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Impact of learning tools on students' technical skills development

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Abstract

This study examined the availability of learning tools and the level of technical skills development among Grade 11 Computer Systems Servicing (CSS) students. A descriptive–correlational research design was employed, with 30 out of 40 students selected through simple random sampling. The majority of the participants were male, aged 16–17 years, and single. Data were gathered using a standardized questionnaire. Findings revealed limited access to learning tools and generally low levels of technical skills development among the students. Statistical analysis indicated no significant relationship between the availability of learning tools and students' profile variables, such as age and sex. Similarly, no significant association was found between technical skills development and these profile variables. However, a significant positive correlation was identified between the availability of learning tools and the level of technical skills development, suggesting that students with greater access to updated and functional tools demonstrate higher technical competence. Given the relatively small sample size, the findings should be interpreted with caution. The study recommends that schools improve access to updated software, strengthen internet connectivity, and implement structured digital learning initiatives, such as online courses and virtual workshops, to enhance students' technical skills. Additionally, teachers are encouraged to adopt varied instructional strategies to mitigate resource constraints and support effective skills development.

Keywords: *learning tools, technical skills development, CSS students, enhancement program, descriptive-correlational*

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1. Introduction

Learning tools are essential in developing the technical skills of students, especially those studying Computer Systems Servicing (CSS). These tools, including updated operating systems, application software, and reliable internet access, enable learners to apply the theoretical knowledge they have acquired (Zou et al., 2025; Dritsas & Trigka, 2025; Haleem et al., 2022; Enakrire, 2024). Without adequate or up-to-date learning tools, students face difficulties in meeting the requirements of the CSS curriculum, which is designed to prepare them for eventual entry into the ICT job market.

In most public schools, access to modern learning resources remains very limited (Mhlanga, 2024; Timotheou et al., 2023; Reginaldo & Ching, 2022; Maphosa et al., Plana & Ybanez, 2023; Gutierrez et al., 2022). Students are often required to work with obsolete computers, unlicensed software, and unstable internet connections, which hinder their ability to learn essential tasks such as troubleshooting, installing operating systems, and configuring data transfer software. According to the Department of Education (DepEd, 2023), these limitations contribute to the digital divide between well-resourced and poorly resourced schools, negatively affecting students' interest, confidence, and preparedness for ICT-related careers. Likewise, the Philippine Institute for Development Studies (PIDS, 2020) reiterated that insufficient access to digital tools adversely affects students' technical-vocational learning performance.

Established learning theories support the integration of technology in education. For instance, Kolb's Experiential Learning Theory (2022) posits that knowledge is most effectively acquired through active experience and reflection. Similarly, Koehler and Mishra's Technological Pedagogical Content Knowledge (TPACK) framework (2020) emphasizes the integration of technological tools, effective pedagogy, and relevant content to enhance learning outcomes. These theories suggest that consistent exposure to updated learning tools can lead to deeper understanding, improved accuracy, and stronger technical proficiency.

Despite these theoretical foundations, several studies continue to report barriers to the accessibility and effective utilization of learning tools in public senior high schools (Murillo-Jiménez et al., 2025; Yu et al., 2024; Francom, 2016; Aldridge & McLure, 2024; Ciuffetelli Parker & Conversano, 2021; Co et al., 2021). These challenges negatively affect the practical application of learning opportunities and reduce the technical competence of students. Addressing this issue is fundamental to achieving industry-standard technical-vocational

education and aligning with the broader digital transformation agenda currently pursued in the Philippines.

This research was conducted to determine the availability of learning tools and the level of technical skills development among Grade 11 CSS students. Specifically, it sought to answer the following: (1) the level of availability of operating systems, application software, and internet access as learning tools; (2) the level of students' technical skills development in terms of practical skills, theoretical understanding, and technical accuracy; and (3) the relationship between the availability of learning tools and students' technical skills development. In this regard, the findings may shed light on how educators and policymakers can develop more appropriate resource allocation strategies, improve teaching approaches, and strengthen ICT integration in technical senior high school programs.

2. Literature Review

2.1. The Role of Learning Tool Availability in Enhancing Technical Skills

Technical education heavily relies on the availability of appropriate learning tools to support both theoretical understanding and hands-on application. Several studies have underlined that the availability and quality of learning tools are among the most important determinants of students' technical performance. For instance, Munje and Jita (2020) reported that a lack of access to ICT resources constrains students' competency in hands-on practical activities and inhibits skill acquisition. In addition, Akpen et al. (2024) showed that students with more complete access to updated learning tools tend to demonstrate higher academic and practical competencies. These observations parallel the findings of Kassab et al. (2024), who documented higher levels of confidence and engagement among students in well-equipped classrooms with updated equipment during technical activities. Collectively, these studies corroborate that access to updated equipment not only improves students' technical competencies but also enhances their motivation and self-efficacy.

On the other hand, Otermans et al. (2025) found that students with fewer learning tools felt unprepared for work, indicating a disconnect between school-based training and workplace expectations. This finding is further supported by Haleem et al. (2022), who stated that dysfunctional equipment reduces students' confidence and willingness to participate in practical learning. Together, these studies indicate a persistent problem in aligning classroom learning with industry-standard skills.

The quality of available tools is also a critical factor. Ibrahim and Aslam (2025) noted that deteriorated or malfunctioning equipment discourages students and diminishes their motivation, resulting in lower performance levels. Conversely, updated and well-functioning tools support the acquisition of technical knowledge and promote deeper learning through active student engagement. Students cannot achieve the level of proficiency expected by the ICT industry without proper learning tools (Zou et al., 2025; Sanfo, 2023; Zubizarreta Pagaldai et al., 2025).

Recent studies further illustrate the link between access to technology and students' technical competence. Indrinal (2022) investigated awareness and literacy in computer software applications among senior high school students and found that, despite the demand for learning outcomes oriented toward practical skills, many students lacked familiarity with the facilities needed to develop relevant competencies. Meanwhile, Dimaunahan and Panoy (2021) examined academic motivation, self-efficacy, and technical skills and found that students' belief in and readiness to use technology appeared to enhance performance in technical-vocational subjects. These findings highlight the role of digital preparedness in developing technical proficiency.

While previous literature has focused on either students' awareness or motivation, few studies have examined how the availability of learning tools, such as operating systems, software, and internet connectivity, directly relates to technical skills acquisition. This study addresses this gap by examining the relationship between the accessibility of learning tools and the technical skills of Grade 11 CSS students.

2.2. Theoretical Framework

This research is grounded in Kolb's Experiential Learning Theory (2022), which is anchored in the continuous process of experience, reflection, conceptualization, and experimentation. This model is particularly applicable to technical-vocational education, where learning relies heavily on direct practice with actual tools and technologies. Students in CSS develop competencies not only by studying concepts but also through real-world applications, including software installation, troubleshooting, and network configuration.

Kolb's framework posits that active learning through the use of instructional tools enhances understanding and retention of technical concepts. Conversely, insufficient access to such tools limits learners' ability to complete the full experiential learning cycle, resulting in

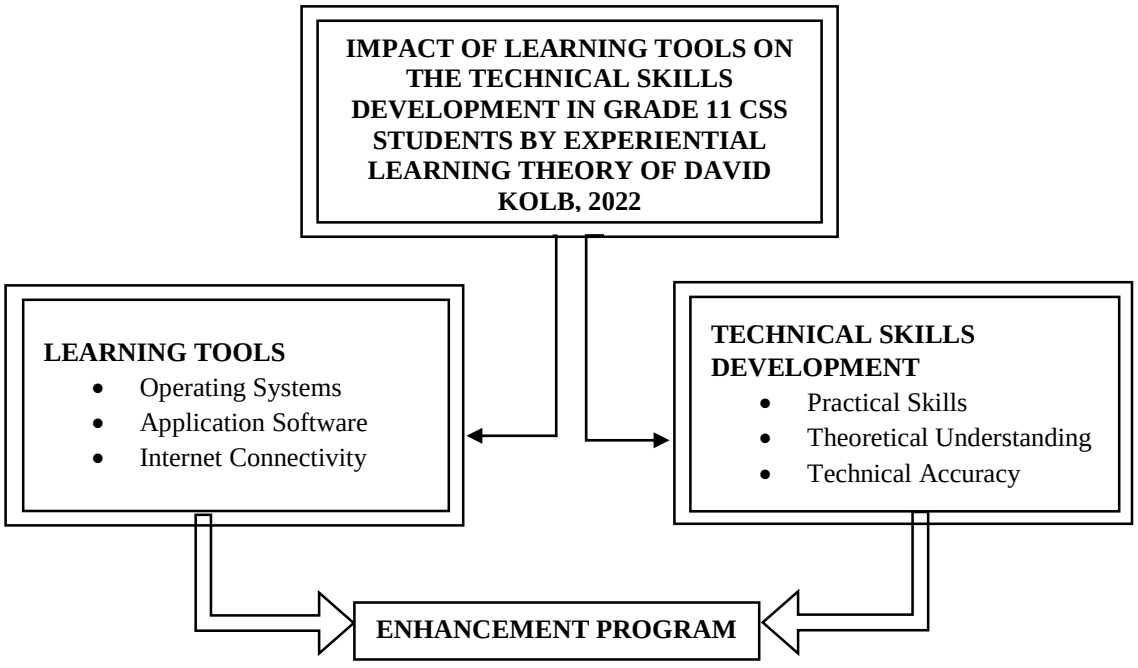
superficial understanding and weak skill development. As such, the theory provides a strong theoretical basis for investigating how the availability of learning tools influences students' technical skills.

In addition, this research is supported by the Technological Pedagogical Content Knowledge (TPACK) framework of Koehler and Mishra (2020), which asserts that effective learning emerges from the integration of technology, pedagogy, and content knowledge. The TPACK model reinforces the notion that teachers must not only possess technical expertise but also know how to utilize learning tools in ways that promote effective student engagement and understanding.

These theories explain how the availability of learning tools, specifically operating systems, application software, and internet connectivity, can influence three key aspects of technical skills development: practical skills, theoretical understanding, and technical accuracy. By providing empirical evidence within the local senior high school context, this study contributes to the growing body of literature on ICT-based technical education.

Figure 1

A conceptual framework of the study



3. Methodology

3.1. Research Design

This study employed a descriptive-correlational research design to determine the availability of learning tools and the level of technical skills development among Grade 11 CSS students, as well as to examine the relationship between these two variables. The descriptive component was used to profile the respondents in terms of age and sex and to determine the extent of learning tool availability and technical skills development. The correlational component examined whether a statistically significant relationship existed between the two variables.

Although the correlation analysis yielded meaningful results, it is acknowledged that the relatively small sample size (n = 30) may limit the generalizability of the findings. Therefore, the results were interpreted with caution and contextualized within the participating school.

3.2. Participants

The participants consisted of 30 Grade 11 CSS students enrolled during the school year 2024–2025 at one public national high school in Cebu City, Philippines. From a total population of 40 students, 30 were selected using simple random sampling to ensure equal opportunity for participation and minimize selection bias. The respondents were drawn from the CSS sections TVL-A, TVL-B, and TVL-C. All participants were officially enrolled in the CSS program and provided voluntary consent to participate in the study.

The majority of the Grade 11 CSS students were male and aged 18–19 years old, reflecting the typical demographic profile of senior high school learners enrolled in technical-vocational strands. This finding supports national trends indicating that technology-related programs continue to attract more male students than female students (Philippine Statistics Authority [PSA], 2022). The limited number of female enrollees suggests a need to further promote gender inclusivity in technical education to encourage more balanced participation in ICT-related fields.

3.3. Research Instruments

The primary data collection instrument was a standardized questionnaire developed by the researcher and grounded in Kolb’s Experiential Learning Theory (2022) and Koehler and

Mishra's Technological Pedagogical Content Knowledge (TPACK) framework (2020). The instrument consisted of two parts:

Learning Tools Questionnaire – assessed the availability and functionality of learning tools, including operating systems, software applications, and internet access.

Technical Skills Development Questionnaire – measured students' levels of technical skills across three domains: practical skills, theoretical understanding, and technical accuracy.

Each section used a five-point Likert scale ranging from 1 ("Not Available" or "Very Poor") to 5 ("Highly Available" or "Highly Developed").

The instrument was validated by three ICT experts and two research experts to establish its content validity and reliability. The validation process integrated the Delphi Method for consensus building and Fleiss' Kappa to determine inter-rater agreement. Based on the experts' feedback, revisions were made to enhance the clarity, accuracy, and relevance of the items prior to final administration.

3.4. Ethical Considerations

Prior to data collection, formal permission was obtained from the school principal and relevant school authorities. Participants were informed about the purpose, scope, and voluntary nature of the study. Written informed consent was secured from all respondents and, where applicable, from their parents or guardians. The researcher assured participants of anonymity and confidentiality, emphasizing that all responses would be used solely for academic purposes. Respondents were also informed of their right to withdraw from the study at any point without penalty.

All procedures adhered to the ethical standards set by the Department of Education and the general principles of responsible conduct in educational research.

3.5. Data Gathering Procedure

After securing administrative approval, the researcher coordinated with the CSS class advisers to schedule the data collection. The questionnaires were distributed during class hours under the supervision of the researcher to ensure clear understanding of the instructions. Respondents completed the survey independently and anonymously.

Upon collection, responses were encoded and tabulated using Microsoft Excel and analyzed using statistical software. Descriptive statistics, including frequency, percentage, and

weighted mean, were employed to describe respondents' profiles and survey responses. The Pearson Product–Moment Correlation Coefficient was used to test the relationship between the availability of learning tools and the level of technical skills development at a 0.05 level of significance.

4. Findings and Discussion

The findings across three key indicators such as operating systems, application software, and internet connectivity in Table 1, revealed that most learning tools were rarely available or not available for student use. Internet access was reported as the least available, followed by application software, while operating systems were slightly more accessible but still below satisfactory levels.

Table 1

Availability of learning tools of Grade 11 CSS students

Indicators of learning tools	WM	Interpretation	Rank
Operating Systems	2.06	Not Available	1
Application Software	1.90	Rarely Available	2
Internet	1.65	Rarely Available	3
Grand Total	**1.87**	**Rarely Available**	

***Legend**:* 5.00-4.21=Highly Available; 4.20-3.41=Moderately Available; 3.40-2.61=Limited; 2.60-1.81=Rarely Available; 1.80-1.00=Not Available

This limited access suggests that students often face disruptions during practical lessons due to outdated or malfunctioning computers and unstable internet connections. The results are consistent with previous studies by PIDS (2020) and DepEd (2023), which both highlighted that insufficient ICT resources hinder the quality of hands-on learning experiences in public schools. The scarcity of licensed software and stable internet connectivity limits students' opportunities to practice troubleshooting, system configuration, and software installation competencies central to the CSS curriculum. The findings affirm Kolb's (2022) Experiential Learning Theory, which emphasizes the need for direct experience to achieve effective learning. Without functional tools, students are deprived of authentic learning experiences essential for building technical proficiency.

Table 2 presents the overall findings show that students' technical skills were very poorly developed across all three domains: practical skills, theoretical understanding, and technical accuracy. Among these, practical skills had the slightly higher mean score, although still categorized as very poor. This trend reflects the strong dependency of technical skills on resource availability. When students lack sufficient access to updated software and hardware, they are unable to apply theoretical concepts to real-world scenarios, leading to superficial learning. The results align with Timotheou et al. (2023), who observed that inadequate exposure to digital tools constrains students' confidence and competence in performing system maintenance and repair tasks.

Table 2

Level of the technical skills development of Grade 11 CSS students

Indicators	WM	Interpretation	Rank
Practical Skills	1.50	Very Poor	1
Theoretical Understanding	1.39	Very Poor	2
Technical Accuracy	1.32	Very Poor	3
Grand Total	**1.40**	**Very Poor**	

***Legend**:* 5.00-4.21=Highly Developed; 4.20-3.41=Moderately Developed; 3.40-2.61=Slightly Developed; 2.60-1.81=Not Developed; 1.80-1.00=Very Poor

In addition, the absence of digital learning materials and manuals further limits students' theoretical understanding and retention of key concepts. This finding suggests that students may rely solely on lectures rather than experiential learning, which is less effective for developing higher-order technical competencies.

Table 3 presents the statistical tests using the Chi-square Test of Independence revealed no significant relationship between the respondents' age or sex and their levels of technical skills development or access to learning tools. These results suggest that students across different demographic categories experience similar resource limitations and learning challenges.

The lack of significant relationships between demographic variables and learning outcomes supports the notion that external factors, such as school facilities and resource availability, may have a stronger influence on technical learning than demographic characteristics. This aligns with the findings of Akpen et al. (2024), who concluded that access

to learning tools, rather than age or sex, is the primary determinant of students' engagement and performance in technical subjects.

Table 3

Relationship between the profile and technical skills development of the Grade 11 CSS students

Profile	Technical Skills	x^2 – value	p – value	Decision	Interpretation
Age	Practical Skills	1.312	0.678	Fail to Reject H_o	Not Significant
Sex		2.314			
Age	Theoretical Understanding	0.987	0.492	Fail to Reject H_o	Not Significant
Sex		1.765			
Age	Technical Accuracy	2.419	0.713	Fail to Reject H_o	Not Significant
Sex		3.021			
Age	Overall TSD	4.313	0.605	Fail to Reject H_o	Not Significant
Sex		2.789			

Note. Significant if p< α (0.05)

Table 4

Relationship between the availability of learning tools and technical skills development of Grade 11 CSS students

Learning Tools	Technical Skills	r-value	p-value	Decision	Interpretation
Application Software	Practical Skills	.012"	.043	Reject H_o	Significant
	Theoretical Understanding	.026"	.027		
	Technical Accuracy	.015"	.036		
Internet	Practical Skills	.036"	.022	Reject H_o	Significant
	Theoretical Understanding	.042"	.035		
	Technical Accuracy	.039"	.040		
Operating Systems	Practical Skills	.025"	.038	Reject H_o	Significant
	Theoretical Understanding	.031"	.045		
	Technical Accuracy	.027"	.041		
Overall LT	Practical Skills	.046"	.039	Reject H_o	Significant
	Theoretical Understanding	.049"	.030		
	Technical Accuracy	.045"	.026		
	Overall TSD	.046"	.018		

Note. Significant if p< α (0.05)

The correlation analysis in Table 4, revealed significant positive relationships between the availability of learning tools and students' technical skills development. Specifically, access to application software, internet connectivity, and operating systems was positively associated with students' practical, theoretical, and accuracy-based skills. However, while statistically significant, the correlation coefficients (r-values) were relatively low to moderate, indicating that the relationships, though present, were not necessarily strong. Therefore, the results should be interpreted cautiously and not as evidence of causation. Rather, they suggest that improving access to learning tools may support but not automatically ensure the development of technical competencies.

These findings are consistent with Kopcha et al. (2014), who found that consistent access to digital tools improves engagement and self-directed learning. Similarly, Zhou et al. (2025) emphasized that technology integration enhances performance only when accompanied by effective teaching strategies. For schools and policymakers, these results underscore the importance of investing in updated equipment, stable internet infrastructure, and software resources to create environments conducive to hands-on learning. For teachers, this highlights the need to design lessons that maximize the use of available technology while providing alternative strategies (e.g., simulations, virtual labs, or offline materials) when access is limited.

5. Conclusion

This study examined the availability of learning tools and the level of technical skills development among Grade 11 Computer Systems Servicing (CSS) students. The findings revealed that students generally experienced low availability of learning tools, particularly updated software and stable internet connectivity. This limitation contributed to their low levels of technical skill development in terms of practical skills, theoretical understanding, and technical accuracy.

No statistically significant relationship was found between students' demographic characteristics (age and sex) and either their access to learning tools or their levels of technical skills. However, correlation analysis showed a positive relationship between the availability of learning tools and students' technical skills development. This indicates that students with greater access to technological resources tend to perform better in skill-based activities.

These results are consistent with Kolb's Experiential Learning Theory, which emphasizes learning through direct experience, and with the Technological Pedagogical Content Knowledge (TPACK) framework, which highlights the role of technology in effective pedagogy. The findings reiterate that learning tools enhance the quality of technical education when they are effectively integrated into the teaching and learning process.

Although the study generated meaningful insights, the results should be interpreted with caution due to the small sample size (n = 30) and the correlational nature of the research, which does not establish causation. Future studies involving larger sample sizes may provide a deeper understanding and yield more generalizable findings.

Based on the findings and conclusions of the study, several recommendations are proposed. Schools and administrators are encouraged to invest in updated operating systems, licensed software, and reliable internet connectivity to strengthen ICT-based instruction. Developing a comprehensive plan to improve digital infrastructure, including upgrading computer laboratories and ensuring network stability, is also recommended. In addition, partnerships with government agencies, private organizations, and non-government organizations may help provide access to technical equipment and training opportunities for both teachers and students.

Teachers are encouraged to adopt modern teaching strategies, such as virtual laboratories, the use of free and open-source software, and simulations, especially in situations where physical resources are limited. The application of blended and experiential learning approaches aligned with Kolb's learning cycle can further support practice and reflection in technical instruction.

For the Department of Education, strengthening policies that support the equitable distribution of ICT resources in public schools is essential, along with continuous monitoring of resource utilization in technical-vocational tracks. Providing professional development programs that focus on integrating digital tools into technical instruction through the TPACK framework is also recommended.

Future researchers may consider conducting similar studies with larger samples and across multiple institutions to replicate and extend the findings of the present study. Additional variables, such as students' motivation, attitudes toward learning, and academic performance, may be explored to gain a more comprehensive understanding of the factors influencing

technical skills development. Employing mixed-methods approaches could also capture both the quantitative and qualitative dimensions of students' learning experiences.

Addressing gaps in the availability of learning tools can better prepare educational institutions for effective technical instruction. Ensuring students' continuous access to updated resources not only enhances their technical competencies but also equips them with a stronger foundation for higher education and future employment in the ICT industry.

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Institutional Review Board Statement

Due to the simple nature of the study, the ethical approval is waived.

AI Declaration

The authors declare the use of artificial intelligence (AI) in writing this paper. In particular, the authors utilised ChatGPT for language editing, restructuring sentences, and improving clarity. The authors take full responsibility for ensuring proper review and editing of the AI-generated content.

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