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Empowering Educators Through Technology Integration: An Explanatory Sequential Mixed Methods Study

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Abstract

Addressing the persistent gap in digital competence among educators in underserved Philippine school contexts, this study examined the impact of a localized training intervention called TEACH-IT (Transforming Education and Creating Holistic Innovative Teaching). While national frameworks promote ICT integration, many rural teachers lack structured, context-relevant digital training. This study aimed to assess the effectiveness of TEACH-IT in improving digital proficiency and exploring how teachers internalized and applied what they learned. Employing an explanatory sequential mixed methods design, the study involved two phases: a quantitative pretest-post test design with 18 teachers, and a qualitative phenomenological inquiry with six purposively selected participants. Quantitative results indicated a statistically significant improvement in digital competence scores (W = 18.0, p = .018), with participants advancing from "Developing" to "Competent" levels. Thematic analysis of interview data revealed eight interconnected themes, including practical tool integration, increased student engagement, peer collaboration, and instructional confidence, as well as barriers such as time constraints and device shortages. The integration of findings showed that measurable gains were supported by meaningful experiential change, emphasizing the program's effectiveness in real classroom contexts. The study concludes that modular, experiential, and peer-supported training models can effectively address digital inequities and foster sustainable pedagogical transformation. These findings have important implications for education policy, teacher professional development, and future research focused on digital equity and context-sensitive ICT integration in low-resource environments.

Keywords: digital competence, pedagogy, professional development, teacher training, Wilcoxon signed rank test

1.0 Introduction

The integration of digital technologies into education systems has redefined teaching and learning worldwide, compelling educators to adapt to evolving technological demands and innovative pedagogical practices. The Fourth Industrial Revolution, characterized by rapid advancements in artificial intelligence (AI), blended learning models, and digital platforms, underscores the need for teachers to develop advanced digital competencies beyond basic ICT literacy (UNESCO, 2022; Segumpan and Alava, 2022; Cha et al., 2024; Wang et al., 2024). However, this shift remains uneven, particularly in rural and underserved educational contexts where limited professional development opportunities, inadequate infrastructure, and insufficient institutional support hinder effective digital adoption (Arellano & Lumogdang, 2025; Gohain et al., 2024).

In the Philippines, this disparity is pronounced in cooperative-based and rural institutions such as the BUSCO (Bukidnon Sugar Company) Academy Multipurpose Cooperative. As both an educational and socio-economic hub situated in an agricultural region, BUSCO represents a unique context where access to modern digital tools and targeted teacher training remains scarce (Mangcucang Villaseñor, 2024). While teachers demonstrate strong commitment to improving their instruction, their baseline digital competence often reflects minimal exposure to structured, context-sensitive professional development.

To address this need, the researchers designed the TEACH-IT (Transforming Education and Creating Holistic Innovative Teaching) training program, grounded in DepEd's ICT framework and the European DigCompEdu framework (2025). TEACH-IT targeted four core competency areas: (1) digital housekeeping skills, (2) instructional technology integration (e.g., Kahoot, Padlet), and (3) data visualization and analytics (Jamovi). The program emphasized experiential learning, collaborative peer support, and localized application to foster instructional agency, confidence, and inclusivity tailored to rural teaching realities.

Despite growing literature on digital transformation in education, two key gaps persist. First, a quantitative gap exists in empirical evidence linking structured digital training to measurable improvements in teacher competence, particularly in underserved or rural contexts (Vo et al., 2024; Yulin & Danso, 2025). While studies often report technology adoption rates or satisfaction scores, few demonstrate statistically significant learning gains following targeted digital interventions. Second, a qualitative gap remains in understanding how educators make sense of and apply digital tools post-training. As Braun and Clarke (2006) emphasize, qualitative inquiry is essential for uncovering meaning-making processes, while Morgan (2023) highlights the value of exploring the "how" and "why" behind digital adoption beyond numerical gains. UNESCO (2022) similarly underscores the importance of context-specific research to address localized realities in low-resource schools.

This study responds to these gaps through an explanatory sequential mixed methods design, integrating a quantitative assessment of digital competence gains with a qualitative phenomenological exploration of teachers' lived experiences. Situated within BUSCO Academy's cooperative school context, this study contributes empirical evidence on how localized, modular training can empower educators in resource-constrained environments. Furthermore, this study , this study is guided by the following research questions: (1) What is the level of teachers' competence before and after participating in the TEACH-IT training program?; (2) Is there a significant difference in teachers' competence levels before and after the TEACH-IT training program?; and (3) How do teacher participants make sense of their experiences during and after the TEACH-IT training program?

2.0 Materials and Methods

2.1 Research Design

This study adopted an explanatory sequential mixed methods design (Creswell & Plano Clark, 2021), integrating both quantitative and qualitative strands to provide a comprehensive understanding of the impact of the TEACH-IT training. The research was conducted in two distinct but interconnected phases. In Phase 1, a quasi-experimental one-group pretest-posttest design was employed to measure changes in teachers' digital competence before and after the intervention. This quantitative phase aimed to determine the extent of improvement attributable to the training. Following this, Phase 2 utilized a qualitative phenomenological approach to explore teachers' lived experiences during the training. This phase sought to explain the underlying mechanisms and perceptions that contributed to the quantitative results, offering deeper insight into how participants internalized and applied what they had learned.

This design allowed initial statistical results to be explained and deepened through lived teacher narratives, aligning outcome data with experiential insights (Yulin & Danso, 2025).

2.2 TEACH-IT Training Program

The TEACH-IT program was a researcher-developed and expert-validated training initiative designed to address the digital competence needs of educators from BUSCO. Grounded in the Department of Education's ICT competency standards and aligned with the DigCompEdu framework (2025), the program focused on four key areas of digital proficiency. It emphasized Digital Housekeeping Skills, which included device management, cloud storage, and cybersecurity fundamentals to ensure safe and efficient technology use. It also targeted Instructional Technology Integration, training participants to effectively use digital tools such as Kahoot, Padlet, and Jamboard to foster learner engagement and interaction. In addition, the program incorporated Data Visualization and Analytics, introducing participants to Jamovi for educational data analysis and interpretation, equipping them with skills essential for data-driven decision-making in teaching and learning contexts.

Training delivery was modular, hands-on, and context-driven, emphasizing experiential learning through real-world classroom applications, peer collaboration, and reflective practice.

2.3 Participants and Sampling Technique

The study involved 25 teachers (but with 18 teachers with completed pretest and posttest evaluation) from BUSCO Academy. For the qualitative phase, six teachers were purposively selected based on performance gains (high, medium, low improvement) from the quantitative phase, following Patton's (2002) maximum variation sampling strategy to capture diverse experiences.

2.4 Research Instrument

The pretest and posttest instruments were developed based on the TEACH-IT modules and validated against the Department of Education's ICT competency rubric to ensure alignment with national standards. Content validation was conducted by a panel of three experts, including an ICT integration specialist, an educational measurement expert, and a faculty member specializing in curriculum and instruction. To establish reliability, the instruments were pilot tested with teachers from Central Mindanao University Laboratory High School. The pilot testing yielded a Cronbach's alpha of 0.81, indicating a high level of internal consistency and confirming the instruments' reliability for use in the study.

Additionally, a semi-structured interview guide was developed for Phase 2 to explore teachers' lived experiences during and after the TEACH-IT training. This qualitative tool was designed to elicit in-depth reflections and uncover the meanings participants ascribed to their experiences (Abao et al., 2025). Key questions included: "What part of the training was most impactful for you?", "How did you apply what

you learned in your classroom?", and "What challenges did you face in integrating digital tools after the training?" These questions aimed to capture both the personal and professional transformations teachers experienced as a result of the program.

2.5 Data Gathering Procedure

The data collection was carried out in two phases over a six-week period. The quantitative phase included the administration of a pretest prior to the training and a posttest immediately after the training. The qualitative phase followed the analysis of quantitative data and involved in-depth interviews with six purposively selected participants who showed significant improvement and engagement, to gain insight into their training experiences. The interviews were conducted in person and recorded with informed consent.

2.6 Data Analysis Procedure

Quantitative analysis involved the use of descriptive statistics, specifically mean and standard deviation, to measure teachers' competence levels before and after the TEACH-IT training program. To determine if there was a statistically significant improvement in competence, the Wilcoxon Signed-Rank Test was employed, as it is appropriate for ordinal data and small sample sizes. This decision was informed by the results of the Shapiro-Wilk test, which confirmed that the data were not normally distributed ($p < .05$).

For the qualitative analysis, Braun and Clarke's (2006) six-phase thematic analysis framework was applied. This process began with familiarization, where researchers immersed themselves in the data by repeatedly reading transcripts. This was followed by generating initial codes to identify meaningful units of data, searching for potential themes by clustering related codes, reviewing these themes for coherence, defining and naming them to capture their essence, and finally producing a detailed report of the findings. AI-assisted coding was also employed to enhance efficiency and rigor during the coding process. Structured prompts were used in ChatGPT, such as: "Identify key themes from the following interview transcript," "Categorize responses by shared ideas or challenges," and "Extract participant quotations to illustrate each theme." The AI outputs were thoroughly reviewed and manually verified to ensure contextual fidelity. The finalized themes were then organized and presented using the Situation–Quotation–Confirmation (SQC) format, which effectively linked participant narratives to interpretive insights.

2.7 Ethical Considerations

The study followed strict ethical protocols. Participants were provided with informed consent forms outlining the research purpose, confidentiality measures, and voluntary nature of participation. Data anonymity was preserved using participant codes. Audio recordings were securely stored and deleted after transcription and validation.

3.0 Results and Discussion

This section presents the findings of the study in line with the explanatory sequential mixed methods design. Quantitative results address the first two research questions, focusing on teachers' digital competence levels before and after the TEACH-IT training and testing for significant differences in scores. The subsequent qualitative results explain and contextualize these quantitative outcomes by exploring how teachers made sense of and applied the competencies they developed during the training.

3.1 Level of Teachers' Competence Before and After the TEACH-IT Training Program

The TEACH-IT program explicitly targeted four core competency areas: (1) digital housekeeping skills (file management, cloud storage, device security), (2) instructional technology integration (tools such as

Kahoot and Padlet for interactive teaching) and (3) data visualization and analytics (using Jamovi to analyze and present data for decision-making).

Table 1. Teachers' Competence in TEACH-IT

Level of Proficiency	Range of Scores	Pretest		Posttest	
		f	%	f	%
Expert	28-30	0	0.00	0	0.00
Proficient	25-27	3	16.67	7	38.89
Competent	22-24	6	33.33	5	27.78
Developing	19-21	2	11.11	5	27.78
Beginning	0-18	7	38.89	1	5.56
Mean		20.00		23.11	
SD		5.30		2.59	
QD		Developing		Competent	

Pre-test and post-test scores were analyzed using a standardized rubric adapted from DepEd Order No. 73, s. 2012, modified to reflect these competencies. Results (Table 1) show that prior to the training, 38.89% of teachers were in the "Beginning" level, reflecting minimal competence in these areas. No participants achieved the "Expert" level. Most clustered at "Competent" (33.33%) or below, confirming the limited baseline digital skills observed in rural settings (Arellano & Lumogdang, 2025).

Following the TEACH-IT intervention, notable improvements were recorded. The proportion of teachers rated as "Proficient" nearly doubled from 16.67% to 38.89%, while those in the "Beginning" category dropped to just 5.56%. Mean scores increased from 20.00 ("Developing") to 23.11 ("Competent"), with a reduced standard deviation (from 5.30 to 2.59), indicating greater performance consistency across participants. This mirrors findings by Cha et al. (2024) and Dai et al. (2023), who emphasized that hands-on, context-driven training significantly reduces performance disparities and raises baseline competence in underserved environments.

These gains reflect mastery across the TEACH-IT modules, particularly in basic digital housekeeping and instructional technology integration, where tools such as Kahoot and Padlet were readily adopted. However, competencies tied to higher-order skills like data analytics (Jamovi) and AI-assisted applications showed slower progress, suggesting the need for extended training duration to deepen proficiency in more complex areas.

3.2 Significant Difference in Teachers' Competence Levels

The Wilcoxon Signed-Rank Test was used due to the ordinal nature of the data and non-normal distribution confirmed by the Shapiro-Wilk test. Results (Table 2) showed a statistically significant improvement in teachers' post-training scores ($W = 18.0$, $p = .018$). This indicates that the TEACH-IT program produced measurable and meaningful gains in digital competence.

Table 2. Summary Table comparing the training competence of teachers of Pre-test and Post-test

			Statistic		p
Pretest	Posttest	Wilcoxon W	18.0	[a]	0.018

Note. H_a μ Measure 1 - Measure 2 ≠ 0

[a] 3 pair(s) of values were tied

These findings substantiate prior claims (Vo et al., 2024; Yulin & Danso, 2025) that structured professional development rooted in clear competency frameworks leads to quantifiable skill advancement. The results provide empirical support for TEACH-IT's modular approach, particularly its progression from foundational digital housekeeping skills toward instructional technology integration and data analytics.

3.3 Teacher Participants' Experiences During TEACH-IT

To explain these quantitative gains, qualitative data were collected from six purposively selected participants representing high, medium, and low improvement levels. Braun and Clarke's (2006) thematic analysis, supported by AI-assisted coding (Morgan, 2023), revealed eight interrelated themes explaining how teachers internalized TEACH-IT's competencies and navigated contextual barriers.

Table 3. Narratives, Codes, Categories, and Emerging Themes

Narratives	Codes	Categories	Themes
P1, P2: "I applied all the training that we have especially Kahoot and Padlet." "Podcast activities… major application."	Use of digital tools in real class activities	Practical Integration of Tools	Practical and Engaging Digital Resource Use
P6: "Spinning the wheel... oral recitation... engaging kaayo sa class." (*"Spinning the wheel... oral recitation... it was very engaging in class."*)	Integration of tech-based games and apps	Interactive Digital Approaches	
P2 :"Jamovi helped me analyze data…"	Skill acquisition with analytics platforms	Research Tool Application	Developing Technological Confidence and Digital Skills
P3: "Code.org dali ra siya... sayon buhaton." ("*Code.org is easy... simple to use.*") P4: "Dali ra ma input ang data sa Jamovi... useful for research." ("*It's easy to input data in Jamovi... useful for research.*")	Functional ease of use	Functional Technological Competence	
P2 : "Students can share their ideas... very interactive." P3: "Padlet allows students to see others' ideas."	Collaborative learning	Learner Engagement	Enhancing Student Engagement Through Digital Interactivity

P6: "Excited ang mga bata... visible ilang work." ("*The students were excited... their work was visible.")*	Student excitement and motivation	Peer Collaboration and Visibility	
P4: "Nagshare mi og laptop kay kulang." (*We shared a laptop because there was a shortage.*) P6: "Wala koy laptop at first... nag-adjust lang." ("*I didn't have a laptop at first... I just adjusted.")*	Limited access to devices	Technological Constraints	Navigating Learning Challenges with Collaboration
P3, P5, "Kulang ra ang oras, especially sa Jamovi." ("*There wasn't enough time, especially for Jamovi*.")	Insufficient time allocation	Time Constraints	Training Time Limitations and Learning Depth Concerns
P6: "Mas maayo unta kung mas taas ang hands-on time." ("*It would be better if there was more hands-on time.")*	Fast-paced learning	Depth of Practice Opportunities	
P4: "I feel more confident now… kabalo nako unsay buhaton." ("*I now know what to do*.") "It made me confident and interactive sa classroom." ("*It made me confident and interactive in the classroom*.")	Improved teaching confidence	Self-Efficacy in Tech Use	Boosting Teacher Confidence and Instructional Agency
P5: "Mas klaro nako unsaon pag-integrate sa apps." ("*I now have a clearer understanding of how to integrate the apps*.")	Clear instructional planning	Clarity in Instructional Design	
P1 : "Old teachers na appreciate gyud kay first time nila ang tools." ("*The older teachers really appreciated it because it was their first time using the tools.*") P6 : "Even the less techy teachers nakasabay." ("*Even*	Inclusion of all experience levels	Inclusivity Across Skill Levels	Promoting Inclusivity and Peer Empowerment in Digital Adoption

the less tech-savvy teachers were able to keep up.")			
P2: "Nag-share mi sa uban nga wala pa kabalo." ("*We shared with others who didn't know yet."*)	Peer mentoring among colleagues	Community Sharing of Digital Tools	
P2 "I recommend this training… very useful and informative." P3: "Grabe among pasalamat... daghan mi'g natun-an." ("*We are very thankful... we learned a lot."*)	Satisfaction with training outcomes	Positive Reception of Program	Affirming Program Value and Broad Applicability

Practical and Engaging Digital Resource Use

Participants emphasized the immediate applicability of tools such as Kahoot, Padlet, and podcasting in their classrooms, which transformed their teaching practices into more dynamic and interactive experiences. P1 shared, "I applied all the training that we have especially Kahoot and Padlet," demonstrating how the TEACH-IT program allowed teachers to integrate digital tools directly into their instructional routines. This finding corroborates Cha et al. (2024), who highlighted that contextualized, hands-on tasks accelerate technology adoption by bridging the gap between training and practice. The program's emphasis on experiential learning facilitated a smoother transition from exposure to integration, enabling teachers to see the relevance of these tools in their actual teaching environments.

Developing Technological Confidence and Digital Skills

Teachers reported marked growth in their confidence and proficiency with previously unfamiliar digital platforms, particularly Jamovi and Code.org. P3 expressed, *"Code.org dali ra siya… sayon buhaton, (Code.org is easy… it's simple to use.)"* indicating a shift from initial apprehension to mastery. Such progression aligns with Dai et al. (2023), who argued that scaffolded, step-by-step training models effectively build digital self-efficacy among educators. By enabling teachers to gradually acquire and apply new skills, the program reduced anxiety associated with technology use and empowered participants to view themselves as capable digital practitioners.

Enhancing Student Engagement Through Digital Interactivity

Participants observed that integrating digital tools significantly improved student participation and enthusiasm. For instance, P6 noted, "Excited ang mga bata… visible ilang work, (The students were excited… their work was visibly seen.)" illustrating how tools like Padlet and Jamboard fostered collaboration and visibility in learning activities. This aligns with Arellano et al. (2024), who stressed that interactive technologies help shift students from passive recipients of knowledge to active co-creators in the learning process. By allowing students to share and showcase their work digitally, teachers reported a noticeable increase in motivation and classroom involvement.

Navigating Learning Challenges with Collaboration

Despite positive outcomes, teachers encountered logistical challenges, including device shortages and initial difficulties with tools like Jamovi. These obstacles were mitigated through strong peer collaboration and resource sharing. P4 recalled, "Nag-share mi og laptop kay kulang, (We shared a laptop because there

weren't enough.)" reflecting how collective problem-solving addressed infrastructure limitations. This finding echoes UNESCO (2022), which emphasizes that peer support systems are vital in sustaining professional development in low-resource contexts. Collaboration not only compensated for material deficiencies but also reinforced a sense of community among participants.

Training Time Limitations and Depth Concerns

While participants appreciated the breadth of content covered in TEACH-IT, many expressed a desire for more time to deepen their mastery of complex tools. P3 remarked, *"Kulang ra ang oras, especially sa Jamovi, (There just wasn't enough time, especially for Jamovi)"* underscoring the challenge of balancing comprehensive content delivery with sufficient practice opportunities. This sentiment mirrors Ramos et al. (2023), who warned that condensed professional development formats risk compromising retention and skill depth. Participants recommended follow-up sessions or modular extensions to reinforce advanced applications of digital tools.

Boosting Teacher Confidence and Instructional Agency

The training empowered teachers not only to acquire new skills but also to redesign their instructional strategies with greater autonomy. P4 reflected, *"I feel more confident now… kabalo nako unsay buhaton, (I feel more confident now… I already know what to do.)"* suggesting that the program cultivated self-efficacy and a stronger sense of instructional agency. Morgan (2023) similarly posited that confidence is a critical driver of pedagogical innovation, enabling educators to experiment with technology-enhanced teaching and adapt lessons to better suit learner needs.

Promoting Inclusivity and Peer Empowerment

An inclusive learning environment was a hallmark of the TEACH-IT program, allowing both tech-savvy and less experienced teachers to learn at their own pace. Peer mentoring played a crucial role in bridging skill gaps, as highlighted by P6's statement, *"Even the less techy teachers nakasabay. (Even the less tech-savvy teachers were able to keep up)"* This reflects Wang et al. (2024), who emphasized that equity-focused training models, supported by differentiated instruction and peer learning, foster broader participation and success in professional development contexts.

Affirming Program Value and Broad Applicability

Participants widely endorsed the training program for its relevance and practical value, expressing interest in its replication for other institutions. P2 stated, *"I recommend this training… very useful and informative,"* underscoring its perceived effectiveness and adaptability. This aligns with Dai et al. (2023), who argued that context-driven, need-based professional development models are more likely to generate long-term impact and scalability. Teachers saw TEACH-IT not merely as a one-time intervention but as a replicable framework for ongoing digital empowerment in education.

3.4 Integration of Findings Across Strands

The explanatory sequential design allowed qualitative insights to illuminate why significant quantitative improvements ($W = 18.0$, $p = .018$) occurred. Gains in competencies such as digital housekeeping and instructional tool integration were reinforced by themes of practical applicability and confidence-building, while slower progress in data analytics aligned with time constraints and the steep learning curve described by participants.

Moreover, peer collaboration and inclusivity explained the narrowing of competence disparities (reduced SD), demonstrating that TEACH-IT's community-driven model enabled equitable learning even in resource-limited conditions. Conversely, the absence of "Expert"-level proficiency contextualized the call

for modular, sustained follow-up training to deepen higher-order skills like analytics and AI-assisted teaching.

By merging statistical improvements with experiential narratives, this integration reinforces that TEACH-IT's impact stemmed not only from its structured content but also from its localized, experiential, and peer-supported design—a critical factor in addressing digital inequities in rural contexts (UNESCO, 2022; Vo et al., 2024).

4.0 Conclusion and Recommendation

This study contributes to the growing body of evidence that localized, modular digital training programs can significantly enhance teacher competence and pedagogical innovation in resource-constrained educational settings. More than a skills-based intervention, the TEACH-IT program demonstrated that experiential, inclusive, and context-aware training fosters not only measurable gains in digital proficiency but also transformational shifts in teaching confidence, student engagement, and professional identity. The mixed methods approach reinforced the value of pairing empirical measurement with phenomenological insights, revealing that the success of digital adoption lies not just in the acquisition of tools but in the meaningful integration of those tools into everyday instructional practice.

These findings have practical implications for teacher development programs, particularly in rural or cooperative school contexts where infrastructure and institutional support remain limited. TEACH-IT's peer-supported, hands-on model can inform national efforts to bridge the digital divide in basic education, supporting DepEd's push for equity-centered digital transformation. Policymakers and school leaders may recognize that training initiatives must go beyond technical orientation and instead embed opportunities for collaboration, reflection, and situated practice.

In terms of educational policy, integrating TEACH-IT-aligned modules into local and national professional development frameworks can support differentiated learning pathways for teachers at various proficiency levels. The study's emphasis on scaffolded learning and peer mentoring aligns with global recommendations for sustainable capacity building, particularly in the wake of rapid digitalization post-pandemic.

For future research, longitudinal and multi-site studies are needed to assess the durability of acquired competencies and their long-term impact on student learning outcomes. Additionally, as AI tools become more accessible in education, future iterations of TEACH-IT may explore ethical and pedagogical frameworks for AI integration, particularly in low-resource schools. Finally, localizing the TEACH-IT model for diverse school types across the Philippines and Southeast Asia can enhance its relevance and scalability, making it a vital template for inclusive and context-sensitive digital empowerment.

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