

Gender Stereotypes in Digital Technologies for Teaching and Learning in TVET Programs of Northern Mindanao, Philippines

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Abstract

This study examines gender stereotypes in the use of digital technologies for teaching and learning in Technical and Vocational Education and Training (TVET) programs in Northern Mindanao, Philippines. Using a descriptive research design, the study identifies the extent of gender stereotyping in digital technologies, while an independent sample t-test was employed to determine significant differences in perceptions between male and female respondents. The study involved faculty members from selected public and private Higher Education Institutions (HEIs) in Region 10 offering technology education programs. Findings indicate that while faculty members generally exhibit positive attitudes toward gender inclusivity, disparities persist in their perceptions of gender-stereotyped classroom practices. Participants disagreed with the notion that the government is not doing enough to raise awareness of gender issues, suggesting either a lack of clarity in government initiatives or limited public awareness of existing measures. Nevertheless, respondents strongly agreed that teachers should promote respect for all genders in educational settings. Although certain levels of gender insensitivity were observed, the overall findings suggest that gender stereotyping in the use of digital technologies within TVET programs is not highly pervasive. This study underscores the importance of continuous efforts to foster gender-inclusive practices in digital learning environments.

1. Introduction

The rapid advancement of digital technologies has significantly transformed education, reshaping teaching and learning methodologies across all levels, including Technical Vocational Education and Training (TVET). Today's learners, often referred to as the "digital generation" (Buzzard, Crittenden, Crittenden, & McCarty, 2011), engage with a diverse range of technological tools that have become integral to modern education. This digital revolution has not only altered traditional learning environments but has also facilitated more interactive and participatory instructional approaches (Sharma, 2017). However, despite these advancements, gender disparities persist in digital technology usage within education, particularly in technology-intensive programs such as TVET.

A major concern in education is the underrepresentation of women in Science, Mathematics, Engineering, and Technology (SMET) fields. Research suggests that gender stereotypes significantly influence students' academic interests and career choices. Studies indicate that curriculum content and teaching approaches often favor male students' interests, thereby limiting female engagement (Sanders, Koch, & Urso, 1997, as cited in Weber & Custer, 2005). Furthermore, culturally ingrained gender norms shape self-perceptions and influence the participation of both male and female students in digital learning environments (Witts, 1997, as cited in Weber & Custer, 2005). The media, peer interactions, and societal expectations reinforce these stereotypes, discouraging women from pursuing technology-related fields (Martin, Eisenbud, & Rose, 1995, as cited in Weber & Custer, 2005).

In the context of TVET, where digital technologies are increasingly integrated into teaching and learning, gender biases remain a pressing issue. Research has shown that men continue to dominate technology-driven fields, while women face systemic barriers, including gendered perceptions of technical competence (Powell, Dainty, & Bagilhole, 2012). Stereotypical beliefs—such as the notion that technology is a male-dominated domain—are embedded in educational settings through curriculum design, teaching strategies, and instructional materials (Kerkhoven, Russo, Land-Zandstra, Saxena, & Rodenburg, 2016). These stereotypes not only limit women's participation but also shape students' confidence, self-efficacy, and motivation in digital learning environments (Muntoni, Wagner, & Retelsdorf, 2020).

Despite extensive research on gender disparities in STEM and technology education, limited studies have explored gender stereotypes specifically in the integration of digital technologies within TVET programs. This gap needs to be addressed to ensure gender-inclusive learning environments and equitable access to technology-driven opportunities in vocational education.

Thus, this study aims to identify and analyze gender stereotypes in the use of digital technologies for teaching and learning in TVET programs in Northern Mindanao, Philippines. It seeks to examine how gender biases influence students' engagement with digital tools, particularly in the context of flexible and innovative learning approaches introduced during the COVID-19 pandemic. By investigating these issues, the study contributes to the ongoing discourse on gender equity in education and the development of more inclusive digital learning environments in TVET.

1.1 Research Objectives

This study aimed to examine gender stereotypes in the use of digital technologies for teaching and learning in TVET programs in Northern Mindanao, Philippines. Specifically, it sought to analyze faculty perceptions of gender sensitivity and gender-stereotyped practices in the use of digital technologies within TVET learning environments. It also aimed to determine whether statistically significant differences existed between male and female faculty members' perceptions regarding gender biases in digital teaching practices. In addition, the study explored the types of curriculum content and classroom activities that were perceived to be more engaging for male or female students, as reported in qualitative responses. Furthermore, it examined the preferred pedagogical approaches that faculty employed when utilizing digital technologies in TVET instruction. These objectives were addressed using a mixed-methods approach involving a structured survey with both closed and open-ended questions administered to selected faculty members across public and private higher education institutions in Region 10. Through this inquiry, the study aimed to generate region-specific insights to inform gender-responsive curriculum development, teacher training, and inclusive digital education practices in post-pandemic TVET systems.

1.2 Theoretical Framework

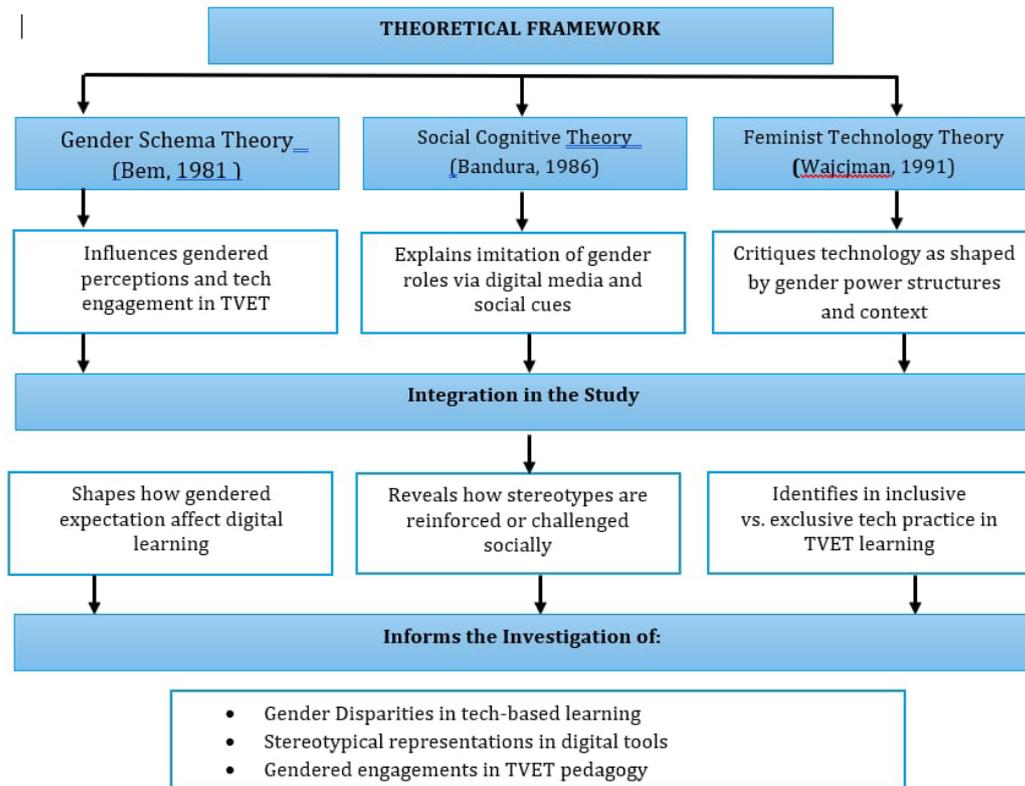


Fig. 1 Theoretical framework

1.3 Conceptual Framework

The conceptual framework for this study on Gender Stereotypes in Digital Technologies for Teaching and Learning in TVET Programs of Northern Mindanao, Philippines, is anchored in established theoretical and empirical research. It is structured around three key interrelated variables: gender perceptions, digital technology use, and pedagogical approaches. Drawing from Bem's (1981) Gender Schema Theory, the framework posits that internalized gender norms shape how individuals perceive and interact with educational technologies. Bandura's (1986) Social Cognitive Theory further supports the idea that these perceptions and behaviors are influenced by observation and social reinforcement within learning environments. In addition, Wajcman's (2004) Feminist Technology Theory highlights how digital technologies are not neutral but are embedded within gendered power relations, influencing both access and pedagogical application. Prior studies (e.g., Cooper, 2006; UNESCO, 2019) have shown that gendered assumptions in the design and use of educational technologies can lead to unequal participation and outcomes. Therefore, this framework justifies the exploration of how gender stereotypes manifest through the interaction of these variables within TVET contexts, guiding the analysis of disparities and strategies for gender-responsive pedagogy.

1.3.1 Key Concepts and Variables

- i. **Independent Variable: Gender (Male and Female Faculty Perceptions)**
 - Faculty perceptions toward gender stereotypes in digital learning environments
 - Attitudes toward gender-sensitive teaching practices
 - Awareness of government initiatives and institutional policies on gender equality in education
- ii. **Intervening Variable: Digital Technologies Used in Teaching and Learning**
 - Types of digital tools and platforms integrated into TVET programs
 - Gender-based preferences in using digital technologies
 - The extent to which digital learning tools reinforce or challenge gender stereotypes

- iii. **Dependent Variable: Prevalence of Gender Stereotypes in TVET Digital Learning**
 - The extent of gender-stereotyped practices in technology education classrooms
 - Differences in how male and female faculty and students experience digital learning
 - Strategies for eliminating gender biases in digital technology use
- iv. **Mediating Variables: Curriculum Content and Pedagogical Approaches**
 - Curriculum topics and activities that appeal more to male or female students
 - Teaching strategies using digital technologies that are most effective in fostering gender inclusion
 - Faculty roles in promoting gender-responsive digital learning

The conceptual framework has been restructured to reflect the interactive and reciprocal nature of the variables influencing gender stereotypes in digital learning environments within TVET programs. Rather than a linear progression, the framework recognizes that faculty gender perceptions, digital technology use, and gender stereotypes are dynamically interconnected and mutually reinforcing.

Specifically, faculty perceptions shaped by gender norms influence the selection and application of digital technologies. In turn, digital technology use affects how gender roles and expectations are reinforced or challenged in instructional settings. These interactions contribute to the formation or disruption of gender stereotypes in digital learning environments. Furthermore, gendered experiences and outcomes feed back into faculty perceptions, leading to iterative changes in beliefs and practices over time.

To address these complex relationships, curriculum and pedagogical interventions are not treated as end-points but as ongoing, adaptive processes that respond to and reshape gender perceptions and technology use. These interventions can actively dismantle stereotypes, promote inclusive teaching strategies, and influence how technologies are perceived and employed across gender lines.

This framework provides a holistic and cyclical approach to understanding and addressing gender disparities in TVET digital education. It enables the identification of leverage points for intervention and highlights the need for continuous feedback and adaptation in promoting gender equity.

2. Literature Review

2.1 Gender and Digital Technology in TVET Education

The integration of digital technologies in Technical and Vocational Education and Training (TVET) programs has transformed the landscape of teaching and learning. However, gender stereotypes continue to shape the adoption and utilization of digital tools in TVET institutions. This literature review examines existing studies on gender biases in digital education, the impact of stereotypes on learners, and strategies for fostering gender inclusivity in TVET programs.

TVET education is crucial for workforce development, yet gender disparities persist in digital technology engagement. Studies indicate that male students are more likely to pursue and excel in technical disciplines, whereas female students face societal biases that discourage them from participating in digital and technical fields (UNESCO, 2020). The digital gender divide remains a significant challenge, particularly in developing regions where cultural norms influence educational choices (EQUALS Global Partnership, 2019).

2.2 The Role of Gender Stereotypes in Digital Learning Environments

Gender stereotypes in digital learning environments manifest in various ways, including differential access to digital resources, confidence gaps, and biased curriculum content. Research suggests that female students are often perceived as less competent in handling digital tools, leading to lower self-efficacy and participation rates (Stoet & Geary, 2018). Additionally, instructional materials and online learning platforms may reinforce gender biases by depicting technology-related roles as predominantly male-dominated (Barker & Aspray, 2016).

2.3 Impact of Gender Stereotypes on TVET Learners

The transformation of Technical and Vocational Education and Training (TVET) systems through substantial government investment, innovative infrastructure, and pedagogies has been recognized as crucial for enhancing TVET's public image and relevance. Singapore's approach serves as a model, with heavy investment in modernizing TVET and developing industry-relevant curricula (Tan & Seet, 2020). Despite TVET's importance for economic development, many countries struggle with inadequate resources and negative perceptions (Ratnata, 2013). Malaysia has made significant investments in TVET, becoming one of Southeast Asia's most developed systems, but still faces challenges such as negative perceptions, curriculum issues, and limited industry collaboration (Amin et al., 2023). The Malaysian government has identified TVET as key to providing highly skilled

human resources and driving economic transformation. However, addressing governance issues and harmonizing stakeholder actions are essential for optimizing the sector's performance and quality (Rasul et al., 2015).

2.4 Strategies for Gender-Inclusive Digital Learning in TVET

The presence of gender stereotypes in digital TVET education can limit students' academic and professional growth. According to Vekiri and Chronaki (2018), female students in male-dominated technical programs experience increased pressure, discouragement, and lack of mentorship opportunities. These challenges contribute to higher attrition rates among women in technology-related fields. Moreover, unconscious biases from educators may further perpetuate gender disparities in learning outcomes (OECD, 2021).

Addressing gender stereotypes in digital TVET education requires multi-faceted strategies, including:

- **Curriculum Reform:** Integrating gender-sensitive language and inclusive imagery in educational materials can challenge stereotypes and encourage equal participation (UNESCO, 2021).
- **Capacity Building for Educators:** Teacher training programs should emphasize gender-responsive pedagogy to create an inclusive learning environment (World Bank, 2020).
- **Mentorship and Role Models:** Exposure to female professionals in digital technology fields can inspire more female students to pursue careers in TVET (European Commission, 2019).
- **Equitable Access to Digital Resources:** Ensuring that both male and female students have equal access to digital tools and training opportunities is crucial for bridging the digital gender divide (ITU, 2022).

2.5 Gender-Inclusive Digital Transformation in TVET Pedagogy

While digital technologies offer immense potential for TVET education, gender stereotypes remain a significant barrier to inclusive learning. Addressing these biases requires targeted interventions at institutional, pedagogical, and policy levels. By fostering an inclusive digital learning environment, TVET programs in Northern Mindanao can empower both male and female learners, promoting equitable opportunities for future employment and career advancement.

Recent research highlights the need to revolutionize TVET pedagogy to meet evolving workforce demands. E-learning initiatives in Nepal's TVET sector show promise as an innovative ICT-integrated approach, though additional support for training and infrastructure is required (Pangeni & Karki, 2021). The digital revolution necessitates continuous skilling and reskilling, emphasizing the importance of integrating informal and non-formal learning in TVET systems (Kanwar et al., 2019). Studies in Nigeria identify key guiding pedagogical principles for TVET teachers, including demonstration of knowledge, problem-based learning, and active learning, recommending continuous professional development to improve teaching practices (Okolie et al., 2021). Singapore's success in transforming its TVET system through substantial government investment, innovative training infrastructure, and pedagogies serves as a model for enhancing TVET's public image and relevance (Tan & Seet, 2020). These findings underscore the importance of adapting TVET pedagogy to incorporate technology, lifelong learning, and industry-relevant curricula.

3. Methods

3.1 Research Design

This study adopted a mixed-methods research design to comprehensively examine gender stereotypes in the use of digital technologies for teaching and learning in TVET programs across Northern Mindanao, Philippines. Unlike general pedagogical reform studies, this research specifically examines how digital teaching practices reinforce or challenge gender norms in technical and vocational education.

The quantitative component utilized a structured survey with Likert-scale items measuring faculty perceptions of: (1) gender-stereotyped classroom practices, (2) gender biases in digital technology use, and (3) strategies to counter stereotypes. Drawing from Gender Schema Theory (Bem, 1981) and Culturally Responsive Pedagogy (Gay, 2000), items were designed to reflect gendered expectations embedded in digital tasks, such as associating technical roles with male students. Data analysis involved descriptive statistics and t-tests to identify significant gender-related differences across demographic groups.

The qualitative component consisted of open-ended responses integrated into the survey, allowing participants to elaborate on their gender-related observations. Using Braun and Clarke's (2006) six-phase thematic analysis, responses revealed themes such as the masculinization of digital competence and the marginalization of female students in collaborative tasks. This theory-driven analysis ensured consistency across data strands and strengthened the study's gender-sensitive lens in interpreting faculty practices and digital learning experiences.

3.2 Sampling Procedure

A purposive sampling technique was employed to select 150 faculty members from technology education programs in Region 10 (Northern Mindanao). This method was deemed appropriate because the study aimed to gather insights from faculty members with direct experience in teaching TVET programs using digital technologies, ensuring relevance to the investigation of gender stereotypes in digital learning environments. In contrast to random or stratified sampling, purposive sampling focuses on information-rich cases (Patton, 2015), which is essential for addressing the study's gender-focused research questions.

To support a gender-comparative analysis, the sample included both male and female faculty members from public and private Higher Education Institutions (HEIs) offering TVET programs. Faculty members not engaged in teaching TVET courses were excluded to maintain the specificity and relevance of the responses.

The survey instrument used for data collection was constructed based on the Gender Schema Theory (Bem, 1981) and Culturally Responsive Pedagogy (Gay, 2000), which informed both the quantitative items and the open-ended qualitative prompts. These frameworks guided the operationalization of variables such as gender-stereotyped practices, bias in technology use, and perceptions of gender equity in digital learning contexts. For instance, items were designed to assess whether faculty perceive certain digital tools or tasks as more appropriate for male or female students, reflecting the influence of gender schemas and cultural norms.

The qualitative data obtained from the open-ended responses embedded in the survey were analyzed using Braun and Clarke's (2006) six-phase thematic analysis approach. This method enabled the identification of key gendered patterns and narratives—such as associations of technical proficiency with masculinity or the exclusion of women in collaborative online tasks—adding depth and context to the statistical findings. This theoretical and analytical alignment ensured internal coherence and enriched the study's interpretation of gender dynamics in TVET digital education.

3.3 Data Gathering Procedure

The data collection process for this study was carefully structured to ensure relevance, depth, and integrity of responses. Permission letters were first sent to academic heads of targeted Higher Education Institutions (HEIs) across various locations in Northern Mindanao, including Iligan City, Naawan, Initao, El Salvador, Opol, Cagayan de Oro, Lala, Maigo, Maranding, and Tubod. Faculty members teaching in TVET programs were identified and provided with informed consent forms that outlined the purpose of the study, the ethical safeguards in place, and the voluntary nature of their participation. Only those who consented were given the survey instrument. Although the initial target sample was 200, a total of 150 faculty members completed and submitted their responses. To ensure that the data gathered was both meaningful and aligned with the study's gender-focused objectives, a purposive sampling method was employed. This approach allowed the researchers to specifically target educators with direct experience in using digital technologies within TVET settings, ensuring that participants had the contextual expertise necessary for addressing the study's focus on gender stereotypes. The survey instrument included both closed-ended items for quantitative analysis and open-ended prompts for qualitative insights. Quantitative responses were analyzed using descriptive and inferential statistics, while the open-ended responses were subjected to thematic analysis using Braun and Clarke's (2006) framework. This dual-format instrument enabled the collection of both broad patterns and in-depth narratives, providing a comprehensive data set that reflects the gendered dimensions of digital teaching and learning in TVET programs.

4. Findings

Table 1 Faculty perceptions on gender inclusivity in teaching and learning

Statement	Mean	SD
Females should be encouraged to enter traditionally male jobs such as drafting, computer engineering, and architecture.	4.56	0.71
There should be concerted efforts to raise students with a non-sexist orientation at home and in schools.	4.34	0.82
Teachers should be involved in shaping their students' perceptions about gender roles.	4.56	0.71
Teachers should discourage students from acting out gender-stereotyped roles.	4.11	0.98
Males and females should be given equal opportunity and not treated differently.	4.73	0.61
Teachers should use gender-equitable language in their lessons.	4.44	0.78
Teachers should obtain and use digital learning materials that are gender-neutral.	4.57	0.65
Teachers should discourage gender-stereotyped behavior in their classes.	4.47	0.87
Teachers should encourage students to respect other genders.	4.80	0.61
Every student needs to learn about gender issues.	4.70	0.56

Statement	Mean	SD
Awareness about gender-stereotyped issues should be incorporated into all school subjects.	4.40	0.84
Schools and governments are not doing enough at the moment to create awareness about gender issues in the Philippines.	2.70	1.14
Technology Education programs should foster awareness of gender-stereotyped issues.	4.32	0.70
Technology Education programs should prepare students to deal with gender stereotypes and bias in the classroom and school.	4.28	0.75
Technology Education programs should promote gender-sensitive behavior.	4.40	0.77
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Teachers should encourage students to respect other genders.	4.80	0.61
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Table 1 demonstrates a strong and consistent commitment among TVET faculty members in Northern Mindanao to gender equity, particularly in the context of digital technologies for teaching and learning. The overall high mean scores ($M = 4.28-4.80$) and low standard deviations show that gender inclusivity is not only widely accepted but also consistently endorsed across the faculty respondents. When interpreted through established theories and compared with previous research, several important insights emerge. Gender Schema Theory (Bem, 1981) posits that individuals internalize societal gender norms, which then shape their perceptions, interactions, and expectations. The faculty's strong agreement that students should receive *equal opportunities* regardless of gender ($M = 4.73$) suggests an active rejection of traditional gender schemas commonly found in technical and digital domains.

The high support for gender-neutral digital materials ($M = 4.57$) indicates that teachers recognize how educational content can unconsciously reinforce gender schemas—a concern echoed in previous findings by Barker and Aspray (2016), who argued that technology-related curriculum materials often privilege male-centric roles. However, the slightly lower score for discouraging students from acting out gender-stereotyped roles ($M = 4.11$) reveals a subtle challenge: while teachers reject the gender bias conceptually, intervening in gendered behaviors may require more confidence or professional development. This aligns with Stoet & Geary (2018), who observed that gender schemas persist subtly in classroom interactions even when teachers express support for equity. Thus, at the theoretical level, the faculty's attitudes show a progression away from rigid gender schemas, although practical intervention remains an area for improvement.

Social Cognitive Theory (Bandura, 1986) emphasizes the impact of observational learning, modeling, and self-efficacy on shaping behavior. Teachers' strong agreement that they play a role in shaping students' gender perceptions ($M = 4.56$) directly reflects SCT's assertion that educators serve as powerful social models. Their support for gender-sensitive behavior and inclusive teaching strategies demonstrates a clear recognition that teachers' own actions shape student attitudes, that students develop stronger self-efficacy in using digital technologies when educators model inclusiveness, and that equitable access and feedback help reduce gender-based learning disparities. Previous studies reinforce this interpretation. Vekiri and Chronaki (2018) found that when teachers express confidence in female learners' digital abilities, girls' self-efficacy increases significantly. Likewise, OECD (2021) reported that unconscious biases among teachers can hinder student participation, but

gender-responsive pedagogies help narrow these gaps. These findings affirm Social Cognitive Theory, showing that faculty understand how their behaviors—especially in technology-mediated learning—serve as catalysts for shaping students’ beliefs about gender and digital competence. Feminist Technology Theory (Wajcman, 2004) further emphasizes that technologies are not neutral but reflect and reproduce existing power relations. The results of this study indicate that faculty recognize this dynamic, acknowledging that digital tools can reinforce stereotypes if used uncritically, that gender-neutral materials are needed to counter these biases, and that TVET programs must integrate gender sensitivity into technology education, as reflected in the consistently high mean ratings ($M = 4.32\text{--}4.40$).

This aligns with feminist critiques that emphasize the importance of critically examining the gendered assumptions embedded in digital systems. UNESCO (2021) similarly emphasized that digital platforms, unless consciously redesigned, may perpetuate gendered biases in content and representation. The faculty’s support for equitable access to digital technologies reflects awareness of the digital gender divide, a phenomenon highlighted by the EQUALS Global Partnership (2019) and ITU (2022), which found that women in developing countries continue to face limited opportunities for digital participation. The low agreement that “schools and governments are not doing enough” ($M = 2.70$) suggests divided perceptions about institutional support. Some may believe frameworks like the Philippine Magna Carta of Women and GAD policies are sufficient, whereas others may feel implementation is inadequate. This aligns with earlier findings by UNESCO (2020), which identified gaps between policy and practice in gender mainstreaming efforts across the Asia-Pacific.

Prior studies reveal that technical and digital fields remain perceived as “male” spaces (Stoet & Geary, 2018; UNESCO, 2020). This study’s findings contradict this trend by showing strong faculty endorsement of equal participation in engineering, architecture, and IT-related activities. This suggests progress in the TVET culture in Northern Mindanao toward dismantling technical–male stereotypes. The relatively lower score on actively discouraging gender-stereotyped behavior suggests that while teachers endorse gender equity, they may require more support. This aligns with recommendations by the World Bank (2020) and OECD (2021), both of which emphasize the need for capacity building in gender-responsive digital pedagogy. Consistent with Singapore’s and Malaysia’s TVET reforms (Tan & Seet, 2020; Amin et al., 2023), this study finds strong support for integrating gender awareness into digital learning—highlighting the need for continuous training, curriculum revision, and improved institutional structures.

Overall, the results demonstrate high awareness of gender inclusivity among TVET faculty, strong support for gender-sensitive digital pedagogy, and clear consistency with international gender equity frameworks. The findings also align with theoretical perspectives that emphasize social modeling, critical examination of technology, and the disruption of gender schemas in educational spaces. At the same time, the results highlight the need for strengthened institutional support and more systematic teacher training to sustain these practices. Taken together, the evidence suggests that TVET educators in Northern Mindanao are active partners in dismantling gender stereotypes and fostering equitable digital learning environments.

Table 2 Gender representation practices in digital learning materials

Statement	Mean	SD
I include diverse stories in digital learning materials featuring females as main characters or males in nurturing roles.	3.39	1.12
I ensure both male and female demonstrators are present in video tutorials on technological tasks.	3.76	1.08
I use gender-neutral pronouns in my PowerPoint presentations.	4.26	0.86
My digital learning materials reflect both male and female life experiences.	4.40	0.80
I ensure equal representation of males and females in shared documents.	4.48	0.78
I balance the use of digital learning materials authored by both males and females.	3.95	1.11
I prefer recorded demonstrations where a dominant gender performs the task.	3.09	1.32
My digital materials contain gendered pronouns that favor a dominant gender.	3.17	1.35
I prefer reference materials where the author is of the dominant gender in the field.	3.37	1.34
I share success stories of individuals excelling in their fields regardless of gender.	4.39	0.80

Table 2 reveals generally high levels of gender-inclusive digital practices among TVET faculty, with means ranging from 3.09 to 4.48. The strongest practices include the use of gender-neutral pronouns ($M = 4.26$), the inclusion of balanced male and female life experiences in digital materials ($M = 4.40$), equal representation in shared documents ($M = 4.48$), and sharing gender-inclusive success stories ($M = 4.39$). These high scores indicate strong awareness of gender representation in digital pedagogy. Anchored in Bem's (1981) Gender Schema Theory, these findings suggest that teachers are consciously attempting to disrupt traditional gender schemas by normalizing balanced and non-stereotypical portrayals of gender in learning materials. Such modeling behavior also aligns with Bandura's (1986) Social Cognitive Theory, which highlights how students internalize gender norms through observational learning. When teachers model inclusivity through their digital content, learners receive cues that technical roles and digital competencies are attainable regardless of gender.

Moderate mean scores ($M = 3.39$ – 3.95) appear in practices related to sourcing diverse materials, such as ensuring gender diversity in video demonstrators or authorship. This pattern reflects the broader structural reality described by Wajcman's (2004) Feminist Technology Theory, which argues that digital tools and media are often produced within male-dominated systems. Because many TVET-related tutorials, software demonstrations, and technical references are authored by men, educators may encounter fewer readily available gender-inclusive resources. This is consistent with Barker and Aspray's (2016) findings that digital educational materials often underrepresent women in technical roles, and UNESCO's (2020) documentation of the persistent digital gender divide in STEM and TVET.

The lowest mean scores—preference for dominant-gender demonstrators ($M = 3.09$), gendered pronouns ($M = 3.17$), and preferring materials authored by the dominant gender ($M = 3.37$)—suggest residual implicit biases. These align with research showing that teachers may unintentionally reproduce gender norms embedded in their own training or materials (OECD, 2021; Stoet & Geary, 2018). In the context of Gender Schema Theory, these lingering preferences reflect internalized cultural assumptions that continue to influence instructional choices. However, the moderate—not high—means indicate that such biases are not strongly entrenched, and that faculty are increasingly engaging in practices aimed at dismantling stereotypes.

Overall, the results demonstrate that TVET faculty are actively integrating gender-responsive practices into digital learning materials, aligning with global recommendations for inclusive digital pedagogy (UNESCO, 2021; World Bank, 2020). These practices support more equitable participation in technical fields by presenting balanced representations, countering stereotypes, and modeling inclusive digital behaviors. While structural and cultural influences still shape some residual biases, the overall trend reflects a shift toward a more gender-inclusive digital learning environment in Northern Mindanao's TVET institutions.

Table 3 Gender differences in perceptions of digital technologies in teaching and learning

Gender	Sample Size (n)	Mean Perception Score	Standard Deviation
Male	70	3.10	0.70
Female	80	3.45	0.75
Total	150		

Table 3 shows a clear gender difference in perceptions of digital technologies in teaching and learning. Female respondents reported a higher mean perception score ($M = 3.45$, $SD = 0.75$) than their male counterparts ($M = 3.10$, $SD = 0.70$). Although the difference is moderate, it reflects notable gendered patterns in how digital tools are interpreted and valued within TVET contexts.

From the lens of Bem's (1981) Gender Schema Theory, these differences may stem from internalized gender norms that shape how individuals evaluate their roles in technology-rich environments. Traditionally, digital and technical fields have been socially coded as "masculine," which has historically discouraged women from participating or perceiving these spaces positively. However, the higher mean among female respondents in this study suggests that women in Northern Mindanao's TVET programs are challenging these schemas and increasingly embracing digital technologies as empowering tools for teaching and learning. This shift is supported by UNESCO (2021), which reports that when educational institutions integrate gender-inclusive digital practices, women demonstrate improved confidence and more positive attitudes toward technology.

The findings also align with Bandura's (1986) Social Cognitive Theory, which emphasizes the role of social reinforcement and observational learning in shaping technology-related behaviors. Female faculty may be experiencing stronger institutional encouragement, peer support, or exposure to gender-inclusive digital pedagogy—all of which increase their self-efficacy and positive perception of digital tools. Vekiri and Chronaki (2018) noted that when educational environments actively model gender equity in technology use, female educators tend to develop stronger digital agency and more favorable views of ICT integration.

Interestingly, the lower perception score among male faculty ($M = 3.10$) echoes emerging literature suggesting that men may not always view digital transformation in pedagogy as necessary or beneficial, especially in fields where traditional, hands-on technical demonstrations remain dominant (Amin et al., 2023). Some male

educators may rely on conventional instructional methods, perceiving digital technologies as supplementary or as increasing workload—a trend also observed by OECD (2021) in digital teaching adoption studies.

From a structural perspective, Wajcman’s (2004) Feminist Technology Theory explains that technologies are shaped by gendered power relations. In many TVET fields where men historically dominate the technical domain, digital pedagogical reforms may be perceived as disrupting established roles and norms. As such, male respondents may express more neutral or cautious perceptions, whereas women—traditionally marginalized in technical spaces—may see digital transformation as leveling the playing field.

International literature further supports this pattern. Research by Barker and Aspray (2016) and Stoet & Geary (2018) demonstrates that women tend to respond more positively to digital tools when these tools promote collaborative, inclusive, and student-centered approaches—features often associated with modern digital pedagogy. Similarly, studies in Malaysia and Nigeria show that female TVET educators frequently value digital technologies for improving instructional inclusivity and accessibility (Okolie et al., 2021; Pangeni & Karki, 2021).

Overall, the gender differences in Table 3 suggest that women in Northern Mindanao’s TVET institutions exhibit higher receptiveness and more positive perceptions of digital technologies than men. This pattern reinforces the importance of gender-responsive digital initiatives, professional development programs, and policies that promote equitable participation in technology-enhanced TVET education. The results align with global evidence that digital transformations—when coupled with inclusivity—can help dismantle gender stereotypes and provide broader participation opportunities for both male and female educators.

Table 4 Preferred pedagogical approaches using digital technologies in TVET education

Pedagogical Approach	% of Faculty Respondents	Digital Tools Used	Engagement Level	Gender Considerations	Sample Verbatim Insight
Blended Learning	68%	LMS (Moodle, High Google Classroom), Zoom	High	Gender-neutral; equally effective for male and female students	Blended learning works saves time and gives
Project Based Learning	42%	AutoCAD, Canva, simulation apps	High	Males favor simulations /robotics; females excel in design/storytelling	"Project-based tasks push students to explore tech that fits their creativity
Interactive Platforms	36%	Kahoot!, Quizizz, Edpuzzle	High	Inclusive for shy and low-performing students of any gender	Kahoot keeps them "alert... even quiet students participate."
Teacher-Centered Lectures	27%	Powerpoint, Youtube	Moderate to Low	More common in rural areas; linked to gaps in digital training	"Sometimes we default to lectures due to a lack of resources or training."

Table 4 shows that TVET faculty prefer pedagogical approaches that leverage digital technologies to enhance engagement and foster inclusive learning environments. Blended learning is the most widely adopted approach (68%), supported by tools such as Moodle, Google Classroom, and Zoom, and is perceived as equally effective for both male and female learners. This preference aligns with Bandura’s Social Cognitive Theory, which emphasizes how digital platforms promote observational learning, feedback, and self-paced mastery, enabling equitable participation across genders. The high engagement observed in blended environments also reflects findings from UNESCO (2021) and Tan and Seet (2020), who report that blended learning strengthens flexibility and accessibility in TVET systems. Project-Based Learning (42%) reveals gender-differentiated strengths—males gravitating toward simulations and robotics, while females often excel in design and storytelling—patterns consistent with Bem’s Gender Schema Theory, which explains how students internalize socially constructed gender expectations. Nevertheless, PBL remains highly engaging, supporting research by Vekiri and Chronaki (2018) showing that gender-inclusive group work helps female learners develop stronger digital self-efficacy. Interactive platforms (36%), including Kahoot!, Quizizz, and Edpuzzle, also generate high engagement and are particularly effective for shy and low-performing students of any gender. These results affirm OECD (2021) and ITU (2022) findings that gamified technologies reduce stereotype threat and encourage broad participation. In contrast, teacher-centered lectures (27%), which rely on PowerPoint and YouTube, show moderate to low engagement and are more common in resource-limited or rural areas. This pattern reflects Wajcman’s Feminist

Technology Theory, which argues that inequitable access to technological resources reinforces gendered barriers in education. Overall, Table 4 illustrates that student-centered digital approaches—especially blended, project-based, and interactive platforms—are more effective in challenging gender stereotypes and promoting equitable TVET learning, while traditional lectures are constrained by infrastructural limitations and may inadvertently maintain existing gendered norms.

5. Conclusion

The findings from the study underscore both progress and persistent challenges in integrating gender sensitivity into digital technologies used for teaching and learning in TVET programs across Northern Mindanao, Philippines. Faculty members demonstrate an awareness of gender inclusivity, as shown in their use of gender-neutral pronouns and balanced representation in documents and instructional materials. However, traditional gender roles still subtly shape their teaching practices, as evidenced by their preferences for gendered reference materials, demonstration videos, and role assignments in digital content.

One notable trend is the division of gender representation based on societal expectations, where male figures are often portrayed in technical and engineering-related tasks, while female figures are more commonly associated with home economics or caregiving roles. This pattern reinforces occupational segregation in TVET fields and may contribute to the continued underrepresentation of women in STEM and technology-driven industries.

The study's overall mean score of 3.83 (interpreted as "Often") suggests that while faculty members frequently make efforts to ensure gender sensitivity, gaps remain in fully dismantling stereotypes embedded in digital learning environments. The variation in responses also highlights differing levels of gender awareness among educators, with some faculty members still unconsciously adhering to traditional gender norms in instructional design.

Given these insights, addressing gender bias in TVET digital technologies requires a more structured and institutionalized approach. Training faculty members, reviewing digital content, and embedding gender equity principles into TVET curricula will be crucial steps toward fostering a more inclusive and gender-responsive education system.

5.1 Implications and Suggestions

The findings of the study highlight the presence of both gender-sensitive and gender-biased practices in the use of digital technologies for teaching and learning in TVET programs in Northern Mindanao, Philippines. While many educators demonstrate efforts to integrate gender-inclusive practices—such as using gender-neutral pronouns and ensuring balanced representation in digital materials—some traditional stereotypes persist. The tendency to prefer gendered reference materials, such as male authors for technical subjects and female demonstrators for domestic-related tasks, reinforces conventional gender roles. This has significant implications for students' perceptions of their capabilities and career aspirations, potentially discouraging women from entering male-dominated fields and vice versa. Such reinforcement of stereotypes could contribute to occupational segregation, where gender continues to dictate career choices rather than personal interests and skills.

Furthermore, the study suggests that there is an uneven level of gender sensitivity awareness among faculty members. Some educators make a conscious effort to eliminate biases in digital learning, while others inadvertently perpetuate stereotypes through their choice of materials and instructional methods. This inconsistency indicates a need for professional development and institutional support to ensure that all educators adopt gender-inclusive teaching strategies. If unaddressed, these biases may persist and influence students' learning experiences, limiting their exposure to diverse and inclusive educational materials. Additionally, TVET institutions play a crucial role in shaping policies that can either challenge or reinforce these biases. Without deliberate policy interventions, gender stereotypes may continue to be embedded in digital learning content, affecting the overall goal of equitable education.

To address these concerns, several strategies can be implemented to enhance gender inclusivity in TVET digital education. First, capacity-building programs should be conducted for faculty members to increase their awareness of unconscious biases and train them in designing non-stereotypical instructional content. Workshops and training sessions focused on gender-sensitive pedagogy can help educators critically assess their teaching materials and ensure balanced representation. Additionally, TVET institutions should develop and promote inclusive digital learning resources that feature both men and women excelling in diverse fields. This can be achieved through a review process that evaluates digital materials for gender bias before they are integrated into the curriculum.

Furthermore, institutional policies should explicitly mandate gender-sensitive teaching approaches, ensuring that all faculty members adhere to guidelines that promote inclusivity. Encouraging student engagement in discussions and initiatives that challenge gender norms can also foster a more equitable learning environment. Programs such as mentorship opportunities for students, particularly women aspiring to enter male-dominated

fields, can provide them with the necessary support and confidence to pursue their career goals. Finally, further research should be conducted to measure the long-term impact of gender-sensitive digital learning materials on student perceptions and professional aspirations. By continuously evaluating and refining educational practices, TVET programs in Northern Mindanao can move towards a more inclusive and empowering learning environment for all students.

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Conflict of Interest

The authors affirm that there are no conflicts of interest related to the publication of this paper, ensuring the integrity, objectivity, and transparency of the research.

Author Contribution

The authors take full responsibility for all aspects of the research, from conception and design to data collection, analysis, interpretation, and manuscript preparation. The study was conducted independently, ensuring its integrity, rigor, and coherence.

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