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Challenges in technical-vocational education: A study on equipment mismatch and national competency performance of computer systems servicing

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Abstract
Aim: This study examined challenges in Technical-Vocational Education (TVE), particularly equipment mismatch and its relationship with the National Competency performance of students enrolled in the Computer Systems Servicing (CSS) program. Specifically, it investigated how the availability, functionality, and alignment of instructional equipment with industry and TESDA competency standards influence students' technical skills development and competency assessment outcomes, with the goal of improving competency-based instruction and technical-vocational education.
Methodology: The study employed a descriptive-correlational research design. The respondents consisted of all Computer Systems Servicing students at Isabela School of Arts and Trade using the total enumeration method. Data were gathered through survey questionnaires, an observation checklist, document review, and National Competency performance records.
Results: The findings revealed that students experienced equipment-related challenges, including outdated and malfunctioning equipment, insufficient tools, and inadequate alignment of instructional resources with competency standards. These limitations restricted hands-on learning opportunities and reduced students' readiness for National Competency assessment. The study further found a significant relationship between equipment mismatch and National Competency performance, indicating that adequate, functional, and industry-aligned instructional equipment contributes to improved competency development and assessment outcomes.
Conclusion: The study concludes that addressing equipment mismatch is essential for strengthening competency-based technical-vocational education. Enhancing resource planning, maintaining and upgrading instructional equipment, strengthening industry partnerships, and ensuring alignment with TESDA and industry standards can improve instructional quality, students' technical competencies, and National Competency performance while supporting more effective technical-vocational teaching and learning.
Keywords: *technical-vocational education, computer systems servicing, equipment mismatch, National Competency assessment, skills development, training resources*

INTRODUCTION

Technical-Vocational Education and Training (TVET) has become an essential pillar of educational systems worldwide because of its significant role in developing a competent, adaptable, and future-ready workforce. As economies continue to undergo rapid technological transformation, TVET institutions are expected not only to provide occupational skills but also to cultivate digital competencies, problem-solving abilities, innovation, and lifelong learning among students (Bano, 2025). Globally, educational reforms have increasingly embraced competency-based education, Industry 4.0 technologies, Education 5.0 principles, artificial intelligence (AI)-supported instruction, digital laboratories, simulation-based learning, and technology-enhanced vocational education to ensure that graduates possess competencies aligned with rapidly evolving labor market demands. These developments have transformed TVET from traditional skills training into an integrated educational approach that prepares learners for increasingly digitalized, technology-driven, and sustainable workplaces.

The international movement toward competency-based education has reinforced the importance of authentic, performance-oriented learning environments supported by modern instructional resources. Rather than emphasizing

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the completion of instructional time alone, competency-based education requires learners to demonstrate mastery of clearly defined competencies through practical performance and evidence-based assessment. Consequently, educational institutions are expected to provide instructional environments equipped with industry-standard facilities, digital technologies, virtual laboratories, simulation platforms, and up-to-date training equipment that enable students to acquire competencies consistent with current workplace expectations. As Industry 4.0 and Smart Manufacturing continue to reshape technical occupations, TVET institutions are likewise challenged to modernize instructional delivery, strengthen digital competency development, and produce graduates capable of adapting to emerging technologies and future workforce requirements.

Despite these international advancements, many technical-vocational institutions continue to experience significant challenges in providing adequate instructional resources. Recent international studies consistently demonstrate that shortages of modern equipment, outdated laboratory facilities, and limited access to industry-standard technologies remain major barriers to effective competency-based education. Adam and Mengistie (2026) observed that although governments have increased investments in technical-vocational education, substantial deficiencies in instructional equipment continue to affect many institutions because funding alone does not guarantee appropriate procurement, maintenance, or alignment with competency standards. Similarly, evidence from Nigeria, Zambia, and other developing educational systems indicates that equipment inadequacy remains a persistent challenge that restricts students' opportunities for authentic hands-on learning and limits the development of industry-relevant technical competencies. These findings suggest that improving instructional quality requires not only qualified instructors and well-designed curricula but also adequate, functional, and technologically relevant instructional resources.

The growing emphasis on competency-based education has also shifted attention toward the quality of instructional processes that support learner achievement. Contemporary educational research consistently demonstrates that competency-based instruction is most effective when learners are provided with sustained opportunities for experiential learning, repeated practice, authentic assessment, and access to appropriate instructional technologies. Although competency-based education has been shown to improve learner performance across numerous professional disciplines, its effectiveness depends heavily on the availability of learning resources that support practical skill acquisition. While competency-based educational approaches initially improve learner performance, these gains may decline when instructional support systems, learning resources, and educational conditions are not consistently maintained. Such findings emphasize that competency-based instruction cannot achieve its intended outcomes without sufficient instructional facilities, appropriate equipment, and continuous institutional support.

Within Information and Communication Technology (ICT) education, particularly in Computer Systems Servicing (CSS), the availability of industry-standard instructional equipment assumes even greater importance because technical competencies are acquired primarily through practical application rather than theoretical instruction alone. CSS programs require learners to develop competencies in computer hardware servicing, networking, troubleshooting, preventive maintenance, and systems installation using tools and equipment comparable to those encountered in actual workplace environments. Recent studies demonstrate that structured, practice-oriented instruction significantly enhances students' technical competencies when supported by appropriate instructional resources. Hung and Yeh (2023) demonstrated that innovative instructional approaches, including technology-enhanced and game-based learning, strengthened learner engagement and practical competency development. These studies reinforce the view that effective technical-vocational education requires instructional environments that integrate appropriate equipment, learner-centered pedagogies, and technology-supported instructional innovations.

In the Philippine context, Technical-Vocational Education and Training is regulated by the Technical Education and Skills Development Authority (TESDA), the national government agency responsible for establishing competency standards, implementing competency-based curricula, accrediting training institutions, and administering National Competency (NC) assessments leading to National Certification. Through this competency-based system, learners are expected to demonstrate mastery of nationally recognized occupational standards that reflect current industry requirements. Consequently, the quality of instructional equipment, laboratory facilities, and practical learning environments directly influences students' opportunities to develop the competencies necessary for successful National Competency assessment and eventual employment. Ensuring alignment between instructional resources, TESDA competency standards, and contemporary industry practices has therefore become a critical concern for curriculum implementation, educational quality assurance, and workforce development.

Beyond curriculum implementation, instructional equipment represents an important educational leadership and institutional management concern. School administrators, laboratory managers, and institutional planners play critical roles in resource allocation, procurement planning, equipment maintenance, industry collaboration, and the continuous modernization of training facilities. Strategic leadership decisions regarding instructional resources influence

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not only laboratory operations but also curriculum delivery, instructional effectiveness, competency assessment, and students' overall learning experiences. Likewise, teacher education and professional development are increasingly important in enabling instructors to maximize available technologies, integrate digital learning strategies, implement competency-based instruction effectively, and facilitate meaningful hands-on learning despite resource limitations. Emerging instructional innovations—including virtual laboratories, simulation technologies, blended practical instruction, and technology-enhanced TVET—also offer complementary approaches that may strengthen competency development when physical instructional resources are constrained.

Although numerous international and Philippine studies have examined instructional equipment adequacy, competency-based education, teaching strategies, laboratory learning, and competency assessment, these variables have largely been investigated independently or within broader technical-vocational contexts. Previous studies have primarily focused on describing equipment availability, evaluating instructional practices, or measuring competency outcomes without directly examining how equipment mismatch influences National Competency performance within a specific Computer Systems Servicing program. Furthermore, relatively few institutional-level investigations have explored this relationship within the Philippine competency-based TVET system governed by TESDA standards. Consequently, there remains limited empirical evidence explaining how equipment mismatch affects students' competency development and National Competency performance in Computer Systems Servicing education.

Addressing this research gap is important because evidence regarding equipment mismatch may inform educational leadership, curriculum planning, instructional innovation, laboratory management, teacher professional development, and institutional resource allocation. By examining the relationship between equipment mismatch and National Competency performance among Computer Systems Servicing students at Isabela School of Arts and Trade, the present study provides localized empirical evidence that may guide institutional decision-making and strengthen competency-based technical-vocational education. Unlike previous studies that examined instructional equipment or competency outcomes separately, this investigation directly analyzes the relationship between equipment mismatch and National Competency performance within a Computer Systems Servicing program operating under TESDA competency standards. The findings are expected to contribute to educational research by advancing understanding of instructional resource management, competency-based teaching and learning, educational quality improvement, and evidence-informed policy and practice in contemporary technical-vocational education.

Review of Related Literature and Studies

Technical-Vocational Education and Training (TVET)

Technical and Vocational Education and Training (TVET) has evolved into one of the most important educational pathways for preparing a highly skilled, innovative, and adaptable workforce capable of responding to rapidly changing economic and technological environments. Unlike traditional academic programs that primarily emphasize theoretical knowledge, TVET integrates cognitive, technical, and practical competencies through competency-based instruction, experiential learning, and workplace-oriented training. Contemporary TVET increasingly promotes lifelong learning, digital literacy, innovation, entrepreneurship, and sustainable workforce development while ensuring that graduates possess competencies aligned with industry requirements.

Recent educational reforms have further transformed TVET through the integration of Industry 4.0 technologies, Education 5.0 principles, artificial intelligence (AI)-supported learning, simulation technologies, virtual laboratories, and digital competency frameworks. These developments require educational institutions to modernize instructional delivery, laboratory facilities, and curriculum implementation to ensure that learners acquire competencies relevant to increasingly technology-driven industries. Consequently, the effectiveness of TVET is no longer measured solely by students' acquisition of occupational skills but also by their readiness to adapt to digital transformation, technological innovation, and future workplace demands.

Several recent studies emphasize the expanding role of TVET in national development. Okoth (2023) described TVET as a major contributor to economic growth, workforce productivity, and sustainable development by producing graduates equipped with competencies aligned with labor market needs. In the Philippine context, TVET serves as an important mechanism for developing middle-level technical professionals capable of supporting industrial growth. Although this study remains relevant in describing the Philippine TVET system, more recent educational reforms have further strengthened competency-based instruction through the integration of digital technologies, industry collaboration, and competency-based quality assurance.

The Philippine Technical Education and Skills Development Authority (TESDA) plays a central role in regulating Technical-Vocational Education and Training by establishing competency standards, implementing competency-based curricula, accrediting training institutions, and administering National Competency (NC) assessments leading to National

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Certification. According to Orbeta (2021), TESDA ensures that training programs remain aligned with industry requirements through competency standards that promote employability and workforce competitiveness. Consequently, the quality of TVET depends not only on curriculum implementation but also on instructional leadership, laboratory management, resource allocation, industry partnerships, and the availability of instructional equipment capable of supporting competency-based education.

Competency-Based Education in Technical-Vocational Training

Competency-Based Education (CBE) has become the dominant instructional framework in technical-vocational education because it emphasizes the demonstration of measurable competencies rather than the completion of instructional time. Under this approach, learners progress according to their demonstrated mastery of knowledge, technical skills, and workplace competencies, thereby ensuring that graduates meet clearly defined occupational standards before certification. Competency-Based Education supports learner-centered instruction, authentic assessment, practical application, and continuous performance evaluation, making it particularly appropriate for skill-oriented disciplines such as Computer Systems Servicing.

Recent educational research demonstrates that Competency-Based Education contributes significantly to improving learner achievement when supported by appropriate instructional conditions. Competency-based instruction allows learners to progress at their own pace while focusing on measurable competency attainment. Similarly, Khan et al. (2022) reported that Competency-Based Education provides an effective instructional framework for technical-vocational programs because it closely aligns learning activities, practical experiences, and competency assessments with workplace expectations. Competency-based assessment enables educators to generate more accurate evidence of learner performance while providing meaningful feedback that supports continuous improvement.

The effectiveness of Competency-Based Education, however, depends heavily on the quality of instructional environments in which competencies are developed. Contemporary educational literature consistently indicates that successful implementation requires clearly defined learning outcomes, qualified instructors, authentic assessment methods, flexible instructional strategies, and access to appropriate instructional technologies. Without adequate laboratories, industry-standard equipment, digital learning platforms, and opportunities for repeated hands-on practice, learners may experience difficulty demonstrating required competencies despite completing formal instruction.

Recent developments in educational technology have further strengthened Competency-Based Education through the integration of digital laboratories, virtual simulations, blended learning environments, and AI-supported instructional systems. These innovations allow learners to engage in authentic workplace scenarios, receive immediate performance feedback, and develop technical competencies within technology-enhanced learning environments. Consequently, competency development increasingly depends on both physical instructional resources and digital instructional innovations that complement traditional laboratory experiences.

Instructional Equipment and Facilities in Technical-Vocational Education

Instructional equipment and laboratory facilities constitute essential educational resources that directly influence the quality of competency-based teaching and learning in technical-vocational education. Modern instructional equipment enables learners to apply theoretical concepts through practical activities, simulate authentic workplace tasks, strengthen technical problem-solving abilities, and acquire competencies required by industry. Adequate facilities likewise enhance learner engagement, improve instructional effectiveness, promote experiential learning, and support accurate competency assessment.

Educational research consistently demonstrates a positive relationship between instructional resource adequacy and learner performance. Opiyo et al. (2025) reported that adequate training facilities significantly improve students' acquisition of technical competencies by providing sufficient opportunities for repeated practice and experiential learning. Although governments have increased investments in technical education, many institutions continue to experience substantial shortages of instructional equipment because resource allocation alone does not guarantee effective procurement, maintenance, or utilization. These findings indicate that instructional quality depends not only on resource availability but also on strategic educational planning, institutional leadership, and effective laboratory management.

Contemporary instructional environments increasingly incorporate digital laboratories, virtual learning platforms, simulation technologies, and technology-enhanced instructional tools alongside traditional workshop equipment. These educational innovations expand students' opportunities to practice technical competencies while addressing limitations associated with physical laboratory resources. Consequently, instructional equipment should be viewed as part of a broader educational ecosystem that integrates physical infrastructure, digital technologies, instructional innovation, and competency-based learning experiences.

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Equipment Mismatch in Technical-Vocational Institutions

Equipment mismatch refers to the condition in which instructional equipment is insufficient, outdated, malfunctioning, or inadequately aligned with current industry standards and competency requirements. Within competency-based technical-vocational education, equipment mismatch reduces opportunities for meaningful practical learning, limits students' exposure to contemporary technologies, weakens instructional effectiveness, and ultimately affects competency development and assessment outcomes. As industries continue to adopt advanced technologies associated with Industry 4.0, ensuring alignment between instructional equipment and workplace practices has become increasingly important.

Recent international studies consistently identify equipment mismatch as one of the major challenges confronting technical-vocational institutions. Düzgünçınar (2025) found that many technical institutions continue to rely on obsolete instructional facilities that no longer reflect current industrial technologies. Vocational institutions were able to provide only a limited proportion of the equipment required by contemporary industry standards, thereby restricting students' opportunities for authentic practical training. Although earlier studies such as similarly documented shortages of modern workshop equipment, more recent evidence indicates that equipment mismatch now extends beyond physical shortages to include inadequate digital technologies, limited access to simulation platforms, and insufficient technology-enhanced instructional resources.

The educational consequences of equipment mismatch extend beyond laboratory instruction. Access to modern instructional equipment improves institutional quality, learner confidence, competency development, and graduate employability. Conversely, when instructional resources fail to reflect contemporary workplace technologies, students encounter fewer opportunities to develop higher-order technical competencies required by modern industries. These limitations also affect curriculum implementation, instructional innovation, teacher effectiveness, laboratory management, and competency assessment, reinforcing the need for continuous institutional investment, industry collaboration, and strategic resource planning.

Collectively, the reviewed literature demonstrates that addressing equipment mismatch requires a comprehensive educational approach involving instructional leadership, curriculum development, faculty capability enhancement, digital transformation, resource modernization, and sustained collaboration between educational institutions and industry partners. Such efforts are essential to ensure that competency-based technical-vocational education remains responsive to evolving technological, economic, and workforce demands.

Foreign Studies on Equipment Adequacy and Technical-Vocational Education

International literature consistently identifies instructional equipment as one of the most influential determinants of quality technical-vocational education. Although competency-based curricula have become increasingly sophisticated, their successful implementation depends largely on the availability of adequate, functional, and industry-aligned instructional resources. Recent studies indicate that institutions that provide learners with sufficient opportunities for practical training using modern equipment consistently demonstrate higher levels of competency development, workforce readiness, and employability than institutions constrained by inadequate laboratory resources.

Recent evidence also suggests that equipment inadequacy has become increasingly complex with the rapid advancement of Industry 4.0 technologies. Beyond shortages of traditional workshop tools, many institutions now struggle to provide digital laboratories, smart manufacturing technologies, virtual simulation platforms, networking devices, and other technology-enhanced learning resources required by modern industries. Toroka and Kafanabo (2024) reported that technical institutions in Tanzania continue to experience substantial instructional limitations because available facilities no longer reflect contemporary industrial technologies. Likewise, vocational institutions in Laos possessed only a small proportion of the instructional equipment required under current industry standards, thereby restricting opportunities for authentic practical learning.

Although earlier investigations documented similar shortages of instructional equipment, recent educational literature demonstrates that the challenge has shifted from simple equipment availability toward ensuring alignment with rapidly evolving technologies and competency standards. Institutions are now expected to maintain laboratories that mirror modern workplaces while integrating digital learning environments capable of supporting competency-based instruction.

Collectively, foreign studies consistently conclude that addressing equipment inadequacy requires strategic institutional planning, continuous resource modernization, effective laboratory management, and sustained collaboration among educational institutions, governments, and industry partners. Such initiatives strengthen competency-based education by ensuring that instructional resources remain responsive to technological advancement and workforce demands.

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Local Studies on Equipment and Technical-Vocational Training

Similar concerns regarding instructional equipment have been documented within Philippine technical-vocational institutions. Local studies consistently indicate that shortages of laboratory equipment, insufficient instructional materials, outdated technologies, and limited access to practical learning environments continue to affect the quality of competency-based education. These challenges are particularly significant because Philippine Technical-Vocational Education and Training is regulated through competency standards established by the Technical Education and Skills Development Authority (TESDA), requiring institutions to provide instructional resources that closely correspond with National Competency assessment requirements.

Recent Philippine studies reveal that instructional resource limitations affect multiple aspects of technical-vocational education. Bangayan et al. (2025) identified deficiencies in access to modern laboratory equipment, updated instructional technologies, and authentic workplace simulations across several state universities. Similarly, financial constraints frequently resulted in inadequate instructional materials, limited laboratory expansion, and insufficient equipment procurement, thereby restricting opportunities for competency-based practical instruction. Overcrowded workshops and inadequate laboratory space reduced students' opportunities to participate actively in practical learning experiences.

Instructional equipment was moderately adequate in several institutions, recent investigations collectively suggest that adequacy alone is insufficient. Educational institutions must also ensure that available equipment remains functional, technologically current, properly maintained, and aligned with evolving industry practices. These findings emphasize that improving instructional quality requires not only increased investment in physical resources but also effective educational leadership, strategic planning, laboratory management, and continuous curriculum enhancement.

Overall, local evidence reinforces the need for institutional policies that prioritize instructional resource modernization, stronger partnerships with industry, and systematic laboratory improvement to support competency-based technical-vocational education and enhance National Competency performance.

Foreign Studies on Competency-Based Education and Performance

Competency-Based Education (CBE) has been widely recognized internationally as an effective instructional framework for improving learner performance because it focuses on measurable competency attainment, authentic assessment, and learner-centered instruction. Rather than emphasizing the completion of prescribed instructional hours, CBE requires learners to demonstrate mastery of clearly defined competencies before progressing to more advanced learning outcomes. Consequently, competency-based systems promote greater accountability, stronger alignment with occupational standards, and improved workforce preparedness.

Recent international studies consistently demonstrate positive educational outcomes associated with Competency-Based Education when supported by adequate instructional resources. Competency-based technical training enhanced students' practical skills and occupational readiness.

Contemporary literature increasingly emphasizes digital competency development, technology-enhanced instruction, virtual simulation, and flexible learning environments as essential components of modern competency-based systems. Current educational practice therefore extends beyond traditional competency assessment toward preparing learners for digital transformation, emerging technologies, and lifelong professional development.

Collectively, recent foreign studies indicate that Competency-Based Education achieves optimal effectiveness only when instructional strategies, assessment systems, learning technologies, and instructional resources are fully aligned with competency standards and evolving workplace expectations.

Local Studies on National Competency Performance

Philippine studies consistently demonstrate that National Competency performance is influenced by multiple instructional, institutional, and learner-related factors. Because National Competency assessments evaluate both theoretical understanding and practical performance, successful outcomes depend on effective competency-based instruction supported by adequate instructional resources, qualified teachers, and meaningful laboratory experiences.

Instructional resources—including laboratory equipment, learning technologies, training facilities, and instructional materials—were significantly associated with students' competency performance.

Learner preparedness, classroom environment, institutional support, and instructional quality as important determinants of National Competency performance. Their findings indicate that successful competency assessment cannot be attributed solely to individual learner ability but instead reflects the combined influence of educational leadership, instructional resources, faculty effectiveness, and supportive institutional environments.

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Taken together, local studies consistently reinforce the importance of comprehensive instructional systems that integrate adequate laboratory facilities, competency-based teaching strategies, effective assessment practices, and continuous institutional improvement to strengthen National Competency performance.

Studies Related to Computer Systems Servicing and Information and Communication Technology Training

Computer Systems Servicing (CSS) education occupies a unique position within technical-vocational training because competency development relies heavily on direct interaction with computer hardware, networking equipment, diagnostic tools, and other industry-standard technologies. Consequently, effective CSS instruction requires extensive practical experience supported by functional instructional equipment, learner-centered pedagogies, and authentic workplace simulations.

Recent Philippine studies consistently demonstrate that structured hands-on learning significantly improves technical competency among CSS students. Laboratory demonstrations, guided practice, and competency-focused instruction positively influenced learner achievement and certification success.

Overall, studies related to Computer Systems Servicing consistently demonstrate that successful competency development depends upon the interaction of several educational factors, including qualified instructors, competency-based curricula, authentic laboratory experiences, industry-relevant instructional equipment, technology-enhanced learning environments, and institutional commitment to continuous instructional improvement. These findings strongly support the importance of examining equipment mismatch as a significant factor influencing National Competency performance among Computer Systems Servicing students.

Synthesis and Research Gap

The reviewed literature consistently establishes Technical-Vocational Education and Training (TVET) as an essential educational system for developing competent, industry-ready graduates through competency-based, experiential, and performance-oriented instruction. Recent international and Philippine studies collectively demonstrate that effective competency development depends on the interaction of multiple educational components, including well-designed curricula, qualified instructors, authentic assessment systems, instructional innovation, and adequate learning resources. Contemporary educational reforms further emphasize that TVET institutions must respond to Industry 4.0, Education 5.0, digital transformation, artificial intelligence (AI)-supported instruction, virtual laboratories, simulation technologies, and technology-enhanced learning to prepare graduates for increasingly digitalized and rapidly evolving workplaces. Consequently, instructional equipment should no longer be viewed merely as physical resources but as integral components of a comprehensive learning environment that supports competency-based teaching, digital competency development, and sustainable workforce preparation.

The literature also consistently demonstrates that instructional equipment significantly influences students' practical learning experiences, competency acquisition, and assessment outcomes. Foreign and local studies report that inadequate, outdated, malfunctioning, or poorly aligned instructional equipment limits opportunities for repeated hands-on practice, reduces learner confidence, constrains instructional innovation, and weakens competency development. Similarly, studies on Computer Systems Servicing emphasize that learners develop technical competencies most effectively when instructional equipment reflects current industry technologies and supports authentic workplace experiences. Collectively, these findings indicate that equipment adequacy is closely associated with instructional quality, educational effectiveness, and graduate employability within competency-based technical-vocational education.

Although numerous studies have examined competency-based education, instructional equipment, laboratory facilities, teaching strategies, and National Competency performance, these variables have generally been investigated independently or within broader technical-vocational contexts. Previous investigations have largely focused on describing equipment adequacy, evaluating instructional strategies, or measuring competency outcomes without directly examining the relationship between equipment mismatch and National Competency performance within a specific Computer Systems Servicing program operating under the Philippine Technical Education and Skills Development Authority (TESDA) competency framework. Furthermore, relatively few institutional-level studies have investigated how equipment mismatch influences competency-based instruction, instructional processes, and National Competency performance in Philippine technical-vocational institutions.

The present study addresses these identified gaps by examining the relationship between equipment mismatch and the National Competency performance of Computer Systems Servicing students at Isabela School of Arts and Trade. Unlike previous studies that investigated instructional resources or competency outcomes separately, this study integrates these variables within a single competency-based educational framework. The investigation provides

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localized empirical evidence that may assist educational leaders, curriculum developers, teachers, laboratory managers, and policymakers in strengthening resource planning, instructional innovation, laboratory modernization, competency-based teaching, and evidence-informed decision-making. Consequently, the study contributes to educational scholarship by extending current knowledge on instructional resource management and competency-based technical-vocational education while providing practical recommendations for improving instructional quality and learner competency development.

Theoretical Framework

This study is anchored on three complementary educational theories that collectively explain how instructional resources influence competency development and National Competency performance in Technical-Vocational Education and Training (TVET): Kolb's Experiential Learning Theory, Competency-Based Education Theory, and Systems Theory. Together, these theories provide a comprehensive framework for understanding how equipment mismatch affects instructional delivery, learning experiences, competency acquisition, and assessment outcomes within the Computer Systems Servicing program.

Experiential Learning Theory

The primary theoretical foundation of this study is Kolb's Experiential Learning Theory (1984), which posits that meaningful learning occurs through a continuous cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Learners acquire knowledge and develop competencies most effectively when they actively engage in authentic experiences that allow them to apply concepts, evaluate outcomes, and refine their skills through repeated practice.

Within Technical-Vocational Education and Training, experiential learning serves as the cornerstone of competency development because technical skills cannot be fully acquired through classroom instruction alone. Students must repeatedly perform laboratory activities using industry-standard equipment to master competencies in computer hardware servicing, systems troubleshooting, networking, preventive maintenance, and related technical operations. Consequently, instructional equipment functions as an essential learning resource that enables learners to participate meaningfully in experiential learning activities.

When instructional equipment is outdated, insufficient, malfunctioning, or poorly aligned with current industry standards, opportunities for experiential learning become significantly restricted. Students may be unable to practice required competencies adequately, resulting in weaker technical skill development and reduced preparedness for National Competency assessments. Thus, Experiential Learning Theory explains why equipment mismatch may adversely influence students' competency acquisition and assessment performance.

Competency-Based Education Theory

The study is further supported by Competency-Based Education (CBE) Theory, which emphasizes mastery of clearly defined competencies rather than completion of predetermined instructional time. Under this framework, learners advance after demonstrating measurable knowledge, technical skills, workplace behaviors, and occupational competencies aligned with established industry standards.

Within the Philippine TVET system, the Technical Education and Skills Development Authority (TESDA) implements Competency-Based Education by establishing competency standards and administering National Competency assessments leading to National Certification. Successful implementation therefore requires close alignment among curriculum content, instructional activities, laboratory experiences, assessment methods, and instructional resources.

Competency-Based Education assumes that learners have sufficient opportunities to practice competencies using appropriate instructional equipment before assessment occurs. Equipment mismatch disrupts this alignment by limiting students' exposure to the tools, technologies, and workplace conditions reflected in competency standards. Consequently, inadequate instructional resources may hinder learners' ability to demonstrate required competencies despite completing formal instruction. This theoretical perspective therefore explains the relationship between equipment mismatch and National Competency performance examined in the present study.

Systems Theory

The third theoretical foundation is Systems Theory, which views educational institutions as integrated systems composed of interdependent inputs, processes, outputs, and feedback mechanisms. Within this framework, instructional equipment, facilities, teachers, curriculum, students, and institutional resources represent educational inputs. Competency-based instruction, laboratory activities, instructional innovation, and assessment practices constitute the educational processes, while students' National Competency performance represents the primary educational output.

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Systems Theory suggests that weaknesses occurring within one component of the educational system inevitably influence the effectiveness of the entire instructional process. Equipment mismatch represents a deficiency within the input component because inadequate instructional resources limit instructional processes, reduce opportunities for practical learning, and ultimately affect competency outcomes. Conversely, improvements in instructional equipment strengthen educational processes, enhance competency development, and contribute to improved National Competency performance.

This systems perspective also emphasizes the importance of educational leadership, institutional planning, laboratory management, resource allocation, and continuous quality improvement in maintaining effective competency-based instructional environments. Consequently, Systems Theory provides an organizational perspective for understanding how equipment modernization contributes to educational effectiveness.

Integration of the Theoretical Framework

The integration of Experiential Learning Theory, Competency-Based Education Theory, and Systems Theory provides a comprehensive explanation of the relationships examined in this study. Experiential Learning Theory explains how students acquire competencies through authentic laboratory experiences. Competency-Based Education Theory explains how these competencies are assessed according to established industry standards. Systems Theory explains how instructional resources, institutional management, and educational processes interact to influence competency outcomes.

Collectively, these theories support the assumption that adequate, functional, technologically current, and competency-aligned instructional equipment is fundamental to effective competency-based instruction, meaningful experiential learning, successful National Competency assessment, and continuous improvement of technical-vocational education.

Conceptual Framework

The conceptual framework of this study was developed from the reviewed literature, empirical studies, and the three theoretical foundations underpinning the investigation. It illustrates the assumed relationship between the independent variable, Equipment Mismatch, and the dependent variable, National Competency Performance, within the competency-based instructional environment of the Computer Systems Servicing program at Isabela School of Arts and Trade.

Equipment mismatch serves as the independent variable because it represents the instructional conditions that influence competency-based teaching and learning. The variable encompasses the availability, functionality, and alignment of instructional equipment with Technical Education and Skills Development Authority (TESDA) competency standards and current industry practices. Drawing from Experiential Learning Theory, adequate instructional equipment provides students with authentic opportunities for repeated hands-on practice that facilitate competency development. Conversely, insufficient, outdated, malfunctioning, or poorly aligned equipment restricts practical learning experiences and weakens students' opportunities to develop required technical competencies.

The instructional process functions as the educational mechanism through which equipment influences learning outcomes. Competency-based instruction, laboratory activities, teacher demonstrations, guided practice, technology-enhanced learning, and authentic performance assessment collectively mediate students' competency development. Guided by Competency-Based Education Theory, effective instructional processes require close alignment among curriculum standards, instructional strategies, assessment practices, and laboratory resources to ensure meaningful competency acquisition.

National Competency Performance constitutes the dependent variable because it represents the measurable educational outcome of competency-based instruction. Within the Philippine TVET system, National Competency assessments evaluate students' mastery of theoretical knowledge, practical skills, and occupational competencies according to nationally established standards. Systems Theory explains that improvements in instructional inputs, particularly instructional equipment, enhance instructional processes and ultimately produce stronger competency outcomes.

The framework therefore assumes that reducing equipment mismatch through improved instructional resource planning, laboratory modernization, industry collaboration, instructional innovation, and educational leadership strengthens competency-based teaching and learning, enhances students' technical competency development, and improves National Competency performance. Guided by existing literature and the integrated theoretical framework, the conceptual model provides the foundation for examining the relationship between equipment mismatch and National Competency performance among Computer Systems Servicing students at Isabela School of Arts and Trade.

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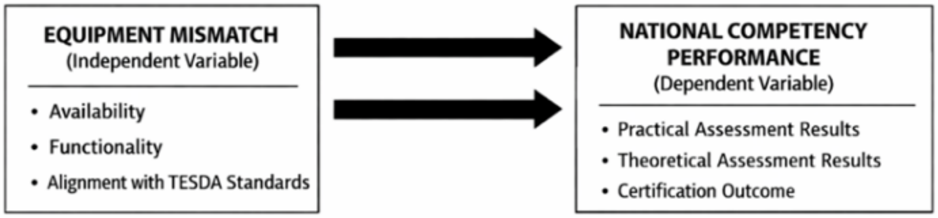

Figure 1. Research Paradigm

Statement of the Problem

Technical-Vocational Education (TVE) relies heavily on competency-based instruction, where students develop practical skills through hands-on learning experiences using industry-standard instructional equipment. In Computer Systems Servicing (CSS) programs, the adequacy, functionality, and alignment of laboratory equipment with Technical Education and Skills Development Authority (TESDA) competency standards are essential to ensuring effective skills development and successful National Competency performance. However, many technical-vocational institutions continue to experience equipment mismatch, characterized by insufficient, outdated, malfunctioning, or non-industry-aligned instructional resources. Such conditions may limit students' opportunities for practical learning, reduce instructional effectiveness, and adversely affect competency development and certification outcomes.

This study investigates the challenges associated with equipment mismatch in the Computer Systems Servicing program at Isabela School of Arts and Trade. Specifically, it examines the availability, functionality, and alignment of instructional equipment with TESDA standards; assesses students' National Competency performance; determines the relationship between equipment mismatch and competency performance; identifies challenges affecting instructional delivery; and proposes interventions that may strengthen competency-based instruction, improve technical skills development, and enhance National Competency performance.

General Objective

To investigate the influence of equipment mismatch on the National Competency performance of Computer Systems Servicing (CSS) students at Isabela School of Arts and Trade.

Specific Objectives

The study aims to:

1. Determine the extent of equipment mismatch in the CSS program in terms of:
   - availability;
   - functionality; and
   - alignment with TESDA competency standards.
2. Determine the instructional process and hands-on training experienced by CSS students.
3. Assess the level of National Competency performance of CSS students based on competency standards, assessment results, and skills demonstration.
4. Identify the challenges encountered by teachers and students related to instructional equipment, laboratory facilities, and learning resources.
5. Examine the significant relationship between equipment mismatch and the National Competency performance of CSS students.
6. Propose interventions to address equipment mismatch and improve competency-based instruction and National Competency performance.

Research Questions

This study sought to answer the following questions:

1. What is the extent of equipment mismatch in the Computer Systems Servicing (CSS) program in terms of:
   a. availability;
   b. functionality; and
   c. alignment with TESDA competency standards?
2. What is the level of instructional process and hands-on training experienced by CSS students?

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3. What is the level of National Competency performance of CSS students based on competency standards, assessment results, and skills demonstration?
4. What challenges related to instructional equipment, laboratory facilities, and learning resources are experienced by teachers and students during CSS instruction?
5. Is there a significant relationship between equipment mismatch and the National Competency performance of CSS students?
6. What interventions may be proposed to address equipment mismatch and improve competency-based instruction and National Competency performance in the CSS program?

Hypothesis

There is no significant relationship between equipment mismatch and the National Competency performance of Computer Systems Servicing students at Isabela School of Arts and Trade.

METHODOLOGY

Research Design

This study employed a descriptive-correlational research design, which is appropriate for describing existing conditions and examining the relationship between variables without manipulating the research environment. Descriptive-correlational research is widely used in educational research to determine the extent to which variables are related while allowing researchers to observe phenomena in their natural settings. Correlational research enables researchers to investigate the magnitude and direction of relationships among variables, providing empirical evidence that may support educational planning and decision-making without establishing causal relationships. Because the present study sought to determine whether equipment mismatch is significantly associated with students' National Competency performance, the descriptive-correlational design was considered the most appropriate methodological approach.

The descriptive component of the study was used to determine the extent of equipment mismatch within the Computer Systems Servicing (CSS) program by examining the availability, functionality, and alignment of instructional equipment with the competency standards of the Technical Education and Skills Development Authority (TESDA), the Philippine government agency responsible for regulating technical-vocational education, establishing competency standards, and administering National Competency assessments leading to National Certification. The descriptive aspect also examined the instructional process, hands-on training experiences, and challenges encountered by teachers and students concerning instructional equipment, laboratory facilities, and learning resources.

The correlational component examined the relationship between the independent variable and the dependent variable. The independent variable was equipment mismatch, operationally defined as the inadequacy, non-functionality, insufficient quantity, outdated condition, or lack of alignment of instructional equipment with TESDA competency standards and current industry practices. The dependent variable was National Competency performance, operationally defined as students' competency assessment results, practical skills demonstration, theoretical assessment performance, and National Certification outcomes as reflected in official school and competency assessment records.

The study did not manipulate the instructional environment or introduce experimental treatments. Instead, it measured naturally occurring conditions within the Computer Systems Servicing program and statistically determined whether equipment mismatch was significantly associated with students' National Competency performance. The descriptive-correlational design therefore provided an appropriate methodological framework for describing existing instructional conditions, identifying educational challenges, and generating empirical evidence that may support instructional improvement, laboratory resource planning, competency-based education, and evidence-informed decision-making in technical-vocational institutions.

Population and Sampling

The respondents of this study consisted of ninety (90) Senior High School students enrolled in the Computer Systems Servicing (CSS) program at Isabela School of Arts and Trade during Academic Year 2025–2026. These students constituted the entire population of learners officially enrolled in the CSS specialization during the conduct of the study.

The study employed the total enumeration sampling technique, wherein all members of the target population were included as respondents. Total enumeration was considered appropriate because the population size was relatively small and manageable, allowing every qualified student to participate in the investigation. According to

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educational research methodology, total enumeration increases the completeness of the data collected by eliminating sampling error within the identified population and ensuring that all eligible participants are represented.

The inclusion criteria required that respondents:

- were officially enrolled in the Computer Systems Servicing program during Academic Year 2025–2026;
- were actively participating in competency-based laboratory instruction and practical training;
- had undergone or were preparing for competency-based assessment under the TESDA Computer Systems Servicing curriculum; and
- voluntarily agreed to participate in the study by providing informed consent. For respondents below the age of eighteen (18), parental or guardian consent was likewise secured before participation.

The exclusion criteria included students who:

- were not officially enrolled in the Computer Systems Servicing program during the data collection period;
- were absent throughout the scheduled data collection activities;
- declined participation in the study; or
- failed to provide complete responses to the research instruments.

The use of total enumeration ensured that the perspectives and experiences of the entire population of Computer Systems Servicing students were represented. This sampling strategy strengthened the reliability of the descriptive findings and enhanced the validity of the correlational analysis by utilizing information obtained from all eligible respondents rather than from a selected sample. Consequently, the findings provide a comprehensive representation of the instructional conditions, equipment mismatch, and National Competency performance of Computer Systems Servicing students at Isabela School of Arts and Trade.

Research Instruments

To obtain comprehensive and reliable data, the study utilized four complementary sources of information: (1) a researcher-developed questionnaire, (2) an observation checklist, (3) National Competency performance records, and (4) document review. The use of multiple research instruments enabled methodological triangulation, thereby strengthening the validity and credibility of the findings by allowing information gathered from one source to be verified using other sources.

Questionnaire

The primary data-gathering instrument was a researcher-developed structured questionnaire designed to determine the extent of equipment mismatch and gather information regarding the instructional process, hands-on training experiences, and challenges encountered by Computer Systems Servicing (CSS) students.

The questionnaire was developed after an extensive review of related literature, the Technical Education and Skills Development Authority (TESDA) Training Regulations for Computer Systems Servicing, competency standards, previous empirical studies, and the objectives of the present investigation. The questionnaire was designed to ensure that every indicator directly corresponded to the study variables.

The instrument consisted of five major dimensions:

1. Availability of Instructional Equipment
2. Functionality of Instructional Equipment
3. Alignment of Equipment with TESDA Competency Standards
4. Instructional Process and Hands-on Training
5. Challenges Related to Instructional Equipment, Laboratory Facilities, and Learning Resources

Each dimension consisted of several indicators measured using a five-point Likert scale:

Scale	Descriptive Rating	Interpretation
5	Strongly Agree	Very High
4	Agree	High
3	Neutral	Moderate
2	Disagree	Low
1	Strongly Disagree	Very Low

Higher mean scores indicated greater agreement regarding the adequacy and effectiveness of instructional equipment and learning experiences, whereas lower scores reflected greater equipment mismatch and instructional challenges.

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The questionnaire also included demographic items describing respondents' educational profile to facilitate descriptive statistical analysis.

Content Validation

Prior to administration, the questionnaire underwent content validation to ensure that all items were relevant, comprehensive, and representative of the study variables.

The instrument was evaluated by three experts with extensive backgrounds in:

- Technical-Vocational Education and Training (TVET);
- educational research and quantitative methodology; and
- Computer Systems Servicing and competency-based instruction.

The validators examined each questionnaire item in terms of:

- relevance;
- clarity;
- appropriateness of language;
- alignment with the research objectives;
- consistency with TESDA competency standards; and
- adequacy of content coverage.

Recommendations provided by the validators were incorporated into the final version of the instrument. Where applicable, the Content Validity Index (CVI) indicated that the questionnaire demonstrated acceptable content validity before field administration.

Reliability Testing

Following content validation, the questionnaire was pilot-tested among Computer Systems Servicing students from another technical-vocational institution who possessed characteristics similar to those of the target respondents but were not included in the actual study.

The pilot-testing procedure was conducted to determine the clarity of instructions, readability of questionnaire items, estimated completion time, and internal consistency of the instrument.

The reliability of the questionnaire was determined using Cronbach's Alpha Coefficient, which measures the internal consistency of Likert-scale instruments. The obtained Cronbach's Alpha coefficient indicated acceptable reliability, demonstrating that the questionnaire possessed satisfactory internal consistency for quantitative educational research.

Suggestions arising from the pilot test were incorporated before the final administration of the instrument.

Observation Checklist

To complement the questionnaire data, a structured observation checklist was employed to obtain an objective assessment of the actual condition of instructional equipment and laboratory facilities used in the Computer Systems Servicing program.

The observation checklist documented:

- availability of instructional equipment;
- operational condition and functionality of tools and devices;
- adequacy of equipment relative to class size;
- compliance of laboratory facilities with TESDA competency standards;
- accessibility of equipment during practical laboratory sessions; and
- overall laboratory environment supporting competency-based instruction.

Laboratory observations were conducted systematically during scheduled practical classes to validate the responses obtained from the questionnaire and minimize respondent bias.

National Competency Performance Records

Students' National Competency performance served as the primary dependent variable of the study.

Official competency records were obtained from authorized school records and competency assessment documents, subject to institutional approval and applicable ethical requirements.

The records included:

- practical competency assessment results;

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Facebook Page : https://www.facebook.com/EmbracingTheCultureOfResearch
Twitter Account : https://twitter.com/ETCOR_research
YouTube Channel : https://tinyurl.com/YouTubeETCOR
E-mail Address : embracingthecultureofresearch@etcor.org
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- theoretical competency assessment results;
- skills demonstration performance; and
- National Certification outcomes, where applicable.

These official records provided standardized and objective measures of students' competency performance, thereby reducing reliance on self-reported information and strengthening the validity of the study.

Document Review

A document review was conducted to verify the alignment between instructional resources and prescribed competency requirements.

Relevant institutional documents examined included:

- TESDA Training Regulations;
- Computer Systems Servicing curriculum guides;
- course syllabi;
- laboratory equipment inventories;
- laboratory utilization records; and
- instructional resource inventories.

The review enabled the researcher to compare prescribed competency requirements with the actual instructional resources available within the institution. The information obtained also served to validate findings from the questionnaire, observation checklist, and National Competency records.

Data Triangulation

The integration of the researcher-developed questionnaire, observation checklist, National Competency performance records, and document review provided methodological triangulation that enhanced the credibility, validity, and reliability of the study.

Student perceptions were verified through direct laboratory observations, official competency records, and institutional documents, thereby minimizing potential biases associated with a single source of information. The combination of these instruments provided a comprehensive understanding of equipment mismatch, instructional conditions, competency-based teaching, and National Competency performance within the Computer Systems Servicing program at Isabela School of Arts and Trade.

Data Collection Procedure

The data collection process was conducted systematically to ensure the accuracy, reliability, and ethical integrity of the study. Prior to the commencement of data gathering, the researcher secured written approval from the administration of Isabela School of Arts and Trade to conduct the study within the institution. Permission was likewise obtained from the Computer Systems Servicing (CSS) program coordinator and subject teachers to facilitate the administration of the research instruments and the conduct of laboratory observations. Where access to official National Competency records was required, authorization was obtained from the appropriate school authorities and, when applicable, from the Technical Education and Skills Development Authority (TESDA), the Philippine government agency responsible for competency assessment and National Certification.

Data collection was conducted during Academic Year 2025–2026 over an approximate period of four weeks. The activities were scheduled in coordination with the school administration to avoid disruption of regular instructional activities. Laboratory observations were conducted in the Computer Systems Servicing laboratories and workshops of Isabela School of Arts and Trade during regularly scheduled practical classes.

Before administering the research instruments, the researcher explained the objectives of the study, the voluntary nature of participation, the confidentiality of all responses, and the rights of the respondents. Informed consent was secured from all participants prior to their participation. For respondents below eighteen (18) years of age, written parental or guardian consent was likewise obtained in accordance with institutional ethical requirements.

The researcher personally administered the researcher-developed questionnaire to all eligible Computer Systems Servicing students. Clear instructions regarding the completion of the questionnaire were provided, and adequate time was allotted to allow respondents to answer carefully and independently. Completed questionnaires were immediately retrieved, reviewed for completeness, and coded to facilitate subsequent statistical analysis.

Following the administration of the questionnaire, systematic laboratory observations were conducted using the structured observation checklist. The observations focused on the availability, functionality, adequacy, and alignment of instructional equipment with TESDA competency standards. These observations served to validate the

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responses obtained from the questionnaire and provided objective evidence regarding the actual instructional conditions within the CSS laboratories.

Subsequently, official National Competency performance records were obtained from authorized institutional sources. These records included practical competency assessment results, theoretical assessment scores, skills demonstration outcomes, and National Certification results, where available. The records served as the primary source of data for the dependent variable of the study.

Finally, relevant institutional documents—including TESDA Training Regulations, course syllabi, laboratory inventories, equipment utilization records, and instructional resource inventories—were reviewed to verify the alignment between prescribed competency standards and the instructional equipment available in the institution.

Upon completion of the data collection process, all questionnaires, observation forms, competency records, and documentary evidence were carefully organized, coded, and prepared for statistical analysis.

Treatment of Data

The quantitative data gathered in this study were analyzed using appropriate descriptive and inferential statistical techniques consistent with the research objectives and the descriptive-correlational research design. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), Version 29, to ensure accuracy, consistency, and reliability in data processing.

Descriptive statistics were employed to summarize and describe the characteristics of the respondents and the study variables. Specifically, frequency counts and percentages were used to present respondents' demographic characteristics, while weighted means and standard deviations were computed to determine the extent of equipment mismatch, the instructional process and hands-on training experienced by students, the challenges encountered during instruction, and the level of National Competency performance.

The following descriptive statistical measures were employed:

- Frequency and Percentage – to summarize respondents' demographic characteristics and categorical data.
- Weighted Mean – to determine the extent or level of each study variable.
- Standard Deviation – to determine the variability and consistency of respondents' perceptions.

Prior to conducting the inferential analysis, the assumptions underlying the use of Pearson's Product-Moment Correlation Coefficient were examined. These assumptions included:

- normality of data distribution;
- linearity of the relationship between variables;
- homoscedasticity; and
- absence of significant outliers.

After confirming that these assumptions were reasonably satisfied, Pearson's Product-Moment Correlation Coefficient (r) was employed to determine the strength, direction, and statistical significance of the relationship between the independent variable (equipment mismatch) and the dependent variable (National Competency performance).

For equipment mismatch, composite scores were computed by averaging respondents' ratings across the three dimensions:

- availability;
- functionality; and
- alignment with TESDA competency standards.

These composite scores were then correlated with the National Competency performance scores obtained from official competency assessment records.

All statistical tests were conducted using a 0.05 level of significance ($\alpha = 0.05$). The null hypothesis was rejected whenever the computed *p*-value was less than 0.05 and accepted when the *p*-value was greater than or equal to 0.05.

The statistical analyses provided empirical evidence regarding the extent of equipment mismatch, the instructional conditions experienced by students, the challenges affecting competency-based instruction, and the relationship between equipment mismatch and National Competency performance. These findings served as the basis for the study's conclusions and proposed interventions.

Ethical Considerations

The study was conducted in accordance with accepted ethical principles governing educational research involving human participants. Prior to the conduct of the study, written permission was obtained from the administration

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of Isabela School of Arts and Trade. Where official National Competency performance records were accessed, permission was likewise obtained from the appropriate school authorities and, when necessary, from the Technical Education and Skills Development Authority (TESDA).

Participation in the study was entirely voluntary. All respondents were informed of the objectives of the study, the nature of their participation, the procedures involved, the expected duration of participation, and their rights as research participants. Written informed consent was obtained from all respondents before data collection commenced. Because some respondents were minors, written parental or guardian consent was likewise secured prior to their participation.

Respondents were informed that participation or non-participation would not affect their academic grades, classroom standing, competency assessment results, or relationship with their teachers or the institution. They were likewise informed of their right to decline participation or withdraw from the study at any stage without penalty or adverse consequences.

Confidentiality and anonymity were strictly maintained throughout the study. Personal identifiers were excluded from all questionnaires, observation forms, and data files. Instead, numerical codes were assigned to protect the identity of each participant. Information obtained from official National Competency records and institutional documents was likewise treated with strict confidentiality and used exclusively for research purposes.

All research records, including completed questionnaires, observation checklists, electronic datasets, and documentary evidence, were securely stored in password-protected electronic files and locked storage accessible only to the researcher. Upon completion of the study and publication of the findings, research data will be retained for the period required by institutional policy and thereafter securely disposed of through appropriate physical and electronic data destruction procedures.

Throughout the conduct of the study, the researcher observed the ethical principles of respect for persons, beneficence, confidentiality, voluntary participation, informed consent, and responsible data management, ensuring that the rights, dignity, welfare, and privacy of all participants were fully protected.

RESULTS and DISCUSSION

This section presents, analyzes, and interprets the data gathered in the study on equipment mismatch and National Competency performance of Computer Systems Servicing students at Isabela School of Arts and Trade.

Table 1.
Status of instructional equipment in terms of availability (n = 90)

Indicators	Weighted Mean	Verbal Interpretation
1. There are enough computers available for all students during laboratory activities.	3.42	Moderately Agree
2. The CSS laboratory has sufficient networking tools and devices for practical activities.	3.35	Moderately Agree
3. The school provides adequate hardware components for hands-on training.	3.28	Moderately Agree
4. Instructional equipment needed for CSS competencies is readily available during class activities.	3.31	Moderately Agree
5. Students have adequate access to the equipment required for National Competency preparation.	3.40	Moderately Agree
Overall Mean	3.35	Moderately Agree

Table 1 presents the status of instructional equipment in terms of availability as perceived by the ninety (90) Computer Systems Servicing (CSS) students of Isabela School of Arts and Trade. The findings revealed an overall weighted mean of 3.35, verbally interpreted as "Moderately Agree," indicating that respondents generally perceived the availability of instructional equipment as moderately adequate for competency-based learning and laboratory instruction. Among the indicators, the availability of computers during laboratory activities obtained the highest weighted mean (3.42), suggesting that the institution has made reasonable efforts to provide learners with access to essential computer resources during practical sessions. However, the availability of hardware components for hands-on training obtained the lowest weighted mean (3.28), indicating that shortages in specialized tools and hardware continue to limit students' opportunities to fully perform the practical competencies required in the Computer Systems Servicing curriculum.

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The findings suggest that while the institution possesses the essential laboratory infrastructure needed to implement competency-based instruction, the quantity and accessibility of instructional equipment remain insufficient to fully accommodate the practical learning requirements of all students. This situation is common in technical-vocational institutions where increasing student enrollment, rapid technological advancements, and limited financial resources make it difficult to maintain laboratories equipped with current industry-standard resources. Consequently, students may not receive equal opportunities to repeatedly perform laboratory exercises, practice technical procedures independently, or gain sufficient exposure to authentic workplace tasks before undergoing National Competency assessment.

These findings support the principles of Kolb's Experiential Learning Theory, which emphasizes that meaningful learning occurs through concrete experiences, active experimentation, reflective observation, and conceptual understanding. In technical-vocational education, instructional equipment serves as the medium through which students transform theoretical knowledge into practical competence. When laboratory resources are only moderately available, opportunities for experiential learning become restricted, thereby limiting repeated practice, immediate feedback, and mastery of technical competencies. Since Computer Systems Servicing relies heavily on repetitive laboratory exercises, insufficient instructional resources may reduce students' confidence, technical proficiency, and readiness for competency assessment.

Similarly, the results reinforce the principles of Competency-Based Education (CBE), which advocate that learners should demonstrate mastery of clearly defined competencies through authentic performance tasks. Competency-based instruction requires adequate access to appropriate tools, equipment, and learning resources that simulate actual workplace conditions. Moderate availability of instructional equipment suggests that although competency-based instruction can still be implemented, some learners may experience unequal opportunities to achieve mastery because laboratory resources must be shared among multiple students. This may prolong skills acquisition and reduce opportunities for individualized practice, which are essential characteristics of competency-based technical-vocational education.

The findings likewise support Systems Theory, which views educational institutions as interconnected systems in which instructional resources, curriculum, teachers, administrators, and students collectively influence educational outcomes. The moderate availability of laboratory equipment demonstrates that instructional quality is influenced not solely by teacher competence but also by institutional resource management. Even highly competent teachers may encounter difficulties implementing competency-based instruction when instructional resources are insufficient to support continuous laboratory practice. This highlights the importance of viewing equipment availability as a strategic institutional concern rather than merely a logistical issue.

The present findings are consistent with those of Adam and Mengistie (2026), who reported that trainers across various Technical and Vocational Education and Training (TVET) sectors encountered significant challenges arising from limited laboratory facilities and unequal access to instructional resources. Their study emphasized that inadequate facilities reduce opportunities for practical learning and constrain students' competency development. In the context of the present investigation, the similarity of findings suggests that equipment availability continues to be a widespread concern among technical-vocational institutions rather than an isolated institutional problem. This consistency strengthens the conclusion that improving instructional resources remains a critical requirement for enhancing the quality of competency-based education.

Beyond confirming previous studies, the present findings provide important educational implications. From a teaching and learning perspective, instructors may need to adopt flexible instructional approaches that maximize the utilization of limited laboratory resources. These may include rotational laboratory activities, cooperative learning groups, peer-assisted laboratory practice, and structured demonstration sessions that allow students to remain actively engaged despite equipment constraints. The integration of digital simulations, virtual laboratory activities, and blended practical instruction may likewise supplement limited physical resources while maintaining students' opportunities for experiential learning.

From a curriculum development perspective, the findings emphasize the importance of aligning laboratory resources with curriculum implementation. Curriculum developers and program planners may periodically review the correspondence between prescribed competencies, laboratory requirements, and available instructional equipment to ensure that every competency identified in the Computer Systems Servicing curriculum can be adequately demonstrated and practiced. Such curriculum-resource alignment strengthens competency-based instruction and ensures that students receive sufficient opportunities to attain the expected learning outcomes.

The results also carry significant implications for educational leadership and institutional management. School administrators, laboratory managers, and technical-vocational program coordinators play a central role in ensuring that instructional equipment remains adequate, accessible, and responsive to evolving industry requirements. Strategic

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resource planning, evidence-based budgeting, preventive maintenance programs, and partnerships with industry stakeholders may improve the availability of instructional equipment and sustain laboratory operations. Viewing laboratory equipment as an investment in instructional quality rather than merely a capital expenditure supports continuous institutional improvement and strengthens competency-based technical-vocational education.

Furthermore, the findings have implications for teacher professional development. Technical-vocational educators may benefit from continuing professional development programs focusing on laboratory resource management, innovative instructional strategies, simulation-based teaching, and effective implementation of competency-based education under conditions of limited equipment. Strengthening teachers' capacity to maximize available resources may help maintain instructional quality even when laboratory facilities remain constrained.

Finally, the findings provide valuable insights for educational policymakers, including the Technical Education and Skills Development Authority (TESDA), technical-vocational school administrators, and education planners. The moderate level of equipment availability demonstrated in this study underscores the continuing need for sustainable funding mechanisms, periodic laboratory modernization, and stronger institutional partnerships with industry to ensure that instructional resources remain aligned with current technological developments and competency standards. Such initiatives may contribute to improved instructional quality, stronger competency development, enhanced National Competency performance, and greater workforce readiness among graduates of technical-vocational education programs.

Table 2.
Status of instructional equipment in terms of functionality (n = 90)

Indicators	Weighted Mean	Verbal Interpretation
1. Computers and equipment used in the CSS laboratory are functioning properly.	3.37	Moderately Agree
2. Laboratory tools and devices are regularly maintained and repaired when necessary.	3.22	Moderately Agree
3. Most equipment used during practical activities can perform the required tasks effectively.	3.33	Moderately Agree
4. Students can complete laboratory activities without interruption caused by defective equipment.	3.18	Moderately Agree
5. The functionality of instructional equipment supports effective skills training in CSS.	3.36	Moderately Agree
Overall Mean	3.29	Moderately Agree

Table 2 presents the status of instructional equipment in terms of functionality as perceived by the ninety (90) Computer Systems Servicing (CSS) students of Isabela School of Arts and Trade. The findings revealed an overall weighted mean of 3.29, verbally interpreted as "Moderately Agree," indicating that the respondents generally perceived the functionality of instructional equipment as moderately satisfactory in supporting competency-based laboratory instruction. Among the indicators, the statement "Computers and equipment used in the CSS laboratory are functioning properly" obtained the highest weighted mean of 3.37, suggesting that most of the laboratory equipment remained operational and usable during instructional activities. Conversely, the statement "Students can complete laboratory activities without interruption caused by defective equipment" registered the lowest weighted mean of 3.18, indicating that equipment malfunctions and technical problems continued to interrupt laboratory sessions and practical activities. Although all indicators were interpreted as "Moderately Agree," the results demonstrate that recurring equipment-related concerns continue to affect the efficiency and consistency of competency-based technical-vocational instruction.

The findings suggest that the effectiveness of competency-based education depends not only on the presence of instructional equipment but also on its continuous functionality and operational reliability. Functional instructional equipment enables students to repeatedly perform laboratory procedures, troubleshoot computer systems, configure networks, and develop occupational competencies using authentic workplace technologies. However, when laboratory equipment becomes defective or unreliable, students lose valuable opportunities for repeated practice, immediate feedback, and independent performance of technical procedures. Such interruptions reduce the continuity of laboratory instruction and may ultimately affect students' preparedness for National Competency assessment.

These findings are consistent with Kolb's Experiential Learning Theory, which posits that meaningful learning develops through a continuous cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Functional instructional equipment provides the concrete learning experiences necessary for

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students to transform theoretical knowledge into practical competence. When laboratory resources malfunction or become temporarily unavailable, the experiential learning cycle is disrupted because students are unable to complete authentic technical tasks under realistic conditions. Consequently, learners may acquire conceptual understanding without achieving the level of practical mastery expected in competency-based technical-vocational education.

The results likewise reinforce the principles of Competency-Based Education (CBE), which require learners to demonstrate mastery of clearly defined occupational competencies through repeated performance of authentic workplace tasks. Competency-based instruction assumes that students have continuous access to operational instructional resources that enable deliberate practice, skills refinement, and performance assessment. The moderate rating obtained for equipment functionality indicates that although competency-based instruction remains feasible, recurring equipment malfunctions reduce students' opportunities to attain mastery of required competencies before competency assessment. Consequently, maintaining functional instructional equipment is fundamental to ensuring the successful implementation of competency-based education within Computer Systems Servicing programs.

From the perspective of Systems Theory, instructional equipment represents one of the essential educational inputs that directly influences instructional processes and educational outputs. Laboratory equipment that is consistently functional strengthens teaching effectiveness, facilitates uninterrupted laboratory instruction, and enhances competency development. Conversely, malfunctioning equipment weakens the instructional process by reducing students' opportunities to participate actively in practical learning experiences, thereby affecting the quality of competency acquisition and National Competency performance. The findings therefore illustrate that instructional equipment maintenance should be regarded as an integral component of institutional quality assurance and educational effectiveness rather than simply a technical maintenance concern.

The findings are consistent with those reported by Wasitoh et al. (2025), who emphasized that the quality, functionality, and reliability of laboratory equipment significantly influence students' practical learning experiences, laboratory engagement, and competency development. Their study explained that functional instructional equipment enables learners to actively participate in laboratory-based instruction, apply theoretical concepts to authentic technical situations, and develop competencies required in professional practice. Conversely, defective or unreliable equipment disrupts instructional flow, limits opportunities for practical application, and weakens students' acquisition of technical skills. Similarly, the present findings indicate that although the instructional equipment in the CSS laboratories is generally operational, recurring equipment malfunctions continue to interrupt practical instruction and reduce opportunities for continuous competency development.

The educational implications of these findings extend beyond laboratory operations. From a teaching and learning perspective, instructors may redesign laboratory instruction to maximize the utilization of available functional equipment through rotational laboratory schedules, collaborative laboratory activities, peer-assisted practical exercises, and structured demonstration sessions. These instructional approaches enable students to remain actively engaged while ensuring equitable access to limited laboratory resources. Moreover, integrating virtual laboratories, simulation software, and blended practical instruction may supplement physical laboratory experiences and reduce the instructional impact of temporary equipment failures.

From a curriculum development perspective, the findings emphasize the need for continuous curriculum-resource alignment. Curriculum developers may periodically evaluate whether laboratory equipment remains capable of supporting every competency specified in the Computer Systems Servicing curriculum and the competency standards established by the Technical Education and Skills Development Authority (TESDA). Where deficiencies are identified, curriculum implementation plans may incorporate alternative instructional strategies while institutional plans for equipment upgrading and modernization are being implemented. Such curriculum-resource alignment helps ensure that competency-based instruction remains relevant to current technological developments and industry expectations.

The results likewise highlight the critical role of educational leadership in maintaining instructional quality. School administrators, laboratory managers, and technical-vocational education leaders may establish comprehensive preventive maintenance programs, equipment replacement schedules, laboratory modernization initiatives, and evidence-based budgeting systems that prioritize instructional resource sustainability. Rather than responding only after equipment failures occur, proactive laboratory management enables institutions to maintain functional learning environments that consistently support competency-based instruction and improve institutional quality assurance.

The findings also have important implications for teacher professional development. Technical-vocational educators may benefit from continuing professional development programs that strengthen competencies in laboratory resource management, equipment troubleshooting, technology integration, simulation-based instruction, and innovative competency-based teaching strategies. Such professional development enables teachers to maximize available instructional resources while maintaining effective laboratory instruction under conditions of limited equipment functionality.

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Finally, the study provides important guidance for educational policymakers, including TESDA, the Department of Education, technical-vocational school administrators, and other stakeholders responsible for workforce development. The moderate level of equipment functionality observed in this study demonstrates the continuing need for sustained investments in laboratory maintenance, equipment upgrading, technology modernization, and institutional support systems. Strengthening these areas may enhance the quality of competency-based education, improve students' National Competency performance, and better prepare graduates to meet the technological demands of contemporary industries.

Table 3.
Status of instructional equipment in terms of alignment with TESDA standards (n = 90)

Indicators	Weighted Mean	Verbal Interpretation
1. The instructional equipment used in CSS is aligned with TESDA competency standards.	3.41	Agree
2. The tools and devices available in the laboratory are similar to those used in TESDA assessments.	3.32	Moderately Agree
3. The CSS laboratory equipment reflects current industry standards and practices.	3.26	Moderately Agree
4. The available instructional resources adequately support competency-based instruction.	3.38	Moderately Agree
5. The equipment used in training prepares students for National Competency assessment requirements.	3.35	Moderately Agree
Overall Mean	3.34	Moderately Agree

Table 3 presents the status of instructional equipment in terms of its alignment with the competency standards of the Technical Education and Skills Development Authority (TESDA) as perceived by the ninety (90) Computer Systems Servicing (CSS) students of Isabela School of Arts and Trade. The findings revealed an overall weighted mean of 3.34, verbally interpreted as "Moderately Agree," indicating that respondents generally perceived the instructional equipment as moderately aligned with TESDA competency standards and the requirements of competency-based instruction. Among the indicators, the statement "The instructional equipment used in CSS is aligned with TESDA competency standards" obtained the highest weighted mean of 3.41, with a verbal interpretation of "Agree." This suggests that students generally recognized that the existing laboratory resources support the implementation of prescribed competencies. However, the statement "The CSS laboratory equipment reflects current industry standards and practices" obtained the lowest weighted mean of 3.26, interpreted as "Moderately Agree," indicating that some laboratory equipment no longer fully reflects contemporary technologies and evolving workplace practices. These findings imply that while instructional resources generally satisfy the minimum requirements of competency-based instruction, continuous modernization remains necessary to ensure stronger alignment with current industry demands and technological advancements.

The findings indicate that alignment with TESDA competency standards involves more than simply possessing instructional equipment. Effective competency-based education requires laboratory resources that accurately represent current workplace technologies, industry procedures, and occupational practices. When instructional equipment only moderately reflects contemporary industry standards, students may successfully complete prescribed learning activities but receive limited exposure to emerging technologies that characterize modern Computer Systems Servicing workplaces. Consequently, graduates may possess the competencies required for certification while still requiring additional workplace adaptation when confronted with newer technologies and industry practices.

These findings are strongly supported by Competency-Based Education (CBE) Theory, which emphasizes that learning outcomes should directly correspond to clearly defined occupational competencies. Competency-based instruction requires that learning environments closely simulate actual workplace conditions to enable students to demonstrate authentic performance. Moderate alignment between laboratory resources and TESDA competency standards suggests that although students are provided with opportunities to develop required competencies, continuous updating of instructional equipment is necessary to ensure that competency development remains responsive to rapidly changing technological environments and labor market expectations.

The findings likewise reflect the principles of Kolb's Experiential Learning Theory, which emphasizes that learners construct knowledge through meaningful experiences involving authentic tasks and real-world applications. Instructional equipment that closely resembles industry-standard technologies allows students to acquire practical

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experience under conditions similar to those encountered in professional practice. Conversely, when laboratory resources no longer reflect current industry technologies, opportunities for authentic experiential learning become limited, thereby reducing students' preparedness for employment and lifelong professional learning.

From the perspective of Systems Theory, curriculum implementation, instructional resources, institutional leadership, and industry expectations function as interconnected components of a single educational system. Alignment between laboratory equipment and TESDA competency standards demonstrates effective interaction among these educational components. However, moderate alignment also suggests that improvements in one component—particularly laboratory modernization—can strengthen the effectiveness of the entire instructional system. Educational institutions must therefore continuously evaluate whether instructional resources remain responsive to revisions in competency standards, technological innovation, and workforce requirements.

The findings are consistent with those reported by Maladzhi and Bello (2025), who emphasized that effective Computer Systems Servicing instruction depends heavily on laboratory-based learning supported by current, industry-relevant instructional resources. Their study explained that competency-based instruction becomes more meaningful when students perform laboratory activities using equipment that accurately reflects workplace technologies and current industry practices. They further observed that limitations in laboratory resources and the underutilization of innovative instructional technologies may reduce students' opportunities to acquire industry-relevant competencies. Similarly, the present findings indicate that although the existing instructional equipment generally supports competency-based instruction, continuous modernization remains necessary to ensure stronger alignment with evolving industry requirements and technological developments.

The educational implications of these findings are substantial. From the perspective of teaching and learning, instructors may continuously integrate authentic industry practices into laboratory instruction by incorporating current case studies, workplace scenarios, project-based learning activities, equipment demonstrations, and simulation-based exercises. When complete laboratory modernization cannot immediately be achieved, technology-enhanced learning tools, virtual laboratories, and industry simulation software may supplement students' practical experiences while preserving the authenticity of competency-based instruction.

From a curriculum development perspective, the findings emphasize the importance of maintaining curriculum-resource alignment. Curriculum developers may periodically review the correspondence between TESDA Training Regulations, laboratory activities, instructional modules, and available equipment to ensure that every prescribed competency is supported by appropriate instructional resources. Such curriculum mapping enables institutions to identify obsolete equipment, prioritize laboratory modernization, and continuously align instructional practices with evolving competency standards and workforce expectations.

The findings also provide important implications for educational leadership. School administrators, laboratory supervisors, and technical-vocational education managers play a critical role in ensuring that institutional resources remain responsive to technological innovation and industry developments. Strategic planning, evidence-based procurement, periodic equipment audits, industry consultations, and sustainable laboratory investment programs may significantly strengthen institutional capacity to provide high-quality competency-based instruction. Effective educational leadership therefore extends beyond administrative management toward ensuring continuous alignment between institutional resources and educational goals.

The study likewise contributes to teacher professional development. Technical-vocational educators may benefit from continuous training on emerging technologies, industry certification updates, curriculum implementation, laboratory innovation, and competency-based instructional strategies. Professional development programs that expose teachers to current industry practices enable them to integrate modern technologies into classroom and laboratory instruction while strengthening students' preparedness for National Competency assessment and employment.

Finally, the findings have significant implications for educational policymakers, particularly TESDA, the Department of Education, technical-vocational institutions, and other agencies responsible for workforce development. Continuous review of competency standards, laboratory accreditation requirements, funding mechanisms, and industry partnerships may strengthen the alignment between technical-vocational education and labor market demands. Sustained investments in laboratory modernization and curriculum-resource alignment may enhance instructional quality, improve students' National Competency performance, and produce graduates who possess competencies that remain relevant in increasingly technology-driven industries.

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Table 4.
Challenges related to equipment mismatch experienced by CSS students (n = 90)

Indicators	Weighted Mean	Verbal Interpretation
1. Some CSS equipment is outdated compared to current industry standards.	3.67	Agree
2. Limited equipment prevents all students from practicing simultaneously.	3.74	Agree
3. I experience difficulty completing tasks due to lack of proper tools.	3.48	Agree
4. Equipment malfunction disrupts hands-on training activities.	3.52	Agree
5. Some competencies are taught without the required equipment.	3.46	Agree
6. Equipment limitations reduce my confidence in performing technical tasks.	3.40	Moderately Agree
Overall Mean	3.55	Agree

Table 4 presents the challenges related to equipment mismatch experienced by the ninety (90) Computer Systems Servicing (CSS) students of Isabela School of Arts and Trade. The findings revealed an overall weighted mean of 3.55, verbally interpreted as "Agree," indicating that the respondents generally experienced considerable challenges arising from equipment mismatch during competency-based laboratory instruction. Among the indicators, the statement "Limited equipment prevents all students from practicing simultaneously" obtained the highest weighted mean of 3.74, suggesting that inadequate quantities of laboratory equipment significantly restrict students' opportunities to participate actively in hands-on learning activities. Conversely, the statement "Equipment limitations reduce my confidence in performing technical tasks" obtained the lowest weighted mean of 3.40, verbally interpreted as "Moderately Agree." Although this indicator received the lowest rating, it nevertheless indicates that equipment-related limitations continue to influence students' confidence in performing technical procedures independently. Overall, the findings demonstrate that equipment mismatch remains a substantial instructional concern affecting the quality, accessibility, and effectiveness of competency-based technical-vocational education within the Computer Systems Servicing program.

The findings suggest that equipment mismatch is not limited to shortages of instructional resources but also encompasses outdated technologies, insufficient quantities of laboratory equipment, malfunctioning tools, and inadequate alignment between available resources and the competencies prescribed by the Technical Education and Skills Development Authority (TESDA). Such conditions reduce students' opportunities to engage in continuous and meaningful laboratory practice, thereby limiting the effectiveness of competency-based instruction. Because Computer Systems Servicing requires learners to repeatedly perform technical procedures such as hardware installation, computer troubleshooting, network configuration, preventive maintenance, and systems diagnosis, inadequate laboratory resources inevitably constrain competency development and reduce students' readiness for authentic workplace situations and National Competency assessment.

These findings strongly support Kolb's Experiential Learning Theory, which emphasizes that effective learning occurs through repeated cycles of concrete experience, reflective observation, abstract conceptualization, and active experimentation. In technical-vocational education, laboratory equipment serves as the primary medium through which students acquire authentic learning experiences. When multiple students are required to share limited equipment or when laboratory resources are unavailable, opportunities for active experimentation become significantly reduced. Consequently, students complete fewer practical exercises, receive less immediate feedback, and have fewer opportunities to refine technical competencies through repeated practice. The moderate effect of equipment limitations on students' confidence further illustrates how restricted experiential learning opportunities may influence learners' self-efficacy and technical readiness.

The findings likewise reinforce the principles of Competency-Based Education (CBE). Competency-based instruction requires learners to demonstrate mastery of occupational competencies through repeated performance of authentic workplace tasks under conditions that closely resemble actual industry practice. The finding that limited equipment prevents simultaneous participation indicates that many students may receive fewer opportunities to demonstrate competencies before formal assessment. Such limitations reduce instructional equity because students do not experience equal access to laboratory resources necessary for mastery learning. Consequently, equipment mismatch may contribute to variations in competency acquisition and assessment performance despite the implementation of the same curriculum.

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From the perspective of Systems Theory, instructional equipment represents a critical educational input that directly influences instructional processes and educational outputs. Equipment shortages, malfunctioning resources, and outdated technologies disrupt laboratory scheduling, instructional planning, classroom management, and competency assessment. Because educational systems function through the interaction of multiple components, deficiencies in instructional resources inevitably influence teacher effectiveness, student engagement, instructional quality, and competency outcomes. The present findings therefore demonstrate that equipment mismatch should be addressed through comprehensive institutional planning rather than isolated equipment procurement initiatives.

The present findings are consistent with those reported by Leones (2024), who emphasized that the availability of learning tools and laboratory resources is significantly associated with the development of technical competencies among Computer Systems Servicing students. Their study demonstrated that inadequate instructional resources reduce opportunities for meaningful practical learning and ultimately affect students' preparedness for industry practice and competency assessment. Similarly, the present study revealed that limited equipment prevents simultaneous laboratory participation, thereby restricting students' opportunities for repeated hands-on practice and mastery of occupational competencies. These findings collectively reinforce the importance of providing sufficient, functional, and industry-aligned instructional resources to support competency-based technical-vocational education.

Beyond confirming previous research, the findings carry important implications for teaching and learning. Technical-vocational instructors may adopt instructional strategies that maximize the use of available laboratory resources while maintaining active student engagement. These strategies may include rotational laboratory schedules, cooperative learning groups, peer-assisted laboratory exercises, project-based instruction, and guided demonstrations. In situations where physical equipment remains insufficient, teachers may supplement laboratory activities with virtual laboratories, simulation software, interactive troubleshooting applications, and blended practical instruction to ensure that all learners continue developing technical competencies despite equipment limitations.

From a curriculum development perspective, the findings emphasize the importance of continuously evaluating the alignment between prescribed competencies and available instructional resources. Curriculum developers and program planners may conduct regular curriculum-resource mapping to identify competencies that cannot be adequately delivered because of equipment limitations. Such evaluations may guide curriculum revision, laboratory module development, and resource acquisition planning while ensuring that competency-based instruction remains responsive to technological advancement and evolving workforce requirements.

The findings likewise underscore the critical role of educational leadership in addressing equipment mismatch. School administrators, laboratory supervisors, and technical-vocational education managers may implement strategic resource planning, preventive maintenance programs, periodic laboratory audits, evidence-based budgeting, and industry partnerships to improve instructional resource availability. Effective educational leadership extends beyond procurement by ensuring that laboratory facilities remain sustainable, technologically current, and fully supportive of competency-based teaching and learning. Institutional decision-making informed by empirical evidence, such as the findings of this study, may contribute to stronger instructional quality and continuous institutional improvement.

The study also provides valuable implications for teacher professional development. Technical-vocational educators may benefit from continuing professional development focusing on innovative laboratory management, simulation-based instruction, technology integration, competency-based assessment, and strategies for maximizing limited instructional resources. Strengthening teachers' instructional capability enables them to provide meaningful learning experiences despite equipment constraints while promoting greater learner engagement and competency development.

Finally, the findings provide important guidance for educational policymakers, particularly TESDA, the Department of Education, and administrators of technical-vocational institutions. The challenges identified in this study demonstrate the continuing need for sustainable funding mechanisms, periodic laboratory modernization, strengthened industry partnerships, and policies that support equitable access to competency-based learning resources. Addressing equipment mismatch through coordinated institutional and policy initiatives may significantly improve instructional quality, strengthen National Competency performance, enhance workforce readiness, and ensure that technical-vocational education remains responsive to the rapidly changing demands of Industry 4.0 and the digital economy.

Table 5.
Summary table on instructional process and hands-on training (n = 90)

Variable	Overall Mean	Verbal Interpretation
Instructional Process and Hands-On Training	3.55	Agree

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Table 5 presents the respondents' perceptions regarding the instructional process and hands-on training in the Computer Systems Servicing (CSS) program at Isabela School of Arts and Trade. The findings revealed an overall weighted mean of 3.55, verbally interpreted as "Agree," indicating that the respondents generally perceived the instructional process as effective in facilitating competency-based learning and practical skills development. The results suggest that classroom instruction, teacher demonstrations, guided laboratory activities, and practical exercises collectively contributed to students' understanding of technical concepts and the acquisition of occupational competencies. Nevertheless, despite the generally positive evaluation of instructional delivery, the findings also demonstrate that limitations in instructional equipment continue to constrain the extent to which students are able to practice all required competencies. Thus, while instructional strategies were perceived as effective, the adequacy and quality of laboratory resources remained essential determinants of the overall effectiveness of competency-based instruction.

The findings indicate that effective competency-based instruction depends not only on teachers' instructional competence but also on the quality of the learning environment in which instruction occurs. Teachers may employ well-designed demonstrations, practical activities, and learner-centered instructional approaches; however, the educational value of these strategies becomes limited when students have insufficient opportunities to perform laboratory tasks independently because of equipment shortages or laboratory constraints. Consequently, the instructional process and the availability of instructional resources should be viewed as complementary components of competency-based education rather than as independent factors affecting learning outcomes.

These findings strongly support Kolb's Experiential Learning Theory, which emphasizes that meaningful learning occurs through active participation in authentic experiences followed by reflection, conceptual understanding, and repeated application. Within Computer Systems Servicing education, teacher demonstrations introduce technical procedures, while laboratory practice enables students to transform theoretical knowledge into practical competence. The respondents' positive evaluation of the instructional process indicates that instructors successfully facilitate experiential learning through demonstrations, guided laboratory instruction, and practical activities. Nevertheless, limitations in equipment availability reduce opportunities for continuous active experimentation, thereby interrupting the experiential learning cycle that is fundamental to technical-vocational education.

The findings also reinforce the principles of Competency-Based Education (CBE), which emphasize that students should demonstrate mastery of occupational competencies through repeated performance of authentic workplace tasks. Competency-based instruction requires sufficient opportunities for deliberate practice, individualized feedback, performance assessment, and competency reinforcement. Although students generally perceived classroom instruction positively, equipment limitations restrict opportunities for repeated laboratory practice, making it more difficult for some learners to achieve complete mastery of required competencies before National Competency assessment. This finding highlights that instructional quality in competency-based education depends upon the interaction between effective teaching and adequate instructional resources.

From the perspective of Systems Theory, instructional processes represent the educational mechanism through which institutional inputs—including teachers, instructional equipment, curriculum, and learning resources—are transformed into competency outcomes. The positive perception of instructional delivery demonstrates that teachers effectively utilize available resources to facilitate competency development despite existing laboratory constraints. However, the findings likewise indicate that deficiencies in instructional inputs, particularly equipment availability and functionality, continue to influence the efficiency of instructional processes and the quality of educational outputs. Thus, strengthening instructional quality requires simultaneous improvements in teacher capability, laboratory resources, curriculum implementation, and institutional support systems.

The present findings are consistent with those reported by May et al. (2023), who identified demonstration methods, laboratory-based instruction, and guided practical activities as highly effective instructional approaches in Computer Systems Servicing education. Their study demonstrated that these instructional strategies significantly improve students' understanding of technical concepts, practical skills, and competency assessment performance. Similarly, the respondents in the present study recognized the effectiveness of teacher-facilitated instruction and practical learning experiences while simultaneously acknowledging that equipment limitations continue to reduce the completeness of laboratory training. These findings collectively suggest that effective teaching alone cannot fully compensate for deficiencies in instructional resources; rather, high-quality competency-based education requires both effective instructional practice and adequate laboratory facilities.

From the perspective of teaching and learning, the findings highlight the important role of teachers in creating meaningful learning experiences even when instructional resources are limited. Technical-vocational educators may continue strengthening learner-centered instructional approaches through collaborative laboratory learning, guided practice, project-based instruction, problem-based learning, and competency-focused performance assessment. In

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situations where laboratory resources remain insufficient, teachers may supplement practical instruction through digital simulations, virtual laboratories, multimedia demonstrations, and blended laboratory activities to provide students with additional opportunities for competency development.

The findings likewise have important implications for curriculum development. Curriculum developers may continuously evaluate whether instructional activities, laboratory exercises, and competency requirements remain appropriately supported by available instructional resources. Curriculum-resource mapping may assist educational institutions in identifying competencies that require additional laboratory facilities, updated technologies, or alternative instructional strategies. Such curriculum alignment ensures that competency-based instruction remains relevant to current industry standards while promoting continuous improvement in technical-vocational education.

The study further emphasizes the significance of educational leadership in supporting effective instructional processes. School administrators, department heads, laboratory supervisors, and technical-vocational education managers may strengthen instructional quality through strategic laboratory planning, systematic equipment acquisition, faculty support, and continuous quality assurance initiatives. Institutional leaders also play a critical role in establishing partnerships with industry stakeholders that provide access to updated technologies, workplace exposure, and additional instructional resources capable of strengthening competency-based instruction.

The findings additionally contribute to teacher professional development. Technical-vocational educators may benefit from continuing professional development programs focusing on competency-based pedagogy, laboratory management, digital instructional technologies, simulation-based learning, authentic assessment, and innovative instructional strategies for resource-constrained environments. Continuous professional learning enables teachers to maximize available resources while maintaining instructional quality and promoting student engagement.

Finally, the findings provide valuable insights for educational policymakers, including the Technical Education and Skills Development Authority (TESDA), the Department of Education, and administrators of technical-vocational institutions. Policies supporting laboratory modernization, teacher capability development, technology integration, competency-based curriculum enhancement, and sustainable instructional resource allocation may significantly strengthen the quality of technical-vocational education. Such initiatives contribute not only to improved instructional effectiveness but also to enhanced National Competency performance, workforce readiness, and institutional responsiveness to the evolving demands of Industry 4.0 and the digital economy.

Table 6.
Level of national competency performance of CSS students in terms of self-assessment (n = 90)

Indicators	Weighted Mean	Verbal Interpretation
1. I feel confident performing CSS tasks required in the NC assessment.	3.51	Agree
2. School-based training prepared me well for the NC assessment.	3.47	Agree
3. I can perform hardware servicing tasks independently.	3.42	Agree
4. I can troubleshoot computer and network problems effectively.	3.38	Moderately Agree
5. Hands-on training improved my technical skills.	3.69	Agree
6. Adequate equipment positively affects my NC performance.	3.81	Agree
Overall Mean	3.55	Agree

Table 6 presents the level of National Competency performance of the ninety (90) Computer Systems Servicing (CSS) students of Isabela School of Arts and Trade based on self-assessment. The findings revealed an overall weighted mean of 3.55, verbally interpreted as "Agree," indicating that the respondents generally perceived themselves as adequately prepared to perform the competencies required in Computer Systems Servicing and the National Competency (NC) assessment. Among the indicators, the statement "Adequate equipment positively affects my NC performance" obtained the highest weighted mean of 3.81, suggesting that students strongly recognized the importance of sufficient, functional, and industry-relevant instructional equipment in enhancing their technical competency and assessment readiness. Conversely, the statement "I can troubleshoot computer and network problems effectively" obtained the lowest weighted mean of 3.38, verbally interpreted as "Moderately Agree." This finding indicates that although students generally expressed confidence in their competencies, more advanced technical skills, particularly troubleshooting and diagnostic tasks, remain areas requiring additional practice and instructional reinforcement. Overall, the findings suggest that competency development among CSS students is positively influenced by practical learning experiences supported by adequate instructional resources.

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The findings demonstrate that students' perceived National Competency performance is closely associated with the quality of competency-based instruction and the adequacy of laboratory resources available throughout the training process. Technical-vocational education emphasizes mastery of occupational competencies through repeated practical application rather than solely through theoretical instruction. Consequently, learners who have regular access to functional, industry-standard equipment are more likely to develop the confidence, procedural knowledge, and technical proficiency required for successful competency assessment. The comparatively lower rating obtained for troubleshooting competencies further suggests that higher-order technical skills require more extensive laboratory exposure, repeated practice, and opportunities to solve authentic technical problems before students achieve full mastery.

These findings strongly support Kolb's Experiential Learning Theory, which explains that learners acquire competence through repeated cycles of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Within the Computer Systems Servicing program, students develop technical proficiency by repeatedly performing hardware installation, preventive maintenance, network configuration, and troubleshooting tasks under authentic laboratory conditions. The strong agreement that adequate instructional equipment positively affects National Competency performance demonstrates that experiential learning is significantly enhanced when students have continuous access to appropriate laboratory resources. Conversely, limited opportunities for practical engagement may hinder the development of complex technical competencies that require repeated application and problem-solving.

The findings likewise reinforce the principles of Competency-Based Education (CBE). Competency-based instruction requires learners to demonstrate mastery of clearly defined occupational competencies through authentic performance assessment. The results indicate that students perceive hands-on training and adequate instructional equipment as essential components of competency acquisition because these resources enable repeated practice, individualized feedback, and progressive mastery of occupational tasks. The comparatively lower confidence in troubleshooting computer and network problems further illustrates that competency mastery develops progressively and requires sustained opportunities for authentic practice before learners can independently perform complex technical procedures. Consequently, competency-based education requires continuous alignment among instructional strategies, laboratory resources, assessment practices, and industry competency standards.

From the perspective of Systems Theory, National Competency performance represents the educational output produced through the interaction of multiple institutional inputs and instructional processes. Laboratory facilities, instructional equipment, curriculum implementation, teacher expertise, competency-based instruction, and institutional support collectively contribute to students' competency development and assessment performance. The findings demonstrate that improvements in instructional equipment strengthen instructional processes and ultimately contribute to better competency outcomes. Conversely, limitations in instructional resources may reduce the effectiveness of even well-designed instructional programs by restricting students' opportunities for meaningful practical learning experiences.

The present findings are consistent with those reported by May et al. (2023), who concluded that practical instruction, laboratory-based learning, and repeated hands-on activities significantly enhance competency development among Computer Systems Servicing students. Their study demonstrated that learners who actively participate in demonstrations, laboratory exercises, and authentic technical tasks achieve higher levels of competency and assessment readiness. Similarly, the present study indicates that students strongly recognize the importance of adequate instructional equipment in strengthening technical skills, increasing confidence, and improving preparedness for National Competency assessment. Both studies emphasize that competency development is most effective when instructional strategies are supported by sufficient, functional, and industry-aligned laboratory resources.

From the perspective of teaching and learning, the findings emphasize the importance of designing instructional activities that provide students with repeated opportunities to apply theoretical knowledge in authentic technical situations. Teachers may strengthen competency development by incorporating structured laboratory exercises, guided troubleshooting activities, project-based learning, authentic performance assessments, collaborative laboratory tasks, and simulation-based instruction. Greater emphasis on complex diagnostic and troubleshooting activities may further improve students' confidence in performing higher-order technical competencies required in professional practice.

The findings likewise have important implications for curriculum development. Curriculum developers may periodically review the balance between theoretical instruction and practical laboratory experiences to ensure that sufficient instructional time is allocated for advanced competencies such as computer troubleshooting, network diagnostics, and systems maintenance. Curriculum-resource mapping may also assist institutions in identifying competencies that require additional laboratory facilities, updated technologies, or revised instructional materials to strengthen students' competency development and assessment performance.

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The study further highlights the critical role of educational leadership in promoting high-quality competency-based education. School administrators, technical-vocational education managers, and laboratory supervisors may strengthen institutional support by prioritizing laboratory modernization, sustainable equipment acquisition, preventive maintenance programs, and evidence-based resource allocation. Strategic leadership decisions that ensure continuous access to functional and industry-standard instructional equipment contribute directly to improved instructional quality and stronger National Competency performance.

The findings also contribute to teacher professional development. Technical-vocational educators may benefit from continuing professional development programs focusing on competency-based assessment, advanced laboratory instruction, technology integration, troubleshooting pedagogy, simulation-based learning, and authentic performance evaluation. Strengthening teachers' pedagogical and technical competencies enables them to facilitate deeper learning experiences and better prepare students for National Competency assessment and workplace performance.

Finally, the findings provide valuable guidance for educational policymakers, particularly the Technical Education and Skills Development Authority (TESDA), the Department of Education, and administrators of technical-vocational institutions. The results reinforce the importance of sustained investments in laboratory facilities, instructional technologies, teacher capability development, competency-based curriculum enhancement, and industry collaboration. Policies supporting these initiatives may significantly improve the quality of technical-vocational education, strengthen National Competency performance, enhance graduate employability, and ensure that educational programs remain responsive to the technological demands of Industry 4.0, digital transformation, and the future workforce.

Table 7.
Relationship between equipment mismatch and national competency performance (n = 90)

Variables	Computed r-value	p-value	Decision	Interpretation
Equipment Mismatch and National Competency Performance	0.67	0.000	Reject Ho	Significant Relationship

Table 7 presents the relationship between equipment mismatch and the National Competency performance of Computer Systems Servicing (CSS) students at Isabela School of Arts and Trade. The findings revealed a computed Pearson correlation coefficient (r) of 0.67, indicating a strong positive relationship between the variables. Furthermore, the obtained p-value of 0.000 was lower than the established 0.05 level of significance, leading to the rejection of the null hypothesis. These findings indicate that equipment mismatch is significantly associated with students' National Competency performance. The results suggest that the adequacy, functionality, and alignment of instructional equipment with the competency standards of the Technical Education and Skills Development Authority (TESDA) play a substantial role in influencing students' competency development and assessment outcomes.

The significant relationship observed in this study demonstrates that instructional resources are not merely supplementary components of technical-vocational education but are fundamental elements of effective competency-based learning. Computer Systems Servicing is a highly skills-oriented specialization that requires students to repeatedly perform authentic technical procedures such as computer assembly, hardware servicing, network installation, systems configuration, preventive maintenance, and troubleshooting. When instructional equipment is insufficient, malfunctioning, outdated, or poorly aligned with industry standards, students experience fewer opportunities to engage in meaningful laboratory practice. Consequently, deficiencies in instructional resources directly influence competency acquisition, practical skill development, and students' readiness to successfully perform during National Competency assessment.

These findings strongly support Kolb's Experiential Learning Theory, which explains that learning is most effective when learners actively participate in authentic experiences that allow repeated practice, reflection, conceptual understanding, and experimentation. In competency-based technical-vocational education, instructional equipment provides the concrete experiences through which theoretical knowledge is transformed into occupational competence. The strong relationship identified in this study indicates that students who have greater access to functional and industry-relevant laboratory equipment are more likely to experience richer experiential learning opportunities, thereby strengthening their technical competence and assessment performance. Conversely, equipment mismatch interrupts the experiential learning cycle by limiting students' opportunities for repeated application and mastery of technical skills.

The findings likewise reinforce the principles of Competency-Based Education (CBE). Competency-based instruction requires learners to demonstrate mastery of clearly defined occupational competencies through authentic

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performance assessment rather than through theoretical knowledge alone. The significant relationship between equipment mismatch and National Competency performance indicates that competency mastery depends not only on instructional quality but also on the availability of learning environments that adequately support practical performance. Students cannot be expected to demonstrate competencies that they have had limited opportunities to practice because of deficiencies in instructional equipment. Therefore, ensuring adequate, functional, and industry-aligned laboratory resources is an essential requirement for the successful implementation of competency-based education.

From the perspective of Systems Theory, the findings demonstrate the interdependence of educational inputs, instructional processes, and educational outputs. Instructional equipment represents one of the primary institutional inputs that support competency-based teaching and laboratory learning. When equipment availability, functionality, and alignment are strengthened, instructional processes become more effective, resulting in improved competency development and stronger National Competency performance. Conversely, weaknesses in instructional resources reduce the efficiency of instructional processes and ultimately affect educational outcomes. The strong positive relationship observed in this study therefore illustrates that improvements in institutional resource management may contribute directly to improvements in students' competency achievement.

The findings are consistent with those reported by Opiyo et al. (2025), who identified a significant relationship between the availability of learning tools and the development of technical competencies among Computer Systems Servicing students. Their study concluded that insufficient instructional resources reduce opportunities for practical learning and negatively affect competency acquisition. Similarly, the present investigation demonstrates that equipment mismatch significantly influences National Competency performance because practical competency development depends heavily on repeated laboratory experiences supported by appropriate instructional resources. The consistency between these findings strengthens existing evidence that instructional equipment is a critical determinant of educational quality within competency-based technical-vocational education.

Beyond establishing statistical significance, the findings have important implications for teaching and learning. Technical-vocational educators may recognize that effective competency development requires instructional approaches that maximize authentic laboratory experiences. While innovative teaching strategies such as collaborative laboratory learning, guided practice, project-based instruction, simulation-based learning, and blended laboratory activities may partially address equipment limitations, these pedagogical approaches cannot completely replace direct interaction with industry-standard instructional equipment. Consequently, instructional innovation should complement rather than substitute for adequate laboratory resources.

From a curriculum development perspective, the findings emphasize the importance of maintaining close alignment among competency standards, instructional activities, assessment procedures, and laboratory resources. Curriculum developers may periodically review competency-resource mapping to ensure that every prescribed competency can be adequately practiced using available instructional equipment. Such curriculum alignment strengthens competency-based instruction while ensuring that graduates possess skills consistent with current industry expectations and technological developments.

The findings likewise provide significant implications for educational leadership. School administrators, technical-vocational education managers, laboratory supervisors, and institutional planners may use the results of this study as empirical evidence to support strategic resource allocation, laboratory modernization, preventive maintenance programs, and sustainable equipment procurement. Educational leadership decisions grounded in evidence-based planning contribute directly to improved instructional quality, institutional effectiveness, and continuous quality assurance within technical-vocational education.

The study also highlights important implications for teacher professional development. Technical-vocational educators may benefit from continuing professional development focusing on competency-based pedagogy, laboratory management, instructional innovation, technology integration, authentic assessment, and strategies for maximizing available instructional resources. Such professional development strengthens teachers' ability to facilitate meaningful learning experiences while maintaining high instructional quality under varying laboratory conditions.

Finally, the findings provide valuable guidance for educational policymakers, particularly the Technical Education and Skills Development Authority (TESDA), the Department of Education, administrators of technical-vocational institutions, and other agencies responsible for workforce development. The strong relationship identified in this study demonstrates that investments in laboratory modernization, competency-based curriculum implementation, teacher capability development, industry partnerships, and instructional resource enhancement are likely to contribute substantially to improved National Competency performance and graduate employability. These initiatives likewise support broader national goals related to workforce competitiveness, digital transformation, Industry 4.0 readiness, and sustainable technical-vocational education.

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Table 8.
Proposed Interventions to Address Equipment Mismatch and Improve National Competency Performance

Identified Problem	Proposed Intervention	Expected Outcome
Insufficient number of computers and tools	Procurement of additional laboratory equipment and devices	Improved access to hands-on training
Malfunctioning and outdated equipment	Regular maintenance and upgrading of instructional equipment	Enhanced effectiveness of practical activities
Limited alignment with TESDA standards	Acquisition of TESDA-compliant and industry-standard tools	Improved competency preparation and assessment readiness
Limited opportunities for practice	Implementation of scheduled laboratory utilization and extended practice hours	Increased student competency and confidence
Inadequate support for practical instruction	Strengthening partnerships with industry stakeholders and TESDA	Improved training resources and instructional quality

Table 8 presents the proposed interventions designed to address equipment mismatch and improve the National Competency performance of Computer Systems Servicing (CSS) students at Isabela School of Arts and Trade. The proposed interventions directly respond to the instructional challenges identified throughout the study, including insufficient laboratory equipment, malfunctioning and outdated instructional resources, limited alignment of laboratory facilities with the competency standards of the Technical Education and Skills Development Authority (TESDA), restricted opportunities for practical learning, and inadequate institutional support for competency-based instruction. The recommended interventions include the procurement of additional laboratory equipment, regular maintenance and upgrading of instructional resources, acquisition of TESDA-compliant and industry-standard technologies, implementation of scheduled laboratory utilization and extended practice sessions, and the strengthening of partnerships with industry stakeholders and TESDA. Collectively, these interventions are intended to improve students' access to authentic learning experiences, strengthen technical competency development, enhance instructional quality, and increase students' readiness for National Competency assessment and future employment.

The proposed interventions reflect the principle that improving competency-based technical-vocational education requires a comprehensive institutional approach rather than isolated equipment procurement. While acquiring additional laboratory resources is essential, sustainable improvement also requires systematic equipment maintenance, strategic resource planning, continuous curriculum evaluation, instructional innovation, faculty development, and active collaboration with industry partners. Addressing equipment mismatch therefore involves strengthening the entire instructional ecosystem that supports competency-based teaching and learning.

The proposed interventions are strongly supported by Kolb's Experiential Learning Theory, which emphasizes that students develop meaningful competencies through repeated engagement in authentic practical experiences. Laboratory equipment serves as the foundation of these experiential learning opportunities because it allows learners to actively perform technical procedures, evaluate outcomes, and continuously refine occupational skills. Procuring additional instructional equipment, extending laboratory practice opportunities, and maintaining functional learning environments enable students to experience the repeated cycles of active experimentation that are essential for developing technical competence and professional confidence.

The interventions likewise reinforce the principles of Competency-Based Education (CBE). Competency-based instruction requires instructional environments that provide sufficient opportunities for learners to repeatedly demonstrate occupational competencies under conditions that closely resemble actual workplace practice. The proposed acquisition of TESDA-compliant and industry-standard instructional equipment strengthens curriculum-resource alignment and ensures that competency development remains consistent with national competency standards and current industry expectations. Likewise, extending laboratory utilization schedules allows students additional opportunities to master competencies before formal competency assessment, thereby promoting greater instructional equity and improved learning outcomes.

From the perspective of Systems Theory, the proposed interventions recognize that educational quality depends upon the interaction of institutional inputs, instructional processes, and educational outputs. Equipment procurement, laboratory modernization, curriculum implementation, faculty capability, institutional leadership, and industry collaboration function as interconnected components of a single educational system. Improvements in any one component strengthen the effectiveness of the entire instructional process, ultimately contributing to higher levels of National Competency performance, improved instructional quality, and greater institutional effectiveness. Consequently, the recommended interventions represent coordinated institutional strategies rather than isolated corrective actions.

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The proposed interventions are consistent with the findings of Toroka and Kafanabo (2024), who identified significant resource limitations within Computer Systems Servicing programs, including inadequate instructional equipment, limited access to modern technologies, and insufficient utilization of innovative instructional resources. Their study emphasized that although competency outcomes may remain satisfactory, instructional quality is constrained when laboratory resources fail to support authentic competency-based learning experiences. Similarly, the present study demonstrates that strengthening equipment availability, functionality, laboratory management, and instructional alignment constitutes an essential strategy for improving competency development and National Competency performance among CSS students.

From the perspective of teaching and learning, the proposed interventions encourage teachers to maximize both physical and digital instructional resources. Technical-vocational educators may integrate collaborative laboratory learning, project-based instruction, guided practice, virtual laboratories, simulation technologies, troubleshooting software, and blended practical instruction to supplement laboratory experiences while equipment modernization is being implemented. Such instructional innovations promote continuous competency development and ensure that learners remain actively engaged despite temporary resource constraints.

The findings also have important implications for curriculum development. Curriculum developers may periodically evaluate the alignment among competency standards, laboratory activities, instructional materials, and available instructional resources. Curriculum-resource mapping enables institutions to identify competencies requiring additional laboratory equipment, revised instructional modules, or updated learning technologies. Continuous curriculum evaluation ensures that competency-based instruction remains responsive to technological advancement, evolving workplace requirements, and emerging occupational competencies associated with Industry 4.0 and digital transformation.

The study likewise highlights the central role of educational leadership in implementing sustainable improvements. School administrators, laboratory supervisors, technical-vocational education managers, and institutional planners may establish evidence-based procurement systems, preventive maintenance programs, laboratory modernization plans, strategic budgeting mechanisms, and long-term equipment replacement schedules. Partnerships with industry stakeholders, alumni, government agencies, and private organizations may further strengthen institutional capacity to provide current and industry-relevant laboratory facilities while supporting continuous quality improvement.

The proposed interventions also contribute significantly to teacher professional development. Technical-vocational educators may participate in continuing professional development focusing on laboratory management, emerging technologies, competency-based assessment, simulation-based instruction, instructional innovation, and industry immersion. These professional learning opportunities strengthen teachers' instructional capability while ensuring that classroom and laboratory practices remain aligned with evolving technological developments and workforce expectations.

Finally, the proposed interventions provide valuable guidance for educational policymakers, particularly the Technical Education and Skills Development Authority (TESDA), the Department of Education, administrators of technical-vocational institutions, and agencies responsible for workforce development. The findings support policies that prioritize sustainable funding for laboratory modernization, competency-based curriculum implementation, teacher capability enhancement, technology integration, and stronger collaboration between educational institutions and industry. Such evidence-informed policy initiatives may significantly improve instructional quality, strengthen National Competency performance, enhance graduate employability, and ensure that Philippine technical-vocational education remains responsive to national development priorities and global technological transformation.

Conclusions

Based on the findings of the study, the following conclusions were drawn:

1. The Computer Systems Servicing (CSS) program at Isabela School of Arts and Trade generally provides instructional equipment that is moderately adequate, functional, and aligned with the competency standards of the Technical Education and Skills Development Authority (TESDA). However, limitations in equipment availability, functionality, modernization, and industry alignment continue to constrain the effectiveness of competency-based instruction and students' opportunities for comprehensive practical learning.
2. Equipment mismatch remains a significant challenge affecting the quality of competency-based technical-vocational education. Insufficient quantities of laboratory equipment, outdated technologies, equipment malfunctions, and incomplete alignment with current industry standards reduce students' opportunities for repeated hands-on practice, authentic laboratory experiences, and mastery of occupational competencies required for National Competency assessment.

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3. The instructional process employed in the Computer Systems Servicing program effectively supports competency-based learning through teacher demonstrations, laboratory instruction, and guided practical activities. Nevertheless, the quality and effectiveness of these instructional strategies are influenced by the adequacy and functionality of instructional resources, demonstrating that successful competency-based education requires both effective teaching and sufficient laboratory support.
4. National Competency performance is strengthened when students are provided with adequate, functional, and industry-relevant instructional equipment that enables continuous experiential learning and repeated competency practice. The significant relationship identified between equipment mismatch and National Competency performance confirms that instructional resources constitute an essential component of competency development and successful technical-vocational education.
5. The findings contribute to educational research by providing empirical evidence that instructional equipment should be regarded as a strategic educational resource rather than merely a physical facility. Effective laboratory resource management, curriculum-resource alignment, instructional innovation, educational leadership, and continuous institutional support collectively contribute to improved teaching and learning, competency development, and educational quality within technical-vocational education.
6. Strengthening competency-based technical-vocational education requires comprehensive institutional and policy interventions that include laboratory modernization, sustainable equipment procurement and maintenance, curriculum enhancement, teacher professional development, industry collaboration, and evidence-based educational planning. These initiatives may improve instructional quality, enhance students' National Competency performance, strengthen workforce readiness, and ensure that technical-vocational education remains responsive to technological advancement and evolving industry requirements.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are offered:

1. School administrators and institutional leaders may prioritize the continuous improvement of Computer Systems Servicing (CSS) laboratories by allocating sufficient resources for the procurement, maintenance, upgrading, and replacement of instructional equipment. Regular laboratory audits and preventive maintenance programs may help ensure that instructional resources remain functional, industry-relevant, and aligned with the competency standards of the Technical Education and Skills Development Authority (TESDA).
2. Technical-vocational teachers may strengthen competency-based instruction by adopting learner-centered and innovative teaching strategies that maximize available instructional resources. These strategies may include collaborative laboratory learning, project-based instruction, rotational laboratory activities, peer-assisted practical exercises, simulation-based learning, virtual laboratories, troubleshooting software, and blended practical instruction. Such approaches may help sustain meaningful learning experiences while laboratory resources are being improved.
3. Curriculum developers and program planners may periodically review the alignment between curriculum competencies, laboratory activities, instructional materials, and available instructional resources. Curriculum-resource mapping may be conducted to identify competency areas requiring updated equipment, revised laboratory modules, or additional instructional technologies. Continuous curriculum evaluation may help ensure that competency-based instruction remains responsive to technological developments, industry standards, and evolving workforce requirements.
4. Educational leaders and laboratory managers may strengthen institutional planning through evidence-based budgeting, strategic resource allocation, equipment inventory management, laboratory modernization programs, and sustainable maintenance systems. Establishing stronger partnerships with industry stakeholders, government agencies, alumni, and private organizations may further support the acquisition of current technologies and enhance the quality of competency-based technical-vocational education.
5. The Technical Education and Skills Development Authority (TESDA), the Department of Education, and other educational policymakers may continue strengthening policies and funding mechanisms that support laboratory modernization, competency-based curriculum implementation, technology integration, teacher capability development, and industry collaboration. Sustained institutional support may contribute to improved instructional quality, enhanced National Competency performance, greater workforce readiness, and increased responsiveness of technical-vocational education to Industry 4.0 and digital transformation initiatives.
6. Teacher education institutions and professional development providers may incorporate competency-based laboratory instruction, laboratory resource management, simulation-based teaching, authentic assessment, educational technology integration, and emerging industry practices into pre-service and in-service teacher

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preparation programs. Continuous professional development may strengthen teachers' instructional competence and improve their capacity to deliver high-quality technical-vocational education under varying instructional conditions.

7. Future researchers may replicate and extend the present study by involving multiple technical-vocational institutions, larger and more diverse respondent populations, or different technical specialization programs to improve the generalizability of the findings. Future investigations may also employ mixed-methods or longitudinal research designs to gain a more comprehensive understanding of how instructional resources influence competency development, instructional quality, National Competency performance, and graduate employability over time. Additionally, future studies may examine emerging instructional innovations, including virtual laboratories, artificial intelligence-assisted technical education, smart laboratories, digital simulation technologies, and Industry 4.0 learning environments as potential strategies for addressing equipment mismatch and strengthening competency-based technical-vocational education.

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