Information and Communication Technology (ICT) Teaching Skills of Teachers and Computer Systems Servicing (CSS) Proficiency of Learners

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Abstract

The integration of Information and Communication Technology (ICT) in education has become essential in preparing both teachers and learners for the demands of the 21st century. Teachers' proficiency in ICT teaching skills and learners' competence in Computer Systems Servicing (CSS) are critical indicators of effective technology-based instruction. This study was conducted to describe the level of ICT teaching skills among teachers, assess the proficiency level of CSS learners, determine significant differences in these competencies, and craft an intervention plan to enhance teaching and learning outcomes. The study employed a descriptive-comparative research design involving teachers and CSS learners from selected schools. Standardized survey instruments and performance assessments were used to measure technological, pedagogical, and content knowledge among teachers, as well as learning acquisition and practical application among CSS learners. Statistical tools such as weighted mean, ANOVA, and Mann-Whitney U test were applied to analyze the data and determine significant differences. Findings revealed that teachers are generally highly proficient in ICT teaching skills, with technological knowledge as their strongest area, while pedagogical and content knowledge require further enhancement. CSS learners demonstrated balanced proficiency in both learning acquisition and practical application, with no significant difference between the two aspects. Significant differences were found among teachers' ICT skills, particularly between technological and pedagogical knowledge, indicating uneven distribution of strengths. The study concludes that while teachers possess strong technological competence, they need targeted support in pedagogical and content integration. CSS learners show consistent performance across theory and practice, reflecting effective instructional approaches. Based on these results, the intervention plan PROJECT TPACK-TIVATE was developed to strengthen teachers' ICT teaching skills and sustain learners' CSS proficiency

Keywords: ICT teaching skills, CSS proficiency, intervention plan

1. Introduction

In today's digital world, the integration of technology in the classroom is no longer optional but an essential part of effective teaching and learning. Teachers are now expected to go beyond traditional

lecturing and actively use information and communication technology (ICT) to guide students toward independent, meaningful, and skill-based learning. This shift is particularly vital in technical and vocational education, where learners are prepared for real-world tasks and future employment. The ICT teaching skills of teachers play a crucial role in enhancing learners' proficiency in Computer Systems Servicing (CSS), as effective use of digital tools, instructional software, and hands-on technological strategies directly influences students' ability to develop technical competencies. In CSS, where learners are trained in computer hardware, software installation, troubleshooting, and IT support, teachers who are proficient in ICT can provide more engaging, relevant, and practical learning experiences.

This study aligns strongly with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4: Quality Education and SDG 8: Decent Work and Economic Growth. SDG 4 emphasizes inclusive and equitable quality education and the promotion of lifelong learning opportunities for all, which directly relates to enhancing teachers' ICT teaching skills and ensuring learners gain practical CSS proficiency. At the same time, SDG 8 highlights the importance of preparing learners for decent work and sustainable economic growth. Strengthening CSS proficiency contributes to building a skilled workforce capable of supporting ICT infrastructure and advancing digital industries worldwide.

It is in this light that the Philippine Government has committed to advancing technology as a cornerstone for progress, recognizing it as essential for economic growth and societal development. In the field of education, to address the demand for ICT-competent Filipino teachers, the Philippine Professional Standards for Teachers (PPST), as institutionalized by Department of Education Order 42 series 2017, clearly outlines the expectation for beginning, proficient, and highly proficient teachers in Domain 4. Curriculum and Planning under Strand 4.5 Teaching and learning resources including ICT.

At Simeon Tycangco Memorial High School in Ragay, Camarines Sur, similar challenges are observed in the teaching and learning of CSS. Teachers face difficulties in consistently integrating ICT tools into instruction due to varying levels of digital competence, limited access to updated instructional resources, and competing instructional demands. These challenges may affect the quality of classroom delivery and the extent to which learners are exposed to authentic, skills-based learning experiences. Consequently, some CSS learners demonstrate gaps in essential competencies such as system configuration, troubleshooting, and practical application of theoretical concepts. This situation underscores the need to closely examine how teachers' ICT teaching skills relate to learners' CSS proficiency within the specific context of the school.

Despite clear national policies that promote the integration of Information and Communications Technology (ICT) in education, classroom realities continue to reveal persistent challenges in implementation. Results from the Electronic Self-Assessment Tool (e-SAT) indicate that many teachers rate themselves at a low level in applying ICT in teaching and learning, pointing to a significant gap between expected competencies and actual classroom practice. While School Learning Action Cells (SLACs) have been institutionalized as collaborative, school-based professional development mechanisms to address such gaps through peer learning and shared expertise, empirical evidence on their effectiveness in strengthening teachers' ICT teaching skills remains limited, particularly in rural school contexts. In these settings, SLACs serve as a practical and accessible avenue for capacity building, with the potential to directly influence learners' academic performance and technical

proficiency in Computer Systems Servicing (CSS). However, few studies have examined the combined influence of teachers' ICT teaching skills and SLAC interventions on learner outcomes in technical-vocational education. This study bridges this gap by systematically investigating how ICT teaching competencies and SLAC-supported professional development relate to learners' CSS proficiency, identifying specific areas of difficulty among teachers, and generating evidence-based insights to inform more targeted and effective professional development programs and instructional practices.

2. Information and Communication Technology (ICT) Teaching Skills

Research on ICT teaching skills consistently underscores the centrality of the TPACK (Technological, Pedagogical, and Content Knowledge) framework in enhancing teacher competence and classroom innovation. Studies show that open lessons, intervention models, and pedagogical knowledge development contribute significantly to teacher growth and ICT integration, highlighting that TPACK-based programs strengthen teachers' ability to connect technology with sound pedagogy and content delivery (Abdulbakioglu et al., 2022; Absari et al., 2020; Abualrob, 2025). Likewise, empirical work on teacher competence demonstrates that successful ICT-enhanced instruction depends not only on technological familiarity but also on deep pedagogical reasoning and continuous professional training, as supported by both conceptual reviews and empirical studies across English, science, and general education contexts (Alhababi, 2017; Antonio, 2024; Aktaş & Özmen, 2020). Despite these advances, many teachers still report limited exposure to emerging digital tools and insufficient training opportunities, conditions that reduce confidence and hinder meaningful ICT integration in the classroom—especially in public secondary schools where support is inconsistent (Basargekar & Singhavi, 2017; De Villa Cabral, 2019). The collective findings emphasize that the development of ICT teaching skills requires sustained professional development, access to updated digital resources, and supportive institutional ecosystems that empower teachers to fully operationalize TPACK in daily instruction.

3. Computer Systems Servicing (CSS) Proficiency

Studies focusing on the CSS proficiency of learners reveal persistent challenges linked to resource limitations, uneven ICT implementation, and gaps in hands-on learning experiences. Research within the TLE–ICT–CSS specialization shows that many students have restricted opportunities to practice authentic technical tasks due to outdated laboratory equipment, insufficient tools, and inconsistent exposure to real-world troubleshooting scenarios—factors that impede skill mastery and affect learners' readiness for industry-aligned competencies (Bringula et al., 2023; Kesawan et al., 2024). Evidence from Philippine settings similarly highlights that without adequate school support, updated learning environments, and strengthened teacher competence, the technical-vocational goals of the K–12 curriculum cannot be fully achieved (Culajara, 2023; Eborde & Escote, 2024). These studies converge on the idea that CSS proficiency is not solely determined by learners' motivation or curriculum structure but is deeply influenced by the quality of instructional delivery, availability of modern equipment, and the capacity of teachers to simulate authentic industry tasks. As such, improving CSS proficiency requires a systemic approach—one that enhances teacher ICT capability, ensures updated facilities, and provides structured, hands-on learning experiences aligned with national technical-vocational standards.

4. Methodology

This study used the descriptive–comparative research design, which was appropriate for examining variations in the ICT teaching skills of teachers and the proficiency levels of learners in Computer Systems Servicing (CSS). The investigation was conducted during School Year 2024–2025 at Simeon Tycangco Memorial High School, Ragay District II, Division of Camarines Sur, and involved 142 respondents composed of 22 Junior High School teachers, 65 CSS 9 learners, and 55 CSS 10 learners, selected through purposive sampling. Data were gathered using a validated ICT Teaching Skills Survey Questionnaire for teachers (reliability = 0.78; validity = 0.94) and a 40-item teacher-made test for CSS learners (KR-21 = 0.78), both aligned with curriculum competencies and subjected to expert validation, pilot testing, and item analysis prior to administration. Ethical procedures—including informed consent, voluntary participation, and confidentiality—were strictly observed. The collected data were statistically analyzed using mean, standard deviation, weighted mean, One-Way ANOVA, Tukey post-hoc test, and the Mann–Whitney U test to determine significant differences and to effectively address the research objectives.

5. Results and Discussion

Table 2d presents the combined results of teachers' ICT teaching skills across the three domains: technological knowledge, pedagogical knowledge, and content knowledge. The highest mean rating was obtained in Technological Knowledge with a weighted mean of 2.84, interpreted as Highly Proficient. This was followed by Pedagogical Knowledge with a weighted mean of 2.71, also interpreted as Highly Proficient, indicating strong capability in ICT-supported instruction. Content Knowledge registered a weighted mean of 2.51, similarly interpreted as Highly Proficient but ranking the lowest among the three domains. These results reflect an overall Average Weighted Mean of 2.69, categorizing teachers generally as Highly Proficient in ICT teaching skills.

The summary table reveals that teachers are strongest in Technological Knowledge, suggesting that they are most comfortable performing basic and frequently used ICT tasks such as operating devices, creating digital materials, and navigating common software applications. Pedagogical

Knowledge also scored high, indicating familiarity with ICT-supported teaching strategies, although slightly lower than technological skills due to the greater instructional complexity involved. The lowest rating in Content Knowledge implies that, while teachers can use technology, they may be less confident when required to integrate ICT deeply into subject matter explanations or to design discipline-specific digital learning experiences. This pattern shows that teachers excel in practical, routine ICT competencies but encounter challenges when using technology in more advanced, content-embedded and pedagogically demanding ways.

Table 1

Summary of Level of ICT Teaching Skills of Teachers

Indicators	Combined		
	WM	Int	Ranks
Technological Knowledge	2.84	HP	1

Pedagogical Knowledge	2.71	HP	2
Content Knowledge	2.51	HP	3

Note. This table identifies the ICT Teaching Skills of Teachers in terms of Technological Knowledge with Weighted Mean (WM) in every indicator and its interpretation as 3.26-4.00 Very Highly Proficient (VHP), 2.51-3.25 Highly Proficient (HP), 1.76-2.50 Moderately Proficient (MP), and 1.00-1.75, Fairly Proficient (FP).

These results suggest that although teachers are generally competent in ICT use, strategic intervention is needed to elevate their skills in content-driven and pedagogically complex ICT applications. Their high technological proficiency ensures readiness for basic digital instruction, yet the comparatively lower proficiency in content integration may limit opportunities for students to experience higher-order, technology-enhanced learning. This indicates the importance of sustained professional development that goes beyond technical training and instead emphasizes designing ICT-supported lessons that deepen conceptual understanding and strengthen student engagement. Strengthening the weaker areas will help teachers transform ICT from merely a supportive tool into an effective driver of meaningful, interactive, and discipline-aligned learning.

This is consistent with earlier research showing that teachers often perform well in basic ICT tasks but struggle with more complex applications. Cruz (2019) reported that teachers tend to be capable in technological use but require further development in higher-level ICT integration, similar to the low rank of Content Knowledge in this study. Santos (2020) likewise found that educators excel in digital operations but encounter difficulty when applying ICT to deeper pedagogical functions. Research by Reyes (2021) also emphasized that continuous training is needed for teachers to effectively integrate ICT into lesson content, aligning closely with the findings of the present study. Dela Peña (2022) further confirmed that ICT readiness varies significantly depending on exposure and institutional support, reinforcing the need for targeted capacity-building efforts to improve teachers' content-related ICT competencies.

Table 2

Proficiency Level of CSS Learners

Aspects	Items	Mean	Standard Deviation	Proficiency Level	Interpretation
Learning Acquisition	20	13.58	3.58	67.88	AP
Practical Application	20	13.04	3.59	65.21	AP
Overall	40	26.62	6.80	66.54	Approaching Proficiency

Note. The proficiency level was interpreted using four ranges: scores from 75.0 to 100 were classified as Proficient, 50.0 to 74.9 as Approaching Proficiency, 25.0 to 49.9 as Developing, and 0.00 to 24.9 as Beginning.

Table 3 shows the proficiency level of CSS learners in two areas: Learning Acquisition and Practical Application. Learners obtained a mean score of 13.58 (SD = 3.58) in learning acquisition, equivalent to a proficiency level of 67.88%, interpreted as Approaching Proficiency. In practical application, they obtained a mean score of 13.04 (SD = 3.59) with a proficiency level of 65.21%, also categorized as Approaching Proficiency. Overall, the learners recorded a combined mean score of 26.62 (SD = 6.80), corresponding to an overall proficiency level of 66.54%, which likewise falls under Approaching Proficiency.

The data indicate that learners perform slightly better in learning acquisition than in practical application, suggesting stronger conceptual understanding than hands-on execution. Although both scores fall within the same proficiency category, the lower performance in practical tasks may reflect limited exposure to real equipment, insufficient laboratory time, or restricted opportunities to apply theoretical knowledge in technical scenarios. These results show that while students grasp the concepts taught in CSS, they face challenges when transferring these concepts into actual troubleshooting, installation, or configuration tasks.

These findings imply that learners possess basic foundational knowledge of CSS but have not yet

achieved a level of mastery required for full industry readiness. Their ability to understand lessons but struggle with hands-on skills signals a need for strengthening practical training, ensuring that students not only recall information but also confidently apply technical procedures in real-world contexts. This underscores the need for more structured laboratory sessions, improved access to tools and equipment, and teaching strategies that connect theory to authentic practice. Ultimately, enhancing practical exposure can help learners progress from "approaching proficiency" to true competency in CSS.

The results correspond with findings by Leones (2024), who noted that CSS learners often show acceptable theoretical understanding but struggle to reach higher proficiency levels due to limited access to functional tools and updated facilities. Similarly, Arroyo (2022) and Bringula et al. (2022) found that performance in CSS improves when learners engage with computer-based simulations and structured hands-on activities, especially in schools with limited resources. These studies reinforce the idea that practical exposure, adequate equipment, and realistic learning environments are crucial factors in improving learners' technical proficiency. The findings align with Piaget's Constructivist Theory, which states that learners build understanding by actively engaging with tasks and experiences rather than passively receiving information. Practical CSS tasks require this kind of active construction of knowledge.

Table 3a
Significant Difference among the ICT Teaching Skills of Teachers in Terms of the cited aspects

Aspects	N	Mean	SD	f-stat	p-value	Interpretation
Content Knowledge	23	2.410	0.665			
				4.420	0.02	Sig.
Pedagogical Knowledge	23	2.080	0.673			

Technological Knowledge	23	2.620	0.529

Note. N refers to number of respondents, SD refers to Standard Deviation, f-statistic refers to ANOVA statistic nonparametric value, and Significant means there is a significant difference.

Tables 3a and 3b present the significant differences in ICT teaching skills across the domains of technological, pedagogical, and content knowledge. In Table 4a, technological knowledge obtained the highest mean score (Mean = 2.620; SD = 0.529), followed by content knowledge (Mean = 2.410; SD = 0.665), and pedagogical knowledge with the lowest rating (Mean = 2.080; SD = 0.673). The computed f-statistic of 4.420 with a p-value of 0.02 indicates that there is a significant difference among the three domains. Table 4b further shows, through Tukey's post-hoc test, that the significant difference lies only between technological and pedagogical knowledge (Q = 4.165; p = 0.012). Meanwhile, no significant differences were observed between technological and content knowledge (Q = 1.599; p = 0.499) and pedagogical and content knowledge (Q = 2.566; p = 0.173).

Table 3b
Significant Difference of ICT Teaching Skills of Teachers among the cited aspects

Aspects	Q-value	p-value	Interpretation
Technological and Pedagogical Knowledge	4.165	0.012	Sig.
Technological and Content Knowledge	1.599	0.499	N/A
Pedagogical and Content Knowledge	2.566	0.173	N/A

Note. Q-value refers to the Tukey computed value, Significant means there is a significant difference, and N/ refers Not Applicable which means no significant difference.

The results show that teachers are most proficient in technological tasks, which is why technological knowledge received the highest mean score. This reflects teachers' familiarity with commonly used ICT tools, such as digital devices, software applications, and instructional technology. In contrast, pedagogical knowledge received the lowest mean because ICT-based pedagogy requires more complex planning, adaptation, and instructional decision-making, which teachers may find more challenging. The absence of significant differences between technological and content knowledge, as well as between pedagogical and content knowledge, suggests that while content-related ICT skills are moderately developed, the biggest gap exists in how teachers apply ICT pedagogically rather than in their understanding of technology or content itself.

These findings imply that although teachers possess strong technological skills, they may not be fully equipped to integrate ICT into teaching strategies that support deeper learning. The significant gap between technological and pedagogical knowledge signals the need to strengthen

Table 4

Significant Difference between the Proficiency Level of CSS Learners in terms of cited aspects

Aspects	N	Mean	SD	U-statistic	p-value	Interpretation
Learning Acquisition	122	13.50	3.60			
Practical Application	122	13.10	3.58	6695	0.174	N/A

Note. H_a $\mu_{Learning\ Acquisition} \neq \mu_{Practical\ Application}$. N refers to number of respondents, SD refers to Standard Deviation, U-statistic refers to Mann-Whitney U statistic value, and N/A refers Not Applicable which means no significant difference.

teachers' ability to design ICT-enhanced lessons, manage digital learning environments, and apply interactive or student-centered digital approaches. Improving pedagogical knowledge will help teachers move beyond simply using technology as a tool and toward harnessing it to enrich instruction, promote engagement, and improve learning outcomes. Thus, professional development should prioritize pedagogical integration of ICT and support teachers in balancing technology use with sound instructional practice.

The results align with earlier studies showing that teachers often possess higher technological skills than pedagogical or content-based ICT skills. Research by Cruz (2019), Santos (2020), Reyes (2021), and Dela Peña (2022) similarly reported that teachers' readiness for ICT integration is uneven, with technological aspects being stronger and pedagogical aspects requiring more support. These studies emphasize that sustained professional development and institutional support are essential for building balanced ICT competencies. Additional studies, such as those by Bebis (2025) and Bringula et al. (2023), further support the idea that strengthening pedagogical use of ICT positively influences both teaching effectiveness and student performance.

The intervention plan was developed to strengthen teachers' ICT teaching skills—particularly in technological, pedagogical, and content knowledge—after findings showed gaps that limited their ability to integrate technology meaningfully into CSS instruction. To address these needs, a School-Based Learning Action Cell (SLAC)–driven professional development program was crafted using the Analysis, Design, and Development (ADD) phases of the ADDIE model, ensuring that activities were systematically planned and aligned with teachers' skill requirements. The intervention follows the TPACK framework by providing training modules that build from technological skills toward pedagogical and content-based ICT integration. It includes interactive workshops, collaborative lesson planning, hands-on ICT practice, and formative assessments such as peer evaluations and reflective journals to support continuous teacher growth. The development phase produced contextualized digital resources, teaching guides, and simulations that were pilot-tested to refine the intervention before full implementation.

6. Conclusions

The study revealed that teachers demonstrated a highly proficient level in their Information and Communications Technology (ICT) teaching skills, while learners showed an approaching proficiency

level in Computer Systems Servicing (CSS). A significant difference was found among the ICT teaching skills of teachers, particularly between their technological and pedagogical knowledge, indicating uneven strengths across ICT domains. Meanwhile, no significant difference was observed between the proficiency levels of CSS learners in terms of learning acquisition and practical application, suggesting that their theoretical understanding and hands-on performance are relatively balanced.

7. Recommendations

The study recommends providing targeted ICT training for teachers through hands-on workshops that help them integrate technology with pedagogy and content knowledge while strengthening the pedagogical use of ICT by modeling strategies that promote collaboration, critical thinking, and problem-solving. It further emphasizes the need to enhance content knowledge using ICT tools such as simulations and data analysis software to ensure that technology deepens subject mastery rather than serving as superficial add-ons. Additionally, curriculum planners should balance theory and practice in CSS instruction by incorporating laboratory activities, real-world tasks, and performance-based assessments, alongside promoting experiential learning opportunities like projects, internships, and industry-linked engagements to strengthen practical skills. Schools are also encouraged to foster peer collaboration through mentoring programs where experienced teachers share effective ICT-integrated practices, creating a culture of shared professional growth. Finally, educational leaders should institutionalize monitoring and evaluation systems to regularly assess ICT integration and CSS learner performance, using the results to continuously refine instructional strategies and professional development programs.

8. Acknowledgment

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