances the learning experience in the TVL classroom (mean=3.53). This high level of agreement indicates that teachers recognize the substantial benefits of technology in enriching educational outcomes (Tondeur et al., 2017). Similarly, respondents agree that technology makes completing tasks and projects more efficient (mean=3.41), underscoring the role of technology in streamlining educational processes and improving productivity (Irima, 2023).

Further, technology tools and resources are seen as essential for mastering vocational skills (mean=3.45), reflecting the critical role that technology plays in vocational education (Agada and Shitmi, n.d.). The belief that technology better prepares students for future employment in technical fields (mean=3.53) aligns with the growing demand for technologically proficient graduates in the workforce (Field, 2020). Finally, educators agree that technology enhances the ability to understand and apply technical concepts (mean=3.41), highlighting its importance in facilitating deeper comprehension and practical application of vocational subjects (Obonyo, 2013).

In terms of ease of use, the mean score is 3.31, indicating strong agreement among educators that the existing technology in the TVL classroom is user-friendly. Respondents find the technology easy to operate (mean=3.32) and straightforward to learn (mean=3.44), suggesting that the current tools and platforms are accessible to teachers with varying levels of technical proficiency (Ngadiran et al., 2021). The clarity of instructions and guidelines for using these technologies is also rated highly (mean=3.49), which supports seamless integration and usage in classroom activities (Sanchez Suasnabar, 2021). These findings are consistent with studies that emphasizes the important significance of user-friendly design and explicit instructional assistance in promoting the successful adoption of educational technologies (Gillispie et al., n.d.). Ensuring that technological tools are easy to use and understand is essential for maximizing their potential in enhancing teaching and learning outcomes in the TVL classroom (Christensen, 2002).

Table 1: Attitude towards technology integration

Items	Mean	Verbal Description
I. Perceived Usefulness	**3.47**	**Strongly Agree**
1. Technology integration into the TVL classroom significantly enhances learning experience.	3.53	Strongly Agree
2. Using technology in TVL subjects makes completing tasks and projects more efficient.	3.41	Strongly Agree

3. Technology tools and resources in the TVL classroom are essential for mastering vocational skills.	3.45	Strongly Agree
4. The use of technology in the TVL track better prepares students for future employment in technical fields.	3.53	Strongly Agree
5. Integrating technology into TVL education enhances the ability to understand and apply technical concepts.	3.41	Strongly Agree
II. Ease of Use	**3.31**	**Strongly Agree**
1. The existing technology used in the TVL classroom is easy to operate and user-friendly.	3.32	Strongly Agree
2. Learning to use existing technological tools in the TVL classroom is straightforward and uncomplicated.	3.44	Strongly Agree
3. The instructions and guidelines for using existing technology in TVL subjects are clear and easy to follow.	3.49	Strongly Agree
4. Technical issues with existing classroom technology are resolved quickly and effectively.	3.25	Strongly Agree
5. Using existing technology in TVL courses does not require extensive technical support or assistance.	3.03	Strongly Agree

Legend: 3.25 – 4.00=Strongly Agree; 2.50 – 3.24=Agree; 1.75 – 2.49=Disagree; 1.00 – 1.74=Strongly Disagree

However, the resolution of technical issues (mean=3.25) and the minimal need for extensive technical support (mean=3.03) highlight areas where there might be slight concerns. While still within the range of strong agreement, these slightly lower scores suggest that while technical issues are generally resolved effectively, there may be occasional delays or challenges that require attention (Nagaraj et al., 2012). Nonetheless, the overall positive rating indicates that teachers feel confident in managing and utilizing technology in their teaching practices (Wozney et al., 2006). It can be mentioned that ensuring that technological tools are easy to use and understand is essential for maximizing their potential in enhancing teaching and learning outcomes in the TVL classroom (Christensen, 2002).

3. Respondents' pedagogical practices on technology integration within TVL classroom

The study's findings on pedagogical practices related to technology integration in the TVL track of Philippine Senior High Schools reveal a mixed but generally positive engagement with technological tools in teaching.

The overall grand mean of 2.84 indicates that, on average, educators often incorporate technology into their pedagogical practices. Multimedia resources such as videos and animations are frequently used to explain complex technical concepts (mean=3.20), suggesting that teachers leverage these tools to enhance understanding and engagement. Digital simulations and virtual labs are also often incorporated into practical lessons (mean=2.95), providing students with interactive and immersive learning experiences that replicate real-world scenarios. These practices are aligned with research emphasizing the benefits of multimedia and interactive technologies in enhancing the learning process, particularly in technical and vocational education (Irkha et al., 2024). The positive engagement with these tools highlights their importance in modernizing pedagogical approaches and improving educational outcomes in the TVL track (Radkevych et al., 2021, March).

Table 2: Pedagogical practices on technology integration

Items	Mean	Verbal Description
1. Multimedia resources (videos, animations) are utilized to explain complex technical concepts.	3.20	Often
2. Digital simulations or virtual labs are incorporated in practical lessons.	2.95	Often
3. Projects that require the use of software or digital tools relevant to the vocational field are assigned.	3.03	Often

4. Online platforms are used to facilitate collaboration and communication among students.	2.48	Seldom
5. Interactive quizzes and assessments are integrated through digital tools.	2.45	Seldom
6. Students are provided with digital resources and tutorials for self-paced learning.	2.45	Seldom
7. Industry-standard software and equipment are demonstrated during lessons.	2.39	Seldom
8. Students are encouraged to use online research for their projects and assignments.	3.19	Often
9. Virtual tours of industries or workplaces relevant to the vocational and industrial track are conducted.	3.10	Often
10. Technology is used to track and assess student progress and provide feedback.	3.11	Often
Grand Mean	2.84	Often

Legend: 3.25 – 4.00=Always; 2.50 – 3.24=Often; 1.75 – 2.49=Seldom; 1.00 – 1.74=Never

Projects that require the use of software or digital tools relevant to vocational fields are commonly assigned (mean=3.03), reflecting an emphasis on practical, hands-on learning that prepares students for industry demands (Mukekhe, 2019). Additionally, virtual tours of industries or workplaces (mean=3.10) and the use of technology to track and assess student progress (mean=3.11) are often utilized, indicating that teachers recognize the value of experiential learning and continuous feedback in vocational education (Kolb and Kolb, 2009). Encouraging students to use online research for their projects and assignments (mean=3.19) further demonstrates the integration of digital literacy into the curriculum (Lyall and Meagher, 2012). These practices are aligned with research suggesting that technology-enhanced learning environments can significantly enhance student engagement, understanding, and readiness for the workforce (Arcadio et al., 2023).

However, some practices are less frequently employed. Online platforms for student collaboration and communication (mean=2.48), interactive quizzes and assessments (mean=2.45), and digital resources for self-paced learning (mean=2.45) are seldom used. This suggests that while technology is being integrated, there are opportunities to enhance its use in fostering interactive and individualized learning experiences (Song et al., 2012). The limited use of industry-standard software and equipment during lessons (mean=2.39) indicates a potential gap in exposing students to the tools they will encounter in the workplace, which could be critical for their career readiness (Lane, n.d.). Addressing these gaps by incorporating more interactive and industry-relevant technologies could significantly enhance the effectiveness of vocational education and better prepare students for their future careers (Wu, 2024; Puspitasari et al., 2018).

4. Respondents' challenges encountered on technology integration within TVL Classroom

The study identifies several challenges encountered in integrating technology within the TVL track of Philippine Senior High Schools, categorized into issues related to infrastructure and accessibility, as well as Technological Pedagogical and Content Knowledge (TPACK).

The mean score of 3.06 indicates that challenges related to infrastructure and accessibility are frequently encountered by educators. Limited access to high-speed internet (mean=3.10) is a notable barrier, affecting the ability to utilize online resources and tools effectively. This barrier restricts educators and students from fully leveraging online resources and tools for teaching and learning purposes (Priyanto, 2024). Research suggests that the digital divide, exacerbated by disparities in internet access, disproportionately affects marginalized communities and exacerbates educational inequalities (Hargittai, 2003). This limitation is compounded by an insufficient number of computers and other digital devices (mean=3.20), which restricts students' opportunities to engage with technology on a regular basis. The scarcity of computers and digital devices restricts students' access to technology, hindering their ability to develop digital literacy skills and participate fully in technology-enhanced learning experiences (Samarakoon et al., 2017). Research suggests that equitable access to technology is essential for preparing students for success in the digital age and

narrowing the digital divide (Kaliisa and Michelle, 2019). Frequent technical issues with hardware such as computers and projectors (mean=2.85) further disrupt the integration process, highlighting the need for reliable equipment. These issues hinder educators' ability to effectively utilize technology in their teaching practices and compromise the learning experiences of students (Eden et al., 2024).). Research suggests that reliable equipment is essential for supporting seamless technology integration and ensuring consistent access to digital resources and tools (Hew and Brush, 2007). The lack of necessary software and digital tools (mean=3.24) poses a significant barrier, preventing educators from fully utilizing technology to enhance learning. The absence of essential software and digital tools hampers educators' ability to create engaging and interactive learning experiences for students (Bingimlas, 2009). Research suggests that access to a diverse range of software and digital tools is essential for supporting diverse teaching strategies and addressing the varied needs of learners (Debettencourt et al., 2016). Additionally, inadequate technical support and maintenance services (mean=2.90) challenge the sustainability of technology use in classrooms, indicating a need for improved support systems. Insufficient technical support and maintenance services hinder educators' ability to effectively address technical issues and maintain the functionality of technology infrastructure (Garcia & Santos, 2021). Research suggests that robust technical support systems are essential for ensuring the smooth operation of educational technology and minimizing disruptions to teaching and learning (Lambert et al., 2024).

Table 3: Challenges encountered on technology integration

Items	Mean	Verbal Description
I. Infrastructure and Accessibility	**3.06**	**Frequently a Problem**
1. Limited access to high-speed internet is a challenge in integrating technology within the TVL classroom.	3.10	Frequently a Problem
2. Insufficient number of computers and other digital devices hinders effective technology integration in the TVL classroom.	3.20	Frequently a Problem
3. Frequent technical issues with hardware (e.g., computers, projectors) disrupt the use of technology in the TVL classroom.	2.85	Frequently a Problem
4. Lack of necessary software and digital tools poses a significant barrier to technology integration in the TVL classroom.	3.24	Frequently a Problem
5. Inadequate technical support and maintenance services are a challenge for sustaining technology use in the TVL classroom.	2.90	Frequently a Problem
II. Technological Pedagogical and Content Knowledge (TPACK)	**2.55**	**Frequently a Problem**
1. Limited knowledge of how to effectively integrate technology with vocational content is a challenge in the TVL classroom. (TP)	2.71	Frequently a Problem
2. Difficulty in adapting teaching methods to incorporate new technological tools and resources is a challenge in the TVL classroom. (TP)	2.48	Infrequently a Problem
3. Insufficient training on the use of educational technology hinders effective technology integration in the TVL classroom. (TP)	2.52	Frequently a Problem
4. Difficulty in designing lesson plans that effectively integrate technology with pedagogical strategies is a challenge in the TVL classroom. (PK)	2.41	Infrequently a Problem
5. Challenges in managing a classroom environment where technology is heavily integrated are encountered in the TVL classroom. (PK)	2.59	Frequently a Problem
6. Inadequate understanding of how to assess student learning outcomes when using technology in teaching is a challenge in the TVL classroom. (PK)	2.40	Infrequently a Problem
7. Difficulty in aligning technology tools with specific content areas in the TVL curriculum is a challenge. (CK)	2.42	Infrequently a Problem

8. Limited availability of digital resources that are directly relevant to the vocational content being taught poses a challenge. (CK)	2.90	Frequently a Problem
9. Challenges in integrating technology in a way that enhances understanding of complex vocational concepts are encountered. (CK)	2.71	Frequently Encountered

Legend: 3.25 – 4.00=Consistently Encountered; 2.50 – 3.24=Frequently Encountered; 1.75 – 2.49=Infrequently Encountered; 1.00 – 1.74=Never Encountered

The overall mean score of 2.55 in the TPACK category suggests that challenges related to educators' knowledge and skills in integrating technology with pedagogy and content are frequently encountered. Limited knowledge of how to effectively integrate technology with vocational content (mean=2.71) and insufficient training on the use of educational technology (mean=2.52) are significant issues, pointing to a need for more comprehensive professional development programs. Studies indicate that all-encompassing professional development programs are crucial for tackling these difficulties and enabling educators to properly utilize technology in their teaching methods (Chaipidech et al., 2021). By offering continuous training and assistance to instructors, educational institutions can strengthen their ability to smoothly incorporate technology into vocational education curricula and promote student learning outcomes (Jaipal-Jamani and Figg, 2015).

Difficulty in adapting teaching methods to incorporate new technological tools (mean=2.48) and designing lesson plans that effectively integrate technology with pedagogical strategies (mean=2.41) are infrequently encountered problems but still notable.

Educators often struggle with adapting their teaching methods to leverage new technological tools effectively, hindering their ability to create engaging and innovative learning experiences for students (West and Graham, 2007).). Additionally, designing lesson plans that seamlessly integrate technology with pedagogical strategies can be a complex task, requiring careful consideration of learning objectives, instructional methods, and technology resources (McKenney et al., 2015).). Research suggests that targeted professional development and support programs can help educators overcome these challenges by providing them with strategies and resources to integrate technology effectively into their teaching practices (Ertmer et al., 2012).

Managing a classroom environment with heavy technology integration (mean=2.59) and inadequate understanding of how to assess student learning outcomes when using technology (mean=2.40) also pose challenges, suggesting that educators may need additional support in classroom management and assessment strategies in a technology-rich environment (Ertmer et al., 2012). Research suggests that effectively managing a technology-rich classroom requires educators to establish clear expectations for technology use, establish routines for accessing and using technology resources, and address issues such as digital distraction and misuse (Johannesen et al., 2024).

Challenges in aligning technology tools with specific content areas in the TVL curriculum (mean=2.42) and the limited availability of digital resources directly relevant to vocational content (mean=2.90) are frequently encountered (Adanza and Sayson, 2022). These issues highlight the difficulty in finding and integrating appropriate technological tools that enhance the understanding of complex vocational concepts. Research indicates that effectively addressing these problems necessitates collaborative endeavors among educators, curriculum writers, and technology specialists to discover and create technological tools and resources that are specifically designed to meet the distinct requirements of vocational education (Summak and Samancıoğlu, 2011). Additionally, investing in the creation of digital resources directly relevant to vocational content can help bridge the gap between theory and practice in vocational education and provide students with authentic learning experiences (Gabriel et al., 2022). To optimize the incorporation of technology and assist student learning in vocational domains, educators can provide technology tools and resources that are aligned with the specific content areas in the TVL curriculum (Klassen, 2024).

5. Relationships of respondents' profile to attitudes, practices and challenges Encountered in connection with technology integration

The correlation analysis explores the relationships between the profile variables of respondents (age, sex, highest educational attainment, years in teaching, and ranks) and their attitudes, practices, and challenges related to technology integration in the TVL track of Philippine Senior High Schools.

Table 4: Correlation between profile of respondents and their belief system

Variables		Attitudes		Practices	Challenges	
		Perceived Usefulness	Ease of Use		Infrastructure and Accessibility	TPACK-related
Age$_a$	r-value	0.215	-0.311*	-0.415**	0.222	-0.257*
	p-value	0.096	0.015	0.001	0.086	0.046
Sex$_a$	r-value	0.011	-0.158	0.102	0.185	-0.054
	p-value	0.394	0.223	0.434	0.153	0.679
Highest Educational Attainment$_b$	ρ-value	0.039	.002	.190	-.095	.002
	p-value	0.767	0.987	0.142	0.468	0.991
Years in Teaching$_b$	ρ-value	-0.110	-0.010	-0.050	0.097	-0.002
	p-value	0.398	0.938	0.704	0.459	0.988
Ranks$_b$	ρ-value	-0.146	0.319*	-0.058	0.002	-0.066
	p-value	0.261	0.041	0.660	0.989	0.613

Legend: Subscripts a=Pearson's r b=Spearman's rho

**significant at the 0.01 level *significant at the 0.05 level

The age of respondents shows a significant negative correlation with challenges related to infrastructure and accessibility ($r = -0.415$, $p = 0.001$), indicating that younger educators tend to encounter fewer infrastructural challenges. The findings illustrate the need of taking age-related aspects into account when tackling technology integration obstacles. This underscores the necessity of implementing customized support and training programs to empower instructors of all age cohorts (Woods, 2020).

There is also a significant negative correlation with TPACK-related challenges ($r = -0.257$, $p = 0.046$), suggesting that younger teachers might be more adept at integrating technology pedagogically. These findings emphasize the significance of age-related aspects in comprehending educators' skills to incorporate technology and emphasize the necessity for customized professional development programs to assist educators of various age groups (Wolfson et al. 2014).

Age also shows a negative correlation with ease of use ($r = -0.311$, $p = 0.015$), indicating that older teachers may find technology less user-friendly. These results show that teachers' perceptions of technology's usability and adoption are influenced by age-related variables, and that older teachers need specific training and support to overcome their usability issues (Li and Luximon, 2018).

Moreover, the rank of educators shows a significant positive correlation with ease of use ($\rho = 0.319$, $p = 0.041$), indicating that higher-ranked teachers find it more easy to use existing technology (Locke, 2014). This may be due to a continuous training or familiarity with newer technological tools among higher-ranked, possibly more senior, educators (Tetiwat and Huff, 2002). Other correlations between rank and attitudes or challenges are not significant, suggesting that rank alone does not largely influence the perceived usefulness of technology or the infrastructural and pedagogical challenges faced by educators.

CONCLUSIONS RECOMMENDATIONS

The study provides valuable insights into the attitudes, practices, and challenges of technology integration within the TVL track of Philippine Senior High Schools. Overall, educators exhibit positive attitudes towards technology, recognizing its perceived usefulness in enhancing learning experiences and preparing students for future employment. However, challenges related to infrastructure and accessibility, as well as technological pedagogical and content knowledge (TPACK), hinder effective integration. Age and rank emerge as significant factors influencing educators' perceptions and challenges, with younger and lower-ranked teachers generally exhibiting more positive attitudes and facing fewer barriers. To address these challenges and leverage technology's potential, targeted interventions such as improved infrastructure, comprehensive professional development, and ongoing support are essential.

To address these challenges, it is recommended to invest in infrastructure improvements, provide comprehensive professional development programs, and support technological literacy among educators. Encouraging collaboration and sharing of best practices, tailoring support for older and higher-ranked educators, and updating curriculum and resources are also crucial steps. By implementing these recommendations, educational institutions can create an enabling environment for effective technology integration, ultimately enhancing the quality of vocational education and preparing students for success in the digital era and the evolving job market.

Ethics statements: The study considered the ethical measures of conflict of interest, privacy confidentiality and data protection, vulnerability management, risks and benefits, informed consent, and terms of reference.

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REFERENCES

Abarra, C. M. U., Abutal, C. W. A., Bagtas, C. N. D., Gutierrez, A. R., Veneracion, J. M., & Villegas, J. R. M. (2020). The perception of fidelis senior high technical-vocational and livelihood information and communication technology on the importance of coding skills for web development. https://doi.org/10.13140/RG.2.2.36092.97929

Adams, A. M., & Baddianaah, I. (2023). Factors affecting female enrolment in technical and vocational education and training institutions in sub-Saharan Africa: insights from north-western Ghana. *International Journal of Training Research*, 21(3), 187–210. https://doi.org/10.1080/14480220.2023.2179096

Adanza, L. S., & Sayson, Z. D. (2022). Challenges Encountered by the Technical Vocational Program Implementers. *In International Journal of Innovative Science and Research Technology* (Vol. 7). www.ijisrt.com

Aderibigbe, S. A., Colucci-Gray, L., & Gray, D. (2014). Mentoring as a collaborative learning journey for teachers and student teachers: a critical constructivist perspective. *Teacher Education Advancement Network Journal*, 6(3), 17-27.

Priyanto, D. (2024). Education towards Equality: A Review of the Contribution of Distance Learning Technology in Expanding Access and Promoting Social Equality. *Technology and Society Perspectives (TACIT),* 2(1). https://doi.org/10.61100/tacit.v2i1.139

Agada, C. N. C. N., & Shitmi, N. L. S. N. L. (n.d.) TVET AND LOCAL TECHNOLOGIES: A TOOL FOR CURBING GLOBAL CHALLENGES HINDERING SUSTAINABLE YOUTH EMPOWERMENT AND NATIONAL DEVELOPMENT.

Arinto, P. B. (2016). Issues and challenges in open and distance e-learning: Perspectives from the Philippines. *International Review of Research in Open and Distributed Learning*, 17(2), 162-180. https://doi.org/10.19173/irrodl.v17i2.1913

Arcadio, R. D., Redgie Arcadio, J. N., Marie Arcadio, S. N., Marie Yongco, J. A., & Bendanillo, A. A. (2023). European Journal of Innovation in Nonformal Education Enhancing Technical Proficiency and Industry Readiness: A Comprehensive Diploma Program for Engineering Technology. *In*

European Journal of Innovation in Nonformal Education (EJINE) (Vol. 3, Issue 7). http://innovatus.es/index.php/ejine

Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. Eurasia *Journal of Mathematics, science and technology education*, 5(3), 235-245.

Borko, H., Jacobs, J., & Koellner, K. (2009). Contemporary Approaches to Teacher Professional Development. In International Encyclopedia of Education, Third Edition (pp. 548–556). *Elsevier.* https://doi.org/10.1016/B978-0-08-044894-7.00654-0

Caron, J. (2020). Understanding the teaching experiences of new tenure track university professors (Doctoral dissertation, Mount Saint Vincent University).

Chaipidech, P., Kajonmanee, T., Chaipah, K., Panjaburee, P., & Srisawasdi, N. (2021). Implementation of an andragogical teacher professional development training program for boosting TPACK in STEM education. *Educational Technology & Society*, 24(4), 220-239.

Christensen, R. (2002). Effects of technology integration education on the attitudes of teachers and students. *Journal of Research on technology in Education*, 34(4), 411-433. www.iste.org.

Daling, R. F. (2018). Accepting ICT integration: A challenge to school and curriculum. *Int. J. Educ. Res,* 6(9), 163-180. www.ijern.com

Debettencourt, L. U., Hoover, J. J., Rude, H. A., & Taylor, S. S. (2016). Preparing special education higher education faculty: The influences of contemporary education issues and policy recommendations. *Teacher Education and Special Education*, 39(2), 121-133. https://doi.org/10.1177/0888406416641007

Delgado, A. J., Wardlow, L., McKnight, K., & O'Malley, K. (2015). Educational technology: A review of the integration, resources, and effectiveness of technology in K-12 classrooms. *Journal of Information Technology Education: Research*, 14. http://www.jite.org/documents/Vol14/JITEv14ResearchP397-416Delgado1829.pdf

Dotong, C. I., De Castro, E. L., Dolot, J. A., & Prenda, M. (2016). Barriers for educational technology integration in contemporary classroom environment. *Asia Pacific Journal of Education, Arts and Sciences,* 3(2), 13-20.

Early, D. M., Maxwell, K. L., Burchinal, M., Alva, S., Bender, R. H., Bryant, D., Cai, K., Clifford, R. M., Ebanks, C., Griffin, J. A., Henry, G. T., Howes, C., Iriondo-Perez, J., Jeon, H.-J., Mashburn, A. J., Peisner-Feinberg, E., Pianta, R. C., Vandergrift, N., & Zill, N. (2007). Teachers' Education, Classroom Quality, and Young Children's Academic Skills: Results From Seven Studies of Preschool Programs. *Child development,* 78(2), 558-580.

Eden, C. A., Chisom, O. N., & Adeniyi, I. S. (2024). Harnessing technology integration in education: Strategies for enhancing learning outcomes and equity. *World Journal of Advanced Engineering Technology and Sciences*, 11(2), 001-008. https://doi.org/10.30574/wjaets.2024.11.2.0071

Enrique-Hinostroza, J. (2018). New challenges for ICT in education policies in developing countries: The need to account for the widespread use of ICT for teaching and learning outside the school. ICT-supported innovations in small countries and developing regions: Perspectives and recommendations for international education, 99-119.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers and Education,* 59(2), 423–435. https://doi.org/10.1016/j.compedu.2012.02.001

Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., & García-Martínez, I. (2022). Digital competences for teacher professional development. Systematic review. *European Journal of Teacher Education*, 45(4), 513-531.

Field, K. M. (2020). Teacher perceptions of collegial collaboration in an academy structure. https://doi.org/10.18297/etd/3529

Gabriel, F., Marrone, R., Van Sebille, Y., Kovanovic, V., & de Laat, M. (2022). Digital education strategies around the world: practices and policies. *Irish Educational Studies,* 41(1), 85-106. https://doi.org/10.1080/03323315.2021.2022513

Gillingham, R. E. (2014). It's a man's world: female students in a male-dominated learning environment (Doctoral dissertation, California State University, Sacramento).

Gillispie, J., Cassis, J., Fujinaka, T., Mcmahon, G., Gatlin, S., Tripp, A., Stein, D. S., & Wanstreet, C. E. (n.d.). Distance Learning i DISTANCE LEARNING 27 A HISTORICAL PERSPECTIVE AND LOOK

FORWARD AT THE E-LEARNING INDUSTRY 37 CLOSING THE DISTANCE: SUCCESS COACHING FOR ONLINE EDUCATION GOES MAINSTREAM. www.infoagepub.com

Hargittai, E. (2003). The digital divide and what to do about it. *New economy handbook*, 2003, 821-839. http://www.eszter.com/papers/c04-digitaldivide.html

Hensley, N. (n.d.). Teacher Perceptions of Blended Learning to Support 21st Century Learners. https://dc.etsu.edu/etd/3821

Hero, J. L. (2019). The Impact of Technology Integration in Teaching Performance. *Online Submission*, 48(1), 101-114. http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational technology research and development*, 55, 223-252. https://doi.org/10.1007/s11423-006-9022-5

Irima, F. K. (2023). Institutional Factors Influencing Implementation of Adult and Continuing Educationin Adult Education Centers in Imenti North Sub-county, Meru, Kenya (Doctoral dissertation, University of Nairobi).

Irkha, A., Hurskaya, V., Hryshchuk, M., Tereshchuk, V., & Chyrva, H. (2024). Digital Transformation in Education: Leveraging Technology for Enhanced Learning Experiences. *Futurity Education*, 4(3), 4-17. https://doi.org/10.57125/FED.2024.09.25.01

Jaipal-Jamani, K., & Figg, C. (2015). A case study of a TPACK-based approach to teacher professional development: Teaching science with blogs. *Contemporary issues in technology and teacher education,* 15(2), 161-200.

Jacob, W. J., Xiong, W., & Ye, H. (2015). Professional development programmes at world-class universities. *Palgrave Communications*, 1. https://doi.org/10.1057/palcomms.2015.2

Johannesen, M., Øgrim, L., & Hatlevik, O. E. (2024). Teachers' Professional Digital Competence: –The Neglected Management of Technology-rich Classrooms?. *Nordic Journal of Digital Literacy*, (2), 64-81. https://doi.org/10.18261/njdl.19.2.2

Kaliisa, R., & Michelle, P. (2019). Mobile learning policy and practice in Africa: Towards inclusive and equitable access to higher education. *Australasian Journal of Educational Technology*, 35(6), 1-14.

Khlaif, Z. N. (2018). Factors Influencing Teachers' Attitudes Toward Mobile Technology Integration in K-12. Technology, Knowledge and Learning, 23(1), 161–175. https://doi.org/10.1007/s10758-017-9311-6

Kim, J., & Lee, K. S. S. (2022). Conceptual model to predict Filipino teachers' adoption of ICT-based instruction in class: using the UTAUT model. *Asia Pacific Journal of Education*, 42(4), 699-713. https://doi.org/10.1080/02188791.2020.1776213

Klassen, J. (2024). International organisations in vocational education and training: a literature review. *Journal of Vocational Education and Training*. https://doi.org/10.1080/13636820.2024.2320895

Kolb, A. Y., & Kolb, D. A. (2009). Experiential learning theory: A dynamic, holistic approach to management learning, education and development. *The SAGE handbook of management learning, education and development,* 7(2), 42-68. https://doi.org/10.4135/9780857021038.n3

LaFave, R. R. (2020). A Qualitative Study of the Preparedness of Novice Teachers to Teach Effectively in a Blended Learning Environment (Doctoral dissertation, Lindenwood University).

Lambert, S., Voros, S., Troccaz, J., Canlorbe, G., & Avellino, I. (2024). Understand-ing The Needs of Mentoring in Surgery to Guide the Design of Surgical Telementoring Systems. 28. *ACM Reference Format: Solène Lambert*, 143(143), 143. https://doi.org/10.1145/3637420ï

Lane, C. M. (n.d.). A Descriptive Study of Louisiana 4-H 8th Through 12th Graders' A Descriptive Study of Louisiana 4-H 8th Through 12th Graders' Perceptions of Career and College Readiness Perceptions of Career and College Readiness. https://repository.lsu.edu/gradschool_theses

Li, Q., & Luximon, Y. (2018). Understanding older adults' post-adoption usage behavior and perceptions of mobile technology. *In International Journal of Design* (Vol. 12, Issue 3). www.ijdesign.org

Lyall, C., & Meagher, L. R. (2012). A Masterclass in interdisciplinarity: Research into practice in training the next generation of interdisciplinary researchers. *Futures*, 44(6), 608–617. https://doi.org/10.1016/j.futures.2012.03.011

Locke, W. (2014). The intensification of rankings logic in an increasingly marketised higher education environment. *European Journal of Education*, 49(1), 77-90.

Marcial, D. E., & Rama, P. A. (2015). ICT competency level of teacher education professionals in the Central Visayas Region, Philippines. *Asia Pacific journal of multidisciplinary research*, 3(5), 28-38.

McKenney, S., Kali, Y., Markauskaite, L., & Voogt, J. (2015). Teacher design knowledge for technology enhanced learning: an ecological framework for investigating assets and needs. *Instructional science*, 43, 181-202. https://doi.org/10.1007/s11251-014-9337-2

Mina, J. C., Subia, G. S., Barlis, P. T., Tuliao, R. C., & Pastorfide, D. M. (2020). Inclinations of Engineering and Marketing Management Students to Engage in Online Learning Technology Amidst the COVID-19 Pandemic (Vol. 62, Issue 09).

Mong, D. J. (2015). The teacher technology integration experience: Practice and reflection in the classroom. *In Journal of Information Technology Education: Research* (Vol. 14). http://www.jite.org/documents/Vol14/JITEv14ResearchP161-178Ruggiero0958.pdf

Mukekhe, M. S. (2019). Perspectives on Relevance of Physics Teacher Education Programmes in Relation to Pedagogic Skills of Student Teachers in Public Universities in Kenya (Doctoral dissertation, Maseno University).

Nagaraj, K., Killian, C., & Neville, J. (2012). Structured comparative analysis of systems logs to diagnose performance problems. *In 9th USENIX Symposium on Networked Systems Design and Implementation (NSDI 12)* (pp. 353-366).

Ngadiran, N. M., Alias, N. A., & Anuar, N. (2021). M-Learning Module for Self-Directed Language Learning; a Study of Students' Needs Analysis. *Development in Language Studies*, 1(1), 1-11. https://doi.org/10.30880/dils.2021.01.01.001

Ngugi, M., & Muthima, P. (2017). Female Participation in Technical, Vocational Education and Training Institutions (TVET) Subsector: The Kenyan Experience (Vol. 7, Issue 4). www.iiste.org

Njenga, M. (2022). Professional competencies and the continuing professional development needs of Technical, Vocational Education and Training (TVET) teachers in Kenya. *Hungarian Educational Research Journal,* 12(4), 475–492. https://doi.org/10.1556/063.2022.00118

Nuncio, R. V. (2020). Benchmarking ICT for education in Japan: Best practices, trends, challenges and lessons learned for Philippine ICT-based education & development. *Asia-Pacific Social Science Review*, 20(2), 136-148. https://www.researchgate.net/publication/342379056

Obonyo, C. O. (2013). Pedagogical, andragogical and holistic development of visually impaired learners in special schools and vocational centres Rarieda, in Siaya County, Kenya (Doctoral dissertation, Kampala International University, College of Education, Open and Distance Learning).

Paracuelles, J. S., Piano, M. M., Linao, C. J. B., Roes, R., Escober, R., Josol, H. C., & Tayactac, E. A. (2024).

 Adversities and Coping Mechanisms of Education Students During Online Learning. 1(5). https://doi.org/10.5281/zenodo.11188557

Plair, S. K. (2008). Revamping professional development for technology integration and fluency. The Clearing House: A Journal of Educational Strategies, *Issues and Ideas*, 82(2), 70-74.

Puspitasari, E. D. T., Surjono, H. D., & Minghat, A. D. (2018). Utilizing web based learning as 21st century learning media for vocational education. *International Journal of Engineering and Technology (UAE),* 7(4), 157-160. www.sciencepubco.com/index.php/IJET

Radkevych, V., Kravets, S., Herliand, T., Radkevych, O., & Kozak, A. (2021, March). Modern technologies in the development of professional competence in teachers from professional (vocational) education schools. In Journal of Physics: Conference Series (Vol. 1840, No. 1, p. 012041). *IOP Publishing.* https://doi.org/10.1088/1742-6596/1840/1/012041

Kotrlik, J. W., & Redmann, D. H. (n.d.). Analysis of Teachers' Adoption of Technology for Use in Instruction in Seven Career and Technical Education Programs. *In Career and Technical Education Research* (Vol. 34, Issue 1).

Ross, H. M. (2019). Technology, Professional Development, and Student Achievement: Using the Tell Survey in a Study of Low Socioeconomic Schools in Kentucky (Doctoral dissertation, Western Kentucky University). https://digitalcommons.wku.edu/diss

Samarakoon, S., Christiansen, A., & Munro, P. G. (2017). Equitable and quality education for all of Africa? The challenges of using ICT in education. *Perspectives on Global Development and Technology*, 16(6), 645-665.

Sanchez Suasnabar, E. (2021). Participatory learning: Measuring learning and educational technology acceptance.

Song, Y., Wong, L. H., & Looi, C. K. (2012). Fostering personalized learning in science inquiry supported by mobile technologies. *Educational Technology Research and Development*, 60(4), 679–701. https://doi.org/10.1007/s11423-012-9245-6

Suárez-Rodríguez, J., Almerich, G., Orellana, N., & Díaz-García, I. (2018). A basic model of integration of ICT by teachers: competence and use. Educational Technology Research and Development, 66(5), 1165–1187. https://doi.org/10.1007/s11423-018-9591-0

Summak, M. S., & Samancıoğlu, M. (2011). Assessment of technology integration in vocational education and training schools. *In International Journal of Education and Development using Information and Communication Technology (IJEDICT)* (Vol. 7).

Tetiwat, O., & Huff, S. (2002). Issues Faced by Thai Educators in Adopting Web-based Educational Technology. *Information Technology and Universities in Asia.*

Tomaro, Q. P. V. (2018). ICT integration in the educational system of Philippines. *Journal of Governance and Public Policy*, 5(3), 259-282. https://doi.org/10.18196/jgpp.5399

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational technology research and development, 65, 555-575.* https://doi.org/10.1007/978-981-13-1179-6_111-1

Trevino Jr, D., Braley, R. T., Brown, M. S., & Slate, J. R. (2008). Challenges of the Public School Superintendency: Differences by Tenure and District Location. *Florida Journal of Educational Administration & Policy*, 1(2), 98-109.

Venkatesh, V., Davis, F. D., & Morris, M. G. (2007). Dead or alive? The development, trajectory and future of technology adoption research. *Journal of the Association for Information Systems*, 8(4), 267–286. https://doi.org/10.17705/1jais.00120

West, R. E., & Graham, C. R. (2007). Benefits and challenges of using live modeling to help preservice teachers transfer technology integration principles. *Journal of Computing in Teacher Education,* 23(4), 131-141.

Wolfson, N. E., Cavanagh, T. M., & Kraiger, K. (2014). Older adults and technology-based instruction: Optimizing learning outcomes and transfer. *Academy of Management Learning & Education,* 13(1), 26-44. https://doi.org/10.5465/amle.2012.0056

Woods, K. D. (2020). Teacher technology efficacy: The relationship among generation, gender, and subject area of secondary teachers.

Wozney, L., Venkatesh, V., & Abrami, P. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and teacher education,* 14(1), 173-207.

Wu, S. (2024). Application of multimedia technology to innovative vocational education on learning satisfaction in China. *Plos one,* 19(2), e0298861.