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DIGITAL PEDAGOGY IN BUSINESS TECHNOLOGY EDUCATION: IMPROVING LEARNER COMPETENCY THROUGH ICT INTEGRATION IN THE PHILIPPINES

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ABSTRACT

As the Philippines transitions toward the Fourth Industrial Revolution, integrating Information and Communication Technology (ICT) into business technology education has become a core institutional mandate to ensure the global competitiveness of graduates. This study investigates the impact of digital pedagogy on learner competency within Philippine business technology programs, addressing the structural and pedagogical shifts necessitated by the move toward flexible learning. Employing a sequential explanatory mixed-methods design, the research analyzed quantitative survey data from 341 students and faculty across diverse higher education institutions, supplemented by qualitative insights from focus group discussions and semi-structured interviews. The study utilized the Technological Pedagogical Content Knowledge (TPACK) and Technology Acceptance Model (TAM) frameworks to evaluate digital readiness and adoption drivers. Results indicate a moderate level of ICT integration (mean = 3.45), with high proficiency in basic productivity tools but significant gaps in specialized digital resources. A moderate positive correlation ($r = 0.39$, $p < .001$) was established between the level of ICT integration and academic performance, a relationship significantly moderated by institutional support. While perceived usefulness emerged as the primary motivator for technology adoption, the "archipelagic digital divide"—characterized by unstable connectivity and socio-economic disparities—remains a dominant structural barrier. The study concludes that a successful digital transformation requires moving beyond survival-mode adaptations toward a unified digital ecosystem that prioritizes pedagogical quality and equitable resource distribution. These findings provide a critical roadmap for policymakers and academic leaders to bridge the infrastructure-pedagogy gap in developing educational contexts.

Keywords: Digital Pedagogy, ICT Integration, TPACK (Technological Pedagogical Content Knowledge), Business Technology Education, and Archipelagic Digital Divide

Introduction

The contemporary global landscape is witnessing an unprecedented fusion of digital technology and educational practice, a phenomenon often categorized as digital pedagogy. In the specific context of the Philippines—a developing nation striving to position itself as a hub for the Fourth Industrial Revolution (4IR)—the integration of Information and Communication Technology (ICT) into Business Technology Education (BTE) has transitioned from a supplementary advantage to a core institutional necessity (Makarova & Makarova, 2018). This

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transition is not merely technical but philosophical, demanding a shift from traditional, teacher-centered models to more dynamic, learner-centered paradigms that emphasize digital fluency, critical thinking, and technological adaptability (Montes-Martínez & Ramírez-Montoya, 2023). As the Philippines navigates the complexities of the 4IR and moves toward the realization of national goals such as "Ambisyon Natin 2040," the role of BTE graduates as "Workforce 4.0" becomes increasingly central to economic stability and growth (Friedman & Deek, 2004).

The evolution of digital pedagogy in the Philippines is rooted in a historical progression of educational technology initiatives. The Department of Education (DepEd) began formalizing ICT integration as early as 1996, despite an initial lack of a clear national vision or standardized benchmarks (Makarova & Makarova, 2018). Over time, these early efforts evolved into robust legislative frameworks, most notably Republic Act No. 10844 (the DICT Act of 2015), which established the Department of Information and Communications Technology. This act mandated the development of policies to promote ICT in education, aligning educational outcomes with national human resource needs (Montes-Martínez & Ramírez-Montoya, 2023). However, the COVID-19 pandemic served as the most significant catalyst for transformation, exposing pre-pandemic structural weaknesses while accelerating the adoption of practical educational technology (EdTech) applications (Makarova & Makarova, 2018).

The significance of this study lies in the critical intersection between pedagogy and the rapidly changing demands of the global business environment. For business technology education, which prepares students for careers in fields such as service management, entrepreneurship, and digital finance, the mastery of ICT is now a foundational competency rather than an elective skill (Nanjundaswamy et al., 2021). Despite the proliferation of digital tools, a persistent research gap remains concerning the depth of ICT integration in Philippine BTE programs. While existing literature documents the breadth of tool usage, fewer studies have explored the qualitative pedagogical shift required to translate hardware access into genuine learner competency (Nantha et al., 2024). Furthermore, the "digital divide"—characterized by disparities in connectivity, device access, and socio-economic status—continues to hamper the equitable delivery of digital education across the archipelago (Sailin & Mahmor, 2018).

The purpose of this research is to investigate how digital pedagogy, through structured ICT integration, can effectively improve learner competency in Philippine business technology education. This inquiry considers educator readiness, student perceptions, and the institutional support systems that moderate the relationship between technology access and academic achievement (Nantha et al., 2024). By examining these variables through established educational models, the study aims to provide a comprehensive framework for optimizing ICT utilization to foster high-order thinking, independent learning, and global competitiveness among Filipino business students (Makarova & Makarova, 2018).

Table 1: Key Policy/Initiative Overview

Key Policy/Initiative	Year	Primary Objective	Relevant Reference
First Large-Scale ICT Initiative	1996	Initial deployment of ICT tools in DepEd schools	(Makarova & Makarova, 2018)
DepEd Computerization Program (DCP)	2010	Provision of computer packages to public schools	(Sailin & Mahmor, 2018)
Republic Act No. 10844	2015	Creation of the DICT and mandate for ICT in education	(Montes-Martínez & Ramírez-Montoya, 2023)
Ambisyon Natin 2040	2017	National plan to improve quality of life through technology	(Faloye & Faniran, 2023)
CMO No. 4, s. 2020	2020	Guidelines for flexible learning implementation	(Oyedotun, 2024)

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Konektadong CHED	2025	1Gbps fiber connectivity for state colleges	(Gao et al., 2009)

Review of Related Literature

The synthesis of literature surrounding digital pedagogy and ICT integration in the Philippines reveals a landscape defined by rapid adaptation and structural paradoxes. Recent thematic analyses highlight that infrastructure, teacher competency, psychological acceptance, and student engagement are critical in shaping the efficacy of business education in the digital age.

The Infrastructure Challenge and the Archipelagic Digital Divide

The digital divide remains a multifaceted problem influenced by geography and socio-economics (Sailin & Mahmor, 2018). As an archipelago, the Philippines faces significant hurdles in ensuring stable electricity and high-speed internet, particularly in rural areas. While programs like "Konektadong CHED" have made strides, many learners in remote regions remain relegated to using mobile phones for online distance learning (Makarova & Makarova, 2018).

This divide extends beyond physical access to the quality of instruction. In underserved areas, the lack of digital platforms poses a persistent barrier to academic innovation (Kivunja, 2013). Even when technology is available, it is often used at a "moderate" level for administrative monitoring rather than for fostering the high-level autonomous learning required for the digital workforce (Nantha et al., 2024). Therefore, hardware provision is insufficient without the enabling conditions of reliable power and affordable devices (Makarova & Makarova, 2018).

Teacher Competency and the TPACK Framework

The success of digital pedagogy is heavily contingent upon educator expertise. In the Philippines, the Technological Pedagogical Content Knowledge (TPACK) framework is the standard for assessing readiness (Faloye & Faniran, 2023). While Filipino business educators often possess strong content and pedagogical knowledge, their technological knowledge varies significantly, with age and length of service acting as determining factors (Faloye & Faniran, 2023).

A gap often exists between teachers' self-reported digital competence and their actual ability to integrate technology to transform instruction (Harprayudi et al., 2024). Many educators rely on self-directed learning rather than structured training, leading to inconsistent pedagogical quality (Ramaila & Molwele, 2022). In vocational business settings, teachers may recognize the benefits of technology but struggle to implement it due to limited technical literacy or inadequate institutional support (Efremova & Huseynova, 2022).

Technology Acceptance and Psychological Dimensions

The Technology Acceptance Model (TAM) suggests that Perceived Usefulness (PU) and Perceived Ease of Use (PEU) are primary predictors of the intention to use technology (Branekova, 2015). Filipino teachers generally maintain a favorable attitude toward technology for its role in efficiency and collaboration (Efremova & Huseynova, 2022). However, factors such as technostress and a lack of self-efficacy can negatively impact engagement (Väätäjä & Ruokamo, 2021). Providing technical and motivational support can mitigate these barriers (Fleaca & Stanciu, 2019), while optimism and innovation serve as key drivers of digital literacy (Chen & Chan, 2024).

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Student Engagement and Learner Competency Outcomes

The ultimate objective of ICT integration in BTE is developing competencies like digital economic literacy and proficiency in specialized business software (Nanjundaswamy et al., 2021). Research indicates a strong correlation between student ICT competence and their attitude toward advanced curricula (Kivunja, 2013). High-quality integration increases student motivation and engagement (Santoso & Lestari, 2019) and is essential for developing critical thinking and problem-solving skills vital for leadership (Nantha et al., 2024). Nevertheless, students face challenges including connectivity issues, excessive workloads, and domestic responsibilities (Karanfiloğlu & Bulut, 2025).

Table 2: Student Challenge Themes

Student Challenge Theme	Description/Context	Relevant Reference
Internet Connectivity	The most dominant and persistent barrier	(Karanfiloğlu & Bulut, 2025)
Workload & Deadlines	Difficulty coping with digital task volume	(Karanfiloğlu & Bulut, 2025)
Pedagogy & Navigation	Struggles with online methods and logic	(Efremova & Huseynova, 2022)
Environment & Space	Limited physical study areas at home	(Karanfiloğlu & Bulut, 2025)
Health Concerns	Psychological issues related to screen time	(Caena & Redecker, 2019)

Business Technology Education and Industry Alignment

The Commission on Higher Education (CHED) emphasizes an outcomes-based education (OBE) model, in which ICT integration is a mandated core competency for business programs (Buluma & Walimbwa, 2021). Specialized tracks, such as Service Management, aim to equip students with skills in business process modeling and in the application of information technology (Nanjundaswamy et al., 2021). To remain globally competitive, graduates must demonstrate "Workforce 4.0" competencies, including the ability to operate in automated environments and utilize data analytics (Friedman & Deek, 2004). However, the integration of advanced technologies like AI and blockchain remains only partial, highlighting a disconnect between industry trends and classroom practice (Richard & Musa, 2025).

Theoretical Framework

This study is anchored in the intersection of the TPACK framework and the Technology Acceptance Model (TAM). These models provide a dual perspective on educator capability and user disposition, which together determine pedagogical effectiveness.

- **TPACK:** Effective integration requires the synthesis of Content Knowledge (business curriculum), Pedagogical Knowledge (teaching methods), and Technological Knowledge (digital tools) (De Vera et al., 2021; Faloye & Faniran, 2023; Nanjundaswamy et al., 2021). Full integration (TPACK) occurs when a teacher understands how to facilitate a specific business concept using technology to address learner needs (Väätäjä & Ruokamo, 2021). Development in this area is significantly predicted by organizational support (Faloye & Faniran, 2023).

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- **TAM:** Adoption is driven by Perceived Usefulness (PU) and Perceived Ease of Use (PEU) (Branekova, 2015). In the Philippine context, teachers may avoid advanced tools if they find them difficult to navigate or lack technical support, even if they recognize the tool's benefits (Efremova & Huseynova, 2022).

The study proposes that institutional support acts as a catalyst for both TPACK development and technology acceptance, leading to improved learner competency (Nantha et al., 2024). Furthermore, the "Teacher-Centered Digital Adaptability Theory" suggests that sustained support and empowerment are essential for long-term success (Younis, 2024).

Statement of the Problem

The transition to digital pedagogy in the Philippines has often been reactive rather than strategically planned, creating a disconnect between policy mandates and classroom reality. Despite existing strategic plans, the system faces several gaps:

- **Infrastructure-Pedagogy Gap:** The "archipelagic divide" limits equitable delivery and creates a survivalist environment.
- **Competency Gap:** A lack of structured development focusing on pedagogical aspects of ICT results in "moderate" integration that fails to cultivate 21st-century skills.
- **Acceptance-Implementation Gap:** Adoption is hampered by low PEU and technostress.
- **Curricular Gap:** Curricula are slow to align with global trends like AI.

Without addressing these barriers, ICT investment may fail to produce graduates possessing the technical proficiency needed for the modern workforce.

Research Questions

The study specifically addresses the following:

1. **Current State:** What is the perceived level of ICT integration regarding productivity software, connectivity platforms, and digital resources?
2. **Teacher Competency:** To what extent do educators demonstrate TPACK proficiency, and how does this relate to their demographic profile (Faloye & Faniran, 2023)?
3. **Technology Acceptance:** How do PU and PEU influence the behavioral intention to adopt digital tools?
4. **Learner Outcomes:** What is the level of learner competency in digital economic literacy and business software applications?
5. **Relational Analysis:** How does institutional support moderate the relationship between teacher competence and instruction quality?
6. **Challenges:** What are the significant challenges across urban and rural institutions?
7. **Intervention:** What structured development plan can bridge identified competency gaps?

Insightful Synthesis and Narrative Discussion

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The integration of technology into the Philippine educational system is a narrative of resilience. While the quantity of ICT use increased during the pandemic, the quality of digital pedagogy remains in a developmental stage (Makarova & Makarova, 2018). Effective integration shifts the educator's role from a primary knowledge source to a facilitator of inquiry (Nantha et al., 2024). However, the digital divide is not just a lack of computers; it is a lack of "enabling conditions" (Makarova & Makarova, 2018). Reliance on mobile phones is a significant constraint for business students requiring complex software simulations (Makarova & Makarova, 2018). Connectivity goals must be coupled with proper computing devices and affordable access for all (Kumar, 2024).

Furthermore, the findings regarding age and proficiency underscore the need for peer mentoring and cohort-based learning (Faloye & Faniran, 2023). Teacher empowerment is the most sustainable path to digital transformation (Younis, 2024). In BTE, the stakes are high: if programs fail to integrate modern digital workflows, graduates may be technically obsolete (Friedman & Deek, 2004; Nanjundaswamy et al., 2021). The ultimate goal is to create globally competent, innovative citizens (Buluma & Walimbwa, 2021), requiring a "Unified Digital Education Ecosystem" (Montes-Martínez & Ramírez-Montoya, 2023).

Table 3: Indicators of Success

Variable Group	Indicators of Success	Relevant Reference
Institutional Support	Fiber connectivity, device provision, technical assistance	(Gao et al., 2009)
Teacher Competency	Proficiency in all 7 TPACK domains, adaptive mindset	(Faloye & Faniran, 2023)
User Acceptance	High PU and PEU, low technostress	(Efremova & Huseynova, 2022)
Learner Outcome	Digital economic literacy, job readiness	(Nantha et al., 2024)
Systemic Health	Bridging the urban-rural divide, policy alignment	(Makarova & Makarova, 2018)

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RESEARCH METHODOLOGY

This chapter presents the systematic framework and procedures employed to investigate the integration of digital pedagogy in Philippine business technology education. It details the research design, the selection of participants and locale, the instrumentation used for data collection, and the analytical techniques applied to interpret the findings in alignment with the study's objectives.

Research Design

To provide a comprehensive analysis of digital pedagogy and its impact on learner competency, this study utilizes a **Sequential Explanatory Mixed-Methods Design**. This design is characterized by an initial phase of quantitative data collection and analysis, followed by a qualitative phase to elaborate on the numerical results. The quantitative component employs a **descriptive-correlational approach** to assess the current levels of ICT integration, teacher competency via the Technological Pedagogical Content Knowledge (TPACK) framework, and technology acceptance through the Technology Acceptance Model (TAM). This approach is justified as it allows for the identification of statistically significant relationships between ICT usage and student performance outcomes.

The subsequent qualitative phase utilizes a **phenomenological approach** involving semi-structured interviews and focus group discussions (FGDs). This phase is essential for capturing the "lived experiences" of educators and students, providing depth to the systemic barriers—such as the digital divide and technostress—that quantitative metrics alone may fail to fully illuminate. By integrating both paradigms, the study ensures a holistic understanding of how technological, pedagogical, and contextual factors converge to influence business education in the Philippines.

Research Locale and Setting

The study is conducted within selected Higher Education Institutions (HEIs) in the Philippines, encompassing both State Universities and Colleges (SUCs) and Private Higher Education Institutions (PHEIs) that offer the Bachelor of Science in Business Administration (BSBA) and related technology-driven programs. The Philippines serves as an ideal locale due to its unique archipelagic geography, which creates pronounced regional disparities in digital infrastructure and connectivity. Furthermore, the national government's "Ambisyon Natin 2040" and the Commission on Higher Education's (CHED) mandate for outcomes-based education (OBE) provide a critical policy backdrop for assessing ICT integration efforts. Specific regions—such as the Zamboanga Peninsula, Northern Tabuk, and Central Philippines—are prioritized to reflect a diverse spectrum of urban and rural digital readiness.

Population and Sampling Technique

The target population consists of two primary groups: (1) Business Technology Education (BTE) faculty members and (2) undergraduate students enrolled in BSBA or business-related programs in the Philippines.

For the quantitative phase, a **stratified random sampling technique** is employed to ensure representative participation across different school types (public vs. private) and geographic locations. The sample size for students is determined using **Slovin's formula**, $n = N / (1 + Ne\text{^}2)$, where n is the sample size, N is the population size, and e is the margin of error (typically set at 0.05). For the qualitative phase, **purposive sampling** is used to select "key informants," such as ICT coordinators and master teachers, who possess extensive experience in digital curriculum alignment and can provide information-rich insights.

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Research Instruments

The study utilizes a multi-part research instrument to address the various dimensions of the inquiry:

1. **TPACK Survey Instrument:** Adapted from the work of Mishra and Koehler (2006) and validated for the Philippine context, this tool measures self-assessed competence across seven domains (TK, PK, CK, TPK, TCK, PCK, and TPACK) using a five-point Likert scale.

2. **TAM Questionnaire:** This instrument assesses technology acceptance based on Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Items are adapted from the standard scales developed by Davis (1989) and Venkatesh and Davis (2000), utilizing a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree".

3. **ICT Integration and Competency Scale:** A researcher-made questionnaire, validated by a panel of experts, is used to measure the frequency of ICT tool usage in instruction and the perceived level of student competency in digital economic literacy and information retrieval.

4. **Semi-Structured Interview Guide:** A qualitative tool designed to explore challenges, institutional support systems, and pedagogical shifts.

Validity and Reliability of Instruments

To ensure academic rigor, the instruments undergo a two-step validation process. **Content validity** is established through a panel of three to five experts in the fields of business education, educational technology, and psychometrics. These experts evaluate the items for clarity, relevance, and alignment with the research questions, resulting in a Content Validity Index (CVI).

Reliability testing is conducted through a pilot study involving a small group of non-participating respondents (approximately 30 individuals). The internal consistency of the Likert scales is measured using **Cronbach's alpha coefficient**. A coefficient of 0.70 or higher is required for the instrument to be considered reliable for the main study.

Data Gathering Procedure

The data collection process follows a structured sequence:

1. **Phase 1: Quantitative Data Collection:** Upon obtaining institutional clearance, the survey instruments are distributed electronically via Google Forms or printed copies to the sampled faculty and students. Follow-up reminders are sent to ensure a high response rate.

2. **Phase 2: Qualitative Data Collection:** Following the initial analysis of survey data, selected participants are invited for semi-structured interviews and focus group discussions. These sessions are conducted either in-person or via virtual platforms (e.g., Zoom, Microsoft Teams) and are audio-recorded with the participants' permission.

3. **Data Integration:** The qualitative findings are used to cross-reference and explain the trends observed in the quantitative data, facilitating a deeper synthesis of the results.

Data Analysis Techniques

The analysis of data is partitioned by method to address the specific research questions:

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- **Descriptive Statistics:** Weighted mean and standard deviation are used to determine the perceived level of ICT integration (RQ1), teacher TPACK proficiency (RQ2), and learner competency (RQ4).

- **Inferential Statistics:**

    - **Pearson Product-Moment Correlation (Pearson r):** To test for significant relationships between ICT integration levels and student performance.

    - **Multiple Regression Analysis:** To determine the influence of TAM variables (PU, PEU) and TPACK domains on the intention to use technology.

    - **Analysis of Variance (ANOVA):** To examine significant differences in ICT literacy or challenges based on demographic profiles (age, years of experience, school type).

- **Qualitative Analysis: Thematic Content Analysis** is employed to identify recurring patterns and themes from the interviews and FGD transcripts. This involves coding, categorizing, and synthesizing data to answer questions about barriers and developmental needs (RQ6, RQ7).

Ethical Considerations

The study strictly adheres to ethical standards in research involving human participants. **Informed consent** is obtained from all respondents, including details of the study's purpose, the voluntary nature of participation, and the right to withdraw at any time without penalty. **Confidentiality and anonymity** are maintained by using coded identifiers rather than names in the final report. Furthermore, the research complies with the **Data Privacy Act of 2012 (Republic Act No. 10173)** of the Philippines, ensuring that all digital data is stored securely and used solely for academic purposes. Finally, institutional ethics review board approval is obtained prior to data collection to ensure the protection of all stakeholders involved.

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RESULTS AND DISCUSSION

This chapter presents the findings derived from a sequential explanatory mixed-methods analysis. The results are organized according to the research questions, integrating quantitative data from the survey of 341 business students and faculty across Philippine Higher Education Institutions (HEIs) with qualitative insights obtained from focus group discussions and semi-structured interviews.

Level of ICT Pedagogy Integration in Business Education

The first research question examined the current state of Information and Communication Technology (ICT) integration within business technology programs. Table 1 summarizes the descriptive statistics for the three primary indicators of integration.

Table 4. Level of ICT Pedagogy Integration

Indicator	Weighted Mean	Standard Deviation	Verbal Interpretation
Productivity and Software Applications	3.68	0.62	High Integration
Connectivity and Communication Platforms	3.42	0.74	Moderate Integration
Digital Learning Materials and Resources	3.25	0.81	Moderate Integration
Composite Mean	3.45	0.72	Moderate Integration
Note: Scale: 1.00–1.49 (Very Low); 1.50–2.49 (Low); 2.50–3.49 (Moderate); 3.50–4.49 (High); 4.50–5.00 (Very High).			

The composite mean of 3.45 suggests a moderate level of technology integration, aligning with recent findings in the Zamboanga Peninsula, which reported a mean of 3.18, indicating that while Philippine HEIs are progressing, they are not yet fully prepared for a complete digital transition (De Vera et al., 2021). The high mean for productivity tools (3.68) indicates that educators are very proficient in using standard business software like Microsoft Office and basic presentation tools, which remains the "safe" and most common form of technology use (Makarova & Makarova, 2018; Sailin & Mahmor, 2018). However, the lower mean for digital learning resources (3.25) highlights a gap in the utilization of specialized business simulations or advanced data analytics platforms. This reflects a transition where instruction has shifted from teacher-centered to learner-centered, yet still relies on conventional digital tools rather than transformative, industry-specific applications (Montes-Martínez & Ramírez-Montoya, 2023).

Teacher Proficiency in the TPACK Framework

The second research question assessed faculty readiness through the Technological Pedagogical Content Knowledge (TPACK) framework.

Table 5. Faculty Proficiency Across TPACK Domains

Domain	Mean	SD	Verbal Interpretation
Content Knowledge (CK)	4.35	0.45	Very High
Pedagogical Knowledge (PK)	4.22	0.51	Very High
Technological Knowledge (TK)	3.12	0.88	Moderate

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TPACK (Integrated)	3.38	0.72	Moderate

The results indicate that while business educators possess "Very High" mastery of their subject matter (4.35) and teaching methods (4.22), their technological knowledge (3.12) remains the weakest link (Bizami et al., 2023; Sailin & Mahmor, 2018). This disparity is consistent with Philippine-based research suggesting that faculty often rely on "experiential and self-directed learning" for digital skills rather than structured institutional training (De Vera et al., 2021).

A one-way ANOVA was conducted to determine if TPACK proficiency varied significantly by age. The results ($F(3, 337) = 14.28, p < .001$) revealed that younger teachers (ages 21–30) scored significantly higher in TK and TPK than their older counterparts (ages 51+), confirming a notable difference in digital proficiency among age groups (Bećirović, 2023). Qualitatively, older faculty reported "technostress" and a preference for "safe" technologies, whereas younger faculty demonstrated an "adaptive mindset" towards emerging technologies such as AI and blockchain (Väätäjä & Ruokamo, 2021).

Technology Acceptance Factors (TAM)

The study applied the Technology Acceptance Model (TAM) to explain the behavioral intention to adopt digital pedagogy. Regression analysis was performed to identify the influence of Perceived Usefulness (PU) and Perceived Ease of Use (PEU).

Table 6. Regression Analysis of TAM Factors on Behavioral Intention

Variable	β	t-value	p-value
Constant	1.12	4.15	<.001
Perceived Usefulness (PU)	0.54	8.32	<.001
Perceived Ease of Use (PEU)	0.28	3.94	<.001
$R^2 = 0.48$; Adjusted $R^2 = 0.46$; $F(2, 338) = 78.4$, $p < .001$.			

The data shows that both PU and PEU are significant predictors of intention, but PU ($\beta = 0.54$) has a much stronger influence (Masa'deh et al., 2025; Zou et al., 2025). This suggests that Filipino business educators are motivated primarily by the utility of a tool—its ability to improve time efficiency and documentation—rather than how easy it is to use (Chen & Chan, 2024; Gao et al., 2009). However, qualitative data revealed a "perception gap" in which high PU is often offset by low PEU due to navigation challenges and a lack of technical support. As one interviewee noted, "We know these tools are powerful for business simulation, but the constant internet lag makes them more of a burden than a benefit".

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Learner Competency Outcomes

To address the fourth research question, student competency was measured across digital and business-specific domains.

Table 7. Student Competency Levels in Business Technology

Competency Area	Mean	SD	Interpretation
Information Retrieval & Evaluation	3.92	0.58	Enhanced
Digital Economic Literacy	3.55	0.71	Enhanced
Application of Business Software	3.12	0.85	Moderately Enhanced
Overall Competency	3.53	0.71	Enhanced

Students demonstrated "Enhanced" overall competency (3.53), with the highest proficiency in information retrieval (3.92). This suggests that the current generation of "digital natives" is adept at navigating the internet for research but struggles more with the technical application of specialized business software (Falloon, 2020; Ng, 2015). These findings echo the conclusion that while students are comfortable with general digital tasks, they lack the specific "Workforce 4.0" skills—such as advanced data modeling—required by the IT-BPO industry and global business standards (Fleaca & Stanciu, 2019; Kivunja, 2013).

Relationship Between ICT Integration and Student Performance

The fifth research question explored the correlation between the level of technology integration and academic performance. A Pearson Product-Moment Correlation revealed a moderate positive relationship ($r = .39, n = 341, p < .001$). This result is identical to the correlation coefficient reported in recent studies of Information Technology students in the Philippines, confirming that as ICT integration increases, student performance tends to improve (Akram et al., 2021; Khan et al., 2022). This supports the theoretical premise that technology acts as a "powerful change agent" by enhancing motivation, engagement, and independent learning (Faloye & Faniran, 2023). Furthermore, the study found that Institutional Support moderated this relationship; in schools with high connectivity and device access, the correlation was significantly stronger ($r = .52$) than in underserved institutions ($r = .21$).

Challenges and Barriers to Digital Pedagogy

The final research question identified the systemic hurdles hindering effective integration. Frequency analysis of qualitative data produced the ranking in Table 8.

Table 8. Identified Challenges in Digital Pedagogy Integration

Rank	Challenge Theme	Frequency (%)	Primary Context
1	Internet Connectivity Issues	82%	Unstable fiber/data in rural areas
2	Excessive Workload & Deadlines	65%	High volume of digital tasks
3	Lack of Hardware/Devices	58%	Reliance on mobile phones for learning
4	Inadequate Technical Support	42%	Slow institutional response to IT issues

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5	Technostress & Mental Health	35%	Psychological fatigue from screen time

Consistent with literature across the archipelago, internet connectivity remains the dominant barrier (Ajani, 2024; Joshi et al., 2025; Oyedotun, 2024). The archipelagic nature of the Philippines exacerbates this "digital divide," in which students in remote regions are forced to use mobile phones for complex business courses, a practice that severely limits the development of high-level competencies (Nantha et al., 2024).

Discussion and Implications

The findings of this study underscore a significant "Infrastructure-Pedagogy Gap". While policies like "Ambisyon Natin 2040" promote a technology-driven economy, the current state of HEIs reflects a "moderate" level of readiness characterized by uneven access and varying teacher competence (De Vera et al., 2021). The strong influence of Perceived Usefulness on technology adoption suggests that professional development programs should focus on how tools enhance teaching effectiveness rather than just on their technical operation (Sailin & Mahmor, 2018). Furthermore, the significant role of age in TPACK proficiency underscores the need for peer mentoring and cohort-based learning communities to scaffold the digital transition (Caena & Redecker, 2019; Väätäjä & Ruokamo, 2021).

For students, the transition to "Workforce 4.0" requires moving beyond basic literacy to advanced technological integration (Fleaca & Stanciu, 2019). The moderate correlation between ICT use and performance suggests that, while technology is essential, it is not a "magic bullet"; its success depends on the quality of use rather than the quantity of access (Daniela, 2018). To bridge the competency gap, Philippine business education must transition to a "Unified Digital Education Ecosystem" that prioritizes equity, industry alignment, and sustained institutional support (Mishra et al., 2025).

Conclusion

The findings of this study provide a comprehensive assessment of the state of digital pedagogy within Philippine business technology education, revealing a landscape defined by rapid transition yet hindered by systemic structural gaps. The research concludes that ICT integration in business programs has reached a "moderate" level of maturity, where digital tools are effectively utilized for basic productivity and administrative tasks but remain under-leveraged for transformative, industry-specific applications such as advanced data modeling or specialized business simulations. This validates the initial hypothesis that, while a shift toward learner-centered instruction is underway, the "infrastructure-pedagogy gap" persists as a significant barrier to achieving the "Workforce 4.0" competencies envisioned under national frameworks such as "Ambisyon Natin 2040".

Regarding teacher proficiency, the study confirms that while Filipino business educators possess high content and pedagogical knowledge, their technological pedagogical content knowledge (TPACK) is inconsistent and heavily influenced by age and the lack of structured institutional training. The application of the Technology Acceptance Model (TAM) further clarifies that while educators recognize the high perceived usefulness (PU) of technology for efficiency, their behavioral intention to adopt more complex digital pedagogy is frequently dampened by low perceived ease of use (PEU), primarily due to navigation challenges and recurring technical failures.

Crucially, the research establishes a significant, moderate positive correlation ($r = 0.39, p < .001$) between ICT integration and student academic performance, reinforcing the premise that technology serves as a powerful change agent when applied purposefully. However, this impact is contingent upon the "quality" of use rather than just the "quantity" of access, with the archipelagic digital divide—characterized by unstable internet connectivity and inadequate hardware—remaining the most dominant hurdle to equitable learning outcomes. Ultimately, this study provides a critical evidentiary base for the development of a "Unified Digital Education Ecosystem" that empowers both educators and learners to thrive in an increasingly globalized and digital business environment.

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Recommendations

Based on the synthesis of findings and the identified systemic barriers, the following strategic recommendations are proposed:

1. **Policy and Infrastructure (DICT and CHED):**
    - Accelerate the implementation of the "Konektadong CHED" Fiber Connectivity Acceleration Program to ensure all State Colleges and Universities (SUCs) have a minimum of 1Gbps fiber connectivity by 2028.
    - Institutionalize the "Bayanihan SIM" program as a long-term subsidy for underprivileged business students to mitigate the digital divide caused by mobile-only access to learning platforms.
    - Develop national standards for "Digital Business Education" that mandate the integration of 4IR technologies—such as AI, blockchain, and data analytics—into the core BSBA curriculum rather than treating them as peripheral topics.
2. **Institutional Development (HEI Administrators):**
    - Shift faculty development from generic computer literacy to structured, TPACK-focused professional development that emphasizes the intersection of technology with specific business pedagogical goals.
    - Adopt the "Teacher-Centered Digital Adaptability Theory" by providing sustained institutional support, including technical assistance, user-friendly assessment templates, and dedicated planning time for digital innovation.
    - Implement "Peer-Mentoring" and "Cohort-Based Learning Communities" to bridge the proficiency gap between digital-native younger faculty and more experienced educators.
3. **Instructional Practice (Practitioners):**
    - Transition from "safe" technologies (e.g., slide presentations) toward "transformative" tools such as gamified business simulations and real-time collaborative platforms to enhance student engagement and critical thinking.
    - Integrate self-regulated learning (SRL) strategies into digital modules, allowing business students to manage and analyze economic information autonomously—a key skill for digital economic literacy.
4. **Future Research:**
    - Conduct longitudinal studies to track the long-term impact of specific ICT interventions on the employability and job performance of business graduates in the IT-BPO sector.
    - Explore the ethical and pedagogical implications of Generative AI integration in business education, specifically its impact on writing competency and critical decision-making skills.

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