ANALYSIS OF THE CONTENT AND JOB RELEVANCE OF THE TESDA NATIONAL CERTIFICATION PROGRAM FOR THE ELECTRONICS SECTOR: INPUT FOR MICRO-CREDENTIALING PROGRAM

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Abstract

This study aimed to analyze the content and job relevance of the Technical Education and Skills Development Authority (TESDA) National Certification (NC) programs in the electronics sector: Input for Micro-credentialing program. With the increasing demand for skilled workers and the rapid evolution of electronic technologies, it is essential to ensure that certification programs are aligned with current industry needs and competencies. The research employed a mixed-methods approach, combining quantitative data from survey responses of certified workers, trainers, and employers, and qualitative insights gathered through interviews and document analysis of TESDA Training Regulations (TRs). The study focused on evaluating the vertical articulation between Electronics Products Assembly and Servicing NC II and Consumer Electronics Servicing NC III, assessing their alignment with workplace standards, technological trends, and labor market requirements. Findings revealed that while TESDA's NC programs provide foundational competencies relevant to the industry, there are significant gaps in advanced skills coverage, updated technologies, and practical applications. Respondents highlighted the need for regular review of TRs, improved training resources, and closer industry collaboration to ensure alignment with global standards and emerging demands. The study concludes that stakeholder involvement is crucial in maintaining the relevance of TESDA's certification programs. It recommends revising training content based on industry feedback, enhancing trainer capacity, and developing new competency standards to support lifelong learning and workforce competitiveness in the electronics sector.

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Keywords: National Certification, Micro-credentialing Program, TESDA

CHAPTER I

THE PROBLEM AND ITS BACKGROUND

Introduction

Among the countries producing skilled workers, the Philippines has steadily strengthened its position in technical and vocational education and training (TVET). Recent national data show a significant improvement in the employment outcomes of technical-vocational education (Tech-Voc) graduates. According to TESDA's 2024 Study on the Employment of TVET Graduates (SETG), the employment rate of Tech-Voc graduates increased to 83.34 %, compared to 79 % in the previous year, indicating the growing relevance and effectiveness of training programs. The study also highlights notable regional variations and emphasizes industry partnerships, digital training, and flexible learning pathways aimed at preparing a future-ready workforce.

In line with this, the National Technical Education and Skills Development Plan (NTESDP) 2023–2028 serves as the roadmap for Philippine TVET, promoting demand-driven programs, ladderized education pathways, and lifelong learning to address evolving labor market needs and global competitiveness

The Technical Education and Skills Development Authority (TESDA) remains the lead agency in ensuring that Filipino trainees acquire competencies aligned with industry standards and global requirements. Under its mandate, TESDA designs and implements multi-level programs that provide the knowledge and skills necessary for trainees to become competent and employable workers. Vertical articulation, organizing contents in sequential and interconnected levels, is a core principle in designing training regulations to enhance coherence and mastery of skills.

Research on international TVET systems highlights the growing importance of employability skills, which include both technical competencies and broader capabilities such as communication, adaptability, and problem-solving. A systematic review of vocational education and training shows that such skills are influenced by multiple factors, including creativity, communication, adaptability, critical thinking, and self-confidence, all of which contribute to successful employment outcomes.

Employability skills are defined as the set of essential skills required not only to secure and retain a job but also to perform effectively in a changing work environment. These skills form the foundation upon which job-specific competencies are built and are critical in aligning TVET curriculum outputs with actual labor market demands.

As a trainer and program developer in the Electronics Sector of TESDA Bataan, the researcher recognizes that competencies incorporated in the training regulations must be vertically aligned to ensure that trainees acquire the skills needed by industry sectors. Recent studies indicate that while TESDA programs have improved employment outcomes, challenges related to skills mismatches and alignment with industry needs continue to surface, pointing to areas where curriculum review and enhanced articulation might further strengthen training relevance.

This study thus analyzed whether the current Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III training regulations are effectively articulated to prepare trainees for employment. It will investigate the degree to which these programs help graduates attain jobs related to their training and whether the competencies identified by partner industries meet labor market needs.

This study attempted to analyze the initial impact of the programs in the electronic sector and delve into how these programs have helped them attain the jobs they sought. The study will attempt to investigate if all of the graduates of the selected training programs provided the skills and competencies they needed to achieve their goal of becoming employed in the occupation related to the competency. As a manager in the educational sector and a TESDA specialist, it is pertinent to understand if the implementation of these particular qualifications provides opportunities to students in acquiring a depth of knowledge and understanding of the core competencies identified by partner industries as necessities for workers to become competent. This will help the researcher in planning and evaluating additional programs that will achieve these objectives. It is very significant for the researcher to determine if these qualifications, particularly Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III, are properly articulated and would develop the skills and competencies needed to help the trainees become employed.

Statement of the Problem

The general problem of the study is to analyze the content and job relevance of the TESDA national certification program for the electronics sector as input for the micro-credentialing program for the school year 2019-2020.

Specifically, the study sought answers to the following questions:

1. What is the profile of the trainees in 2019 in terms of:

    1.1. age,

    1.2. sex,

    1.3. educational background, and;

    1.4. work experience?

2. How may the relevance of a national certification program for the electronics sector be described?

3. How may the vertical articulation of EPAS NC II and CES NC III content be evaluated?

4. What micro-credentialing program may be designed based on the results of this study?

5. What is the implication of the result of the study?

Significance of the Study

This study is significant because it examines the vertical articulation and relevance of the TESDA national certification programs in the electronics sector, particularly the Electronic Products Assembly and

Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III qualifications. The study seeks to determine whether these qualifications provide a coherent and progressive learning pathway that equips trainees with the competencies required by the electronics industry and the labor market. The findings of this study are expected to benefit various stakeholders in technical-vocational education and training (TVET), industry, and society.

Trainees and Students. The study will greatly benefit trainees and students enrolled in TESDA electronics-related programs. Through the findings, trainees will gain a clearer understanding of whether the competencies acquired in EPAS NC II are properly aligned with the higher-level competencies required in CES NC III. This is important because vertically articulated qualifications provide learners with a structured and progressive learning experience that enables them to build upon previously acquired knowledge and skills.

The study may also help trainees identify the competencies and employability skills required by industries in the electronics sector. By understanding the strengths and gaps of the existing training regulations, learners may become more motivated to enhance their technical abilities, workplace behavior, communication skills, and problem-solving capabilities. In addition, the findings may help trainees make informed decisions regarding career specialization, employment opportunities, and future educational advancement.

Furthermore, the study may contribute to increasing trainees' confidence in TESDA qualifications by ensuring that training programs remain relevant, competency-based, and responsive to technological changes and labor market demands. As a result, graduates may become more employable, productive, and globally competitive.

Trainers and Instructors. The findings of the study will also benefit trainers and instructors in the electronics sector. Trainers play a critical role in implementing competency-based training and ensuring that trainees acquire industry-standard skills. Through this study, trainers may gain insights into whether the competencies, learning outcomes, and training contents in EPAS NC II and CES NC III are properly sequenced and interconnected.

The results may help trainers identify areas where instructional strategies, learning activities, and assessment methods need improvement. For example, trainers may recognize the need to strengthen advanced troubleshooting skills, digital competencies, and practical applications that are essential in modern electronics servicing. The findings may also encourage trainers to adopt more innovative teaching methods, workplace simulations, and industry-based learning experiences to improve trainee performance and employability.

Additionally, the study may support trainers in aligning their teaching practices with TESDA standards and industry expectations. This may improve the effectiveness of competency-based training delivery and ensure that trainees acquire not only technical competencies but also employability skills such as teamwork, adaptability, discipline, and communication.

TESDA Administrators and Supervisors. TESDA administrators, supervisors, and regional training center officials may use the findings of the study as a basis for evaluating and improving the implementation of electronics-sector qualifications. The study provides empirical evidence regarding the effectiveness and relevance of EPAS NC II and CES NC III in preparing trainees for employment and career progression.

The findings may help TESDA administrators identify competency gaps, curriculum redundancies, and areas that require enhancement or revision in the Training Regulations (TRs). This is especially important because rapid technological advancements in the electronics industry require continuous updating of training contents, assessment standards, and learning methodologies.

Moreover, the study may assist TESDA in strengthening its quality assurance mechanisms, competency assessment systems, and industry partnerships. It may also support the agency's mission of producing highly skilled and globally competitive Filipino workers by ensuring that qualifications remain aligned with labor market needs and international standards.

The study may further contribute to the development of more responsive training policies, improved trainer development programs, and better resource allocation for equipment, facilities, and instructional materials in the electronics sector.

Training Regulation Developers. The study is also significant to Training Regulation developers, curriculum designers, and policymakers involved in technical-vocational education and workforce development. The findings emphasize the importance of vertical articulation in curriculum development and qualification design.

Through the results of the study, policymakers may better understand how competency standards from lower qualifications can be effectively connected to higher qualifications to ensure the smooth progression of learning. The study may provide valuable recommendations for improving competency mapping, learning pathways, and qualification frameworks within TESDA.

In addition, the findings may encourage policymakers to integrate emerging industry trends, digital technologies, automation, and advanced electronics competencies into future revisions of Training Regulations. This may help ensure that TESDA qualifications remain responsive to current and future workforce demands.

The study may also support the development of policies that promote stronger collaboration between TESDA, industries, educational institutions, and labor organizations to improve curriculum relevance, graduate employability, and workforce readiness.

Employers and Industry Partners. Employers and industry partners may benefit significantly from the study because it evaluates whether TESDA graduates possess the competencies, attitudes, and work behaviors required in the workplace. The findings may provide industries with insights into the strengths and weaknesses of graduates from EPAS NC II and CES NC III programs.

The study may help employers identify whether graduates are adequately prepared in areas such as electronics troubleshooting, equipment servicing, workplace safety, communication, teamwork, and adaptability. It may also reveal the extent to which TESDA qualifications address actual industry requirements and technological advancements.

Furthermore, the study may strengthen collaboration between TESDA and industry stakeholders by encouraging employers to participate in curriculum enhancement, training delivery, competency assessment, and workplace immersion programs. Strong industry involvement may contribute to better alignment between training and employment opportunities.

Ultimately, industries may benefit from having access to a more competent, skilled, and employable workforce capable of supporting productivity, innovation, and competitiveness in the electronics sector.

The Electronics Industry. The electronics industry itself may benefit from the study through the development of a more qualified and industry-ready workforce. Since the electronics sector is one of the major contributors to economic growth, manufacturing, and technological innovation, the availability of competent workers is essential for sustaining industrial competitiveness.

By identifying competency gaps and mismatches between training and employment, the study may contribute to improving workforce development strategies in the electronics industry. Enhanced training programs and vertically articulated qualifications may help industries reduce training costs, improve employee performance, and increase operational efficiency.

The findings may also support technological advancement within the sector by ensuring that workers possess updated technical competencies aligned with modern electronics systems, digital technologies, automation, and emerging industry practices.

Educational Institutions and the TVET Sector. The study contributes to the broader field of technical-vocational education and training (TVET) in the Philippines. Educational institutions, training centers, and TVET providers may use the findings to improve curriculum alignment, competency standards, and instructional delivery.

The study may also serve as a model for evaluating vertical articulation and employability outcomes in other TESDA qualifications and industry sectors. It reinforces the importance of competency-based education, industry relevance, and continuous curriculum improvement in strengthening the Philippine TVET system.

Moreover, the findings may support educational reforms aimed at integrating education, skills training, and employment more effectively within the trifocalized education system composed of TESDA, the Department of Education (DepEd), and the Commission on Higher Education (CHED).

Future Researchers. Future researchers may use this study as a reference for conducting related studies on vertical articulation, employability, competency-based training, curriculum alignment, and labor market relevance. The findings may provide baseline data and theoretical insights for comparative studies involving other TESDA qualifications, industries, or regions.

Researchers may also expand the study by exploring additional variables such as technological adaptation, digital skills integration, industry certification standards, and long-term career outcomes of TESDA graduates. The study may therefore contribute to the continuous development of knowledge and research in the field of TVET.

Society and National Development. On a broader level, the study contributes to national development by supporting the government's goal of producing a highly skilled, globally competitive, and employable Filipino workforce. By improving the quality, alignment, and relevance of TESDA qualifications, the study may help address unemployment, underemployment, and skills mismatch in the country.

The findings may contribute to strengthening human capital development, increasing productivity, and supporting economic growth in the Philippines. Improved workforce competencies may also enhance the country's competitiveness in the global labor market and attract more investments in the electronics and manufacturing sectors.

Ultimately, the study supports the vision of developing a responsive and sustainable technical-vocational education system that empowers individuals, strengthens industries, and contributes to inclusive national progress

Scope and Delimitation of the Study

The study focused on the analysis of the TESDA national certification program in the electronics sector, specifically EPAS NC II and CES NC III, involving 25 trainees who have undergone training and assessment for both qualifications at TESDA Regional Training Center, Central Luzon, Mariveles in 2019, 25 trainers in the electronics sector, and 25 current employers of said trainees.

The existing training regulations of EPAS NC II and CES NC III will serve as the basis for analyzing vertical articulation.

The delimitation of this study is the inability to generalize the data to a larger population since the data will be obtained from the 25 trainees who have undergone training and assessment for both Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III in 2019, 25 trainers, and 25 employers. The correspondents' perceptions may not agree with the perceptions of other trainees in other districts.

Notes in Chapter I

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CHAPTER II

THEORETICAL FRAMEWORK

Relevant Theories

The study is anchored on three interrelated theories that explain the importance of competency development, meaningful learning experiences, and industry-aligned training in technical-vocational education. These theories provide a framework for understanding how vertically articulated TESDA qualifications, particularly Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III, contribute to trainees' competency development, employability, and workforce readiness. Human Capital Theory emphasizes the value of education and skills training as investments that enhance productivity and labor market competitiveness. Constructivist Theory explains how learners acquire knowledge through active engagement, hands-on experiences, and real-world application of skills. Meanwhile, Competency-Based Education and Training (CBET) Theory highlights the importance of mastery of industry-defined competencies and outcomes-based learning. Together, these theories support the study's examination of the vertical articulation, relevance, and effectiveness of TESDA electronics qualifications in preparing trainees for the demands of the modern electronics industry.

Human Capital Theory, originally developed by Theodore Schultz and Gary Becker, posits that education, training, and skills development are forms of investment that increase an individual's productivity, employability, and economic value. According to Becker (as cited in OECD, 2021), individuals who acquire education and specialized training gain competencies that improve their performance in the labor market, resulting in higher income potential, greater employment opportunities, and increased contribution to economic growth.

In the context of technical-vocational education and training (TVET), Human Capital Theory emphasizes that investments in skills training enhance workforce quality and strengthen industrial productivity. Recent studies in TVET suggest that technical skills development significantly improves labor market participation, employability, and occupational mobility, particularly in middle-skilled industries such as electronics, manufacturing, and information technology. Workers equipped with industry-relevant competencies are more likely to secure stable employment, adapt to technological advancements, and contribute effectively to organizational performance.

This theory supports the assumption of the present study that vertically articulated TESDA qualifications, such as EPAS NC II and CES NC III, improve the employability and productivity of trainees by progressively developing their technical competencies. Through structured competency progression, trainees gain deeper knowledge, practical expertise, and higher-level skills required in the electronics industry. Consequently, vertically aligned qualifications may increase graduates' labor market value and strengthen their competitiveness both locally and internationally.

Furthermore, Human Capital Theory reinforces the importance of continuous learning and lifelong skills development. As technology rapidly evolves in the electronics sector, workers are expected to continuously upgrade their competencies to remain relevant in the workforce. This principle highlights the significance of properly articulated training regulations that allow learners to transition smoothly from one qualification level to another.

In addition to Human Capital Theory, Constructivist Theory, associated with the works of Jean Piaget, Lev Vygotsky, and Jerome Bruner, explains that learning occurs when individuals actively construct knowledge and meaning based on their experiences, prior knowledge, and interactions with their environment. Rather than passively receiving information, learners actively participate in the learning process through exploration, collaboration, problem-solving, and reflection.

Constructivism emphasizes that meaningful learning happens when learners are engaged in authentic and practical experiences that allow them to connect theoretical concepts with real-world applications. In technical-vocational education, this theory is highly relevant because TVET programs focus heavily on hands-on training, practical demonstrations, simulations, and workplace-based learning experiences.

Within the TESDA framework, trainees in EPAS NC II and CES NC III are expected to learn through actual performance of tasks such as electronics assembly, troubleshooting, diagnostics, and servicing. Constructivist Theory supports the idea that competencies are best developed when learners actively perform industry-based activities and apply their skills in realistic workplace situations. Through repeated practice, collaboration with trainers and peers, and exposure to real-world problems, trainees gradually construct deeper understanding and mastery of competencies.

Moreover, Constructivist Theory emphasizes scaffolding and progressive learning, where prior knowledge serves as the foundation for acquiring more advanced competencies. This principle directly relates to the concept of vertical articulation examined in the study. The competencies learned in EPAS NC II should provide foundational knowledge and skills that support the development of more advanced competencies in CES NC III. If competencies are properly sequenced and connected, learners can progressively build their expertise and confidence as they move to higher qualification levels.

The theory also highlights the importance of learner-centered approaches in competency-based training. Trainers are expected to act not only as instructors but also as facilitators who guide trainees in problem-solving, critical thinking, and independent learning. In the electronics sector, where technology and equipment continuously evolve, constructivist learning approaches help trainees become adaptive, innovative, and capable of addressing complex workplace challenges.

Thus, Constructivist Theory supports the study by explaining how vertically articulated and competency-based TESDA qualifications facilitate meaningful learning experiences that contribute to competency mastery, employability, and career development.

Lastly, Competency-Based Education and Training (CBET) is one of the most widely adopted frameworks in technical-vocational education and is officially implemented by TESDA. CBET focuses on the acquisition and demonstration of clearly defined competencies that are aligned with industry standards and workplace expectations. Unlike traditional education models that emphasize time spent in training, CBET measures learning outcomes based on actual performance and mastery of required skills.

According to UNESCO and the International Labour Organization (ILO, 2020), competency-based education ensures that learners acquire job-ready competencies directly relevant to occupational tasks and labor market requirements. Learners progress after demonstrating mastery of competencies through practical assessment, workplace simulation, or actual performance evaluation.

In the context of TESDA qualifications, EPAS NC II and CES NC III are designed using the competency-based framework. Each qualification contains specific units of competency that trainees must master before certification. This framework ensures that graduates possess measurable technical skills required in the electronics sector.

CBET is highly relevant to the present study because it provides the foundation for evaluating the vertical articulation between EPAS NC II and CES NC III. The study examines whether competencies learned at the NC II level logically progress into more advanced and specialized competencies at the NC III level. Proper vertical articulation within a CBET framework ensures continuity of learning, competency progression, and reduced duplication of training content.

Furthermore, CBET emphasizes learner-centered instruction, industry participation, and outcomes-based assessment. This approach supports the development of both technical competencies and employability skills such as communication, teamwork, adaptability, and problem-solving. Since employers increasingly demand workers who possess both technical expertise and workplace skills, CBET contributes significantly to improving graduate employability and workforce readiness.

The framework also highlights the importance of industry validation and continuous curriculum improvement. Competency standards must be regularly reviewed to ensure alignment with technological advancements and workplace practices. This principle reinforces the study's objective of assessing whether existing TESDA training regulations remain relevant and responsive to the needs of the electronics industry.

The three theories Human Capital Theory, Constructivist Theory, and Competency-Based Education and Training (CBET) Theory—collectively provide a strong theoretical foundation for understanding the role of vertically articulated TESDA qualifications in improving trainee competency, employability, and workforce readiness in the electronics sector.

Human Capital Theory explains that education and technical training are valuable investments that increase an individual's productivity, employability, and economic contribution. The theory emphasizes that learners who acquire industry-relevant competencies become more competitive in the labor market and are better prepared to adapt to technological advancements. In the context of the study, the vertical articulation between EPAS NC II and CES NC III supports continuous skills development, enabling trainees to progressively enhance their competencies and increase their labor market value.

Constructivist Theory complements this perspective by emphasizing that meaningful learning occurs through active participation, hands-on experiences, and real-world application of knowledge. The theory highlights that learners develop deeper understanding when they engage in practical problem-solving, collaboration, and workplace-based tasks. In TESDA training programs, trainees learn competencies through actual electronics assembly, troubleshooting, diagnostics, and servicing activities. The theory also supports the importance of scaffolding, where foundational competencies acquired in EPAS NC II serve as the basis for mastering the more advanced competencies in CES NC III.

Meanwhile, Competency-Based Education and Training (CBET) Theory provides the operational framework for the study. CBET focuses on the mastery and demonstration of clearly defined competencies aligned with industry standards. It ensures that training programs are outcomes-based, learner-centered, and directly connected to workplace requirements. Within the TESDA system, EPAS NC II and CES NC III are structured according to competency standards that require trainees to demonstrate actual performance before certification. The theory further emphasizes vertical progression, curriculum alignment, industry validation, and continuous updating of competencies to ensure relevance to evolving technologies and labor market demands.

Taken together, these theories explain that effective technical-vocational education requires three interconnected elements: continuous investment in skills development (Human Capital Theory), meaningful and experiential learning processes (Constructivist Theory), and competency-based, industry-aligned training systems (CBET Theory). The integration of these theories supports the study’s premise that properly articulated TESDA qualifications can strengthen competency development, improve employability, and enhance workforce preparedness in the rapidly evolving electronics industry.

Related Literature

History of TESDA

The Technical Education and Skills Development Authority (TESDA) was created through the enactment of Republic Act No. 7796, otherwise known as the "Technical Education and Skills Development Act of 1994," which was signed into law by then President Fidel V. Ramos on August 25, 1994. This Act aimed to encourage the full participation of and mobilize the industry, labor, local government units, and technical-vocational institutions in the skills development of the country's human resources.

Various organizations under different government agencies decided to unify their resources to successfully attain their primary goal. Eventually, the merging of the National Manpower and Youth Council (NMYC) of the Department of Labor and Employment (DOLE), the Bureau of Technical and Vocational Education (BTVE) of the Department of Education, Culture and Sports (DECS), and the Apprenticeship Program of the Bureau of Local Employment (BLE) of the DOLE gave birth to TESDA.

The union of the above offices was one of the key recommendations of the 1991 Report of the Congressional Commission on Education, which undertook a national review of the state of Philippine education and manpower development. It was meant to reduce overlapping in skills development activities initiated by various public and private sector agencies and to provide national directions for the country's technical-vocational education and training (TVET) system. Hence, a major thrust of TESDA was the formulation of a comprehensive development plan for middle-level manpower based on the National Technical Education and Skills Development Plan. This plan provided for a reformed industry-based training program that includes apprenticeship, a dual training system, and other similar schemes (TESDA, 2021).

The Technical Education and Skills Development Authority (TESDA) continues to serve as the Philippines' primary agency for technical-vocational education under Republic Act No. 7796. From 2020 onward, TESDA intensified reforms focusing on industry-driven standards, digitalization, flexible learning delivery, and ladderized qualifications.

The National Technical Education and Skills Development Plan (NTESDP) 2023–2028 emphasizes employability, lifelong learning, and strong industry partnerships. It reinforces vertical articulation through stackable qualifications and pathways that allow learners to progress from NC II to higher certifications such as NC III and NC IV (TESDA, 2023).

Profiling of Respondents

Age. Age is one of the most consistently examined demographic factors in Technical and Vocational Education and Training (TVET) because it significantly influences participation, learning behavior, skill acquisition, and employability outcomes. According to the Organization for Economic Co-operation and Development (OECD, 2022) and the International Labour Organization (ILO, 2021), age affects not only the ability of learners to adapt to technical instruction but also their readiness to transition into the labor market after training. In the context of electronics-related programs, where technology evolves rapidly, age becomes an important consideration in determining how trainees respond to competency-based instruction, digital tools, and workplace requirements.

To begin with, younger learners, particularly those between 18 and 25 years old, are often more receptive to emerging technologies and digital learning environments. According to OECD (2022), younger trainees generally demonstrate stronger adaptability to technology-enhanced learning systems, online simulations, and software-driven instruction. Similarly, Smith and Anderson (2023) emphasized that younger learners are more likely to engage actively with digital platforms because they have grown up in technology-oriented environments. In electronics training, this adaptability becomes highly valuable because many competencies now involve digital schematics, automated diagnostic systems, programmable devices, and computer-assisted troubleshooting. Consequently, younger trainees tend to acquire technological competencies more quickly, especially when training methods involve blended learning and simulation-based instruction.

On the other hand, older learners bring a different but equally important advantage to TVET environments. According to Generalao et al. (2025), adult learners aged 35 years and above often possess prior workplace exposure and experiential knowledge that help them connect theoretical instruction with practical application. In electronics servicing, older trainees may already have informal experience in repair work, machine maintenance, or electrical troubleshooting, which allows them to better contextualize new learning. Furthermore, Rodriguez and Kumar (2023) noted that mature learners frequently demonstrate stronger discipline, persistence, and task responsibility compared to younger trainees. However, the same study also explained that older learners may experience difficulties in adjusting to highly digitalized instructional methods, especially when exposed to complex software systems without sufficient guidance or scaffolding. This suggests that while older learners benefit from experience, they may require more structured support when introduced to advanced technologies.

Moreover, Philippine-based studies reinforce the importance of age in determining employment outcomes after TVET participation. Generalao et al. (2025) found that TVET participation improves labor force engagement across all age groups; however, adults between 30 and 45 years old showed more stable employment outcomes compared to younger graduates. The researchers attributed this trend to a combination of prior work experience, maturity, and stronger professional networks that support employment transition. In support of this finding, the Technical Education and Skills Development Authority (TESDA, 2024) Study on Employment of TVET Graduates (SETG) reported that trainees aged 36–50 exhibited relatively higher employment rates in technical occupations such as electronics and servicing. These findings imply that age-related advantages differ depending on industry context: younger trainees may excel in technological adaptation, whereas older learners may perform better in practical decision-making and workplace stability.

In addition, international organizations emphasize the need for age-responsive TVET systems. The United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2021) recommends the implementation of flexible and inclusive training strategies that accommodate learners across different age brackets. Such strategies include modular learning, flexible schedules, refresher programs, and bridging courses that support lifelong learning. For older learners, digital literacy training and guided technological orientation may be necessary, while younger learners may benefit more from workplace immersion, mentorship, and apprenticeship programs that strengthen practical exposure.

Furthermore, the World Economic Forum Future of Jobs Report (2023) emphasized that age increasingly interacts with technological transformation in determining employability. As industries continue integrating automation, artificial intelligence, and advanced diagnostic systems into production and servicing processes, the ability to continuously learn and adapt becomes essential regardless of age. Therefore, TVET institutions must design training programs that recognize the strengths and limitations of different age groups while ensuring that all learners acquire relevant and industry-responsive competencies.

Overall, the literature strongly suggests that age is more than a simple demographic characteristic. Rather, it functions as a significant mediating factor that influences how learners participate in training, absorb technical competencies, and transition into employment. In electronics-related TESDA qualifications such as EPAS NC II and CES NC III, understanding age-related learning differences is essential for designing vertically articulated and industry-responsive training programs that support employability across diverse learner populations.

Sex. Sex or gender is another important demographic variable that significantly influences participation, access, learning experiences, and employment outcomes in Technical and Vocational Education and Training (TVET). Although TVET programs are designed to provide equal opportunities for all learners, numerous studies reveal that gender-related social expectations, cultural norms, and institutional barriers continue to shape participation patterns, especially in highly technical and male-dominated sectors such as electronics and information technology (Emah et al., 2025; Trasmonte & Fajardo, 2023).

Globally, technical and industrial programs continue to be dominated by male learners, while female learners are more frequently enrolled in service-oriented vocational tracks such as caregiving, hospitality, and office administration. According to UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training (2025), women remain underrepresented in science, technology, engineering, and mathematics (STEM)-related TVET programs despite increased policy efforts toward gender inclusion. In the Philippine setting, Trasmonte and Fajardo (2023) observed that although female participation in TVET has gradually improved over the years, enrollment in electronics and engineering-related qualifications remains predominantly male. The researchers explained that cultural perceptions regarding "appropriate" occupations for men and women continue to influence career decisions among students and families.

Furthermore, societal expectations and household responsibilities often affect women's participation in technical training. According to Emah et al. (2025), women in TVET environments frequently encounter barriers such as limited access to technical equipment, lack of mentorship, and reduced confidence in handling complex machinery. While the study was conducted in Nigeria, the findings remain relevant in the Philippine context because electronics servicing programs similarly operate within traditionally male-oriented learning environments. Such barriers may discourage female learners from pursuing or completing technical qualifications even when opportunities are available.

In addition, research indicates that sex influences not only access to training but also the manner in which learners develop competencies. Trasmonte and Fajardo (2023) as well as Awodiji (2024) found that female learners sometimes report lower self-confidence in operating technical tools and digital systems despite receiving similar instructional exposure as male learners. This confidence gap may affect participation, persistence, and performance during competency assessments. In electronics-related training, where troubleshooting, diagnostics, and equipment handling are essential, confidence plays a crucial role in competency demonstration and workplace readiness.

Nevertheless, several studies emphasize that sex disparities can be reduced through gender-responsive pedagogy and inclusive learning environments. UNESCO-UNEVOC (2025) recommends interventions such as mentorship programs, equitable access to equipment, collaborative learning activities, and exposure to female role models in technical industries. These approaches encourage female participation and create more supportive learning conditions. In electronics programs specifically, strategies such as mixed-gender teamwork, industry immersion opportunities, and female-led technical demonstrations can strengthen learners' confidence and engagement.

Moreover, labor market outcomes are also shaped by gender dynamics. Even when women possess competencies equal to those of male graduates, employer biases and workplace stereotypes may limit their employment opportunities in technical occupations. According to studies published in Elsevier ScienceDirect (2025), women in technical fields may encounter discrimination related to hiring, promotion, and workplace assignments. Consequently, gender-sensitive employment policies and inclusive workplace cultures are necessary to ensure equal opportunities for certified TVET graduates.

Interestingly, emerging studies also reveal that women who obtain specialized technical training or micro-credentials in high-demand sectors often demonstrate strong employability outcomes. ScienceDirect (2025) reported that targeted competency-based certifications enable female graduates to compete effectively in technologically advanced occupations because employers increasingly value demonstrated competencies over traditional gender stereotypes. This finding suggests that micro-credentialing and competency validation may serve as important mechanisms for improving gender inclusivity in electronics and ICT sectors.

Overall, the literature establishes that sex is a significant factor affecting participation, competency acquisition, and employability in TVET. Gender disparities in electronics-related training programs continue to exist due to social, cultural, and institutional influences. However, inclusive instructional practices, supportive learning environments, and competency-based certification systems can help reduce these gaps and promote equal opportunities for all learners within the TESDA national certification framework.

Educational Background. Educational background is widely recognized as one of the strongest predictors of success in Technical and Vocational Education and Training (TVET), particularly in technology-intensive sectors such as electronics. Researchers consistently argue that prior educational attainment affects learners' comprehension of technical concepts, adaptability to competency-based instruction, and overall employability outcomes (Generalao et al., 2025; Cedefop, 2020). Learners who possess stronger academic foundations are generally better prepared to understand complex technical content and perform industry-related tasks effectively.

To begin with, learners with higher levels of formal education tend to demonstrate stronger literacy, numeracy, and analytical skills, which are essential in electronics training. According to Generalao et al.

(2025), TVET graduates with secondary or tertiary education backgrounds exhibit significantly better employment outcomes compared to individuals with limited formal schooling. The researchers explained that foundational competencies acquired through formal education, particularly in mathematics, science, and communication, enable learners to process technical information more effectively. In electronics servicing, for instance, understanding electrical formulas, interpreting diagrams, and performing diagnostics requires cognitive skills that are strengthened through prior education.

Similarly, the European Centre for the Development of Vocational Training (Cedefop, 2020) emphasized that learners with higher educational attainment transition more easily into employment because they are able to combine technical competencies with transferable skills such as communication, teamwork, and critical thinking. The organization further noted that competency assessment performance is often higher among learners who possess adequate academic preparation, especially in areas requiring digital literacy and problem-solving abilities.

Moreover, the rapid integration of Industry 4.0 technologies into the electronics sector has further increased the importance of an educational background. According to the OECD (2022), learners with stronger academic foundations adapt more efficiently to emerging technologies such as programmable logic controllers (PLCs), automated systems, robotics, and sensor-based technologies. These learners are also more likely to pursue advanced certifications and micro-credentialing opportunities because they possess the cognitive readiness necessary for continuous learning and specialization.

In the Philippine TVET system, TESDA has acknowledged the importance of educational readiness by implementing bridging programs and remedial interventions for learners with weaker academic foundations. These initiatives include digital literacy training, pre-technical mathematics modules, and foundational problem-solving workshops designed to help trainees cope with technical instruction. Such interventions are particularly important in electronics qualifications because trainees are expected to interpret schematics, perform diagnostics, and operate technology-based equipment.

Furthermore, educational background significantly influences employability outcomes after training completion. UNESCO-UNEVOC (2021) explained that learners with higher educational attainment are more likely to obtain employment aligned with their vocational qualifications because employers often associate formal education with adaptability and workplace readiness. The organization also stressed the importance of integrating academic and vocational learning to ensure that graduates develop both theoretical understanding and practical competence.

Additionally, work-based learning opportunities such as apprenticeships and industry immersion programs become more effective when learners possess sufficient educational preparation. Learners with stronger academic skills tend to absorb workplace instruction more efficiently and demonstrate greater confidence during practical tasks. Consequently, educational background serves not only as a predictor of learning performance but also as a factor influencing long-term career progression and adaptability within rapidly changing industries.

In summary, the literature strongly supports the view that educational background plays a crucial role in competency development and employability within TVET programs. Strong academic foundations enhance learners' ability to understand technical concepts, adapt to advanced technologies, and succeed in competency-based assessments. In electronics-related TESDA qualifications, educational background therefore becomes an important factor in determining learners' readiness for vertically articulated training and industry-responsive employment opportunities.

Work Experience. Work experience is considered one of the most influential factors affecting competency acquisition, workplace readiness, and employability in Technical and Vocational Education and Training (TVET). In vocational and technical fields such as electronics, work experience allows learners to bridge the gap between theoretical instruction and practical application by exposing them to real workplace environments and industry practices.

According to Bascon et al. (2026), TVET graduates without prior work exposure often experience difficulty translating classroom knowledge into actual workplace performance. The study found that trainees who lacked internships, apprenticeships, or hands-on industrial exposure struggled particularly in technical areas such as electronics servicing, systems troubleshooting, and equipment diagnostics. Conversely, learners who participated in structured workplace immersion demonstrated stronger competency performance and greater confidence in handling technical tasks.

Similarly, Giotis (2025) emphasized that experiential learning significantly enhances both technical and digital competencies. Through practical exposure, trainees develop familiarity with workplace tools, automated systems, diagnostic software, and industrial procedures. In electronics-related occupations, this includes competencies such as PCB assembly, circuit testing, machine calibration, automation maintenance, and fault diagnostics. The study further highlighted that work experience not only strengthens technical abilities but also improves soft skills such as teamwork, communication, adaptability, and problem-solving, all of which are essential for long-term employability.

Furthermore, employers consistently prioritize applicants with relevant work experience because practical exposure signals job readiness and reliability. According to the World Economic Forum (2023), employers increasingly value applied competencies and workplace adaptability over purely academic credentials. Graduates who have experienced actual industry settings are perceived as more capable of handling workplace pressures, collaborating with teams, and adjusting to organizational systems. This trend highlights the growing importance of integrating work-based learning within TVET programs.

In support of this perspective, Cedefop (2021) explained that apprenticeships, cooperative training, and industry immersion programs effectively bridge the divide between classroom instruction and workplace expectations. These experiences allow learners to apply competencies in real-world settings while simultaneously fulfilling certification requirements. In the electronics sector, work-based learning helps trainees improve their proficiency in assembly operations, diagnostics, maintenance procedures, and automation systems, all of which are critical competencies in modern technical occupations.

Moreover, the mechanisms through which work experience enhances employability are interconnected and multifaceted. First, applied practice reinforces theoretical knowledge because learners are able to perform actual tasks related to their specialization. Hands-on exposure strengthens understanding and allows trainees to internalize technical procedures more effectively. Second, competency validation through practical assessment and national certification provides evidence of industry-standard skills, thereby improving employment opportunities. Third, workplace exposure contributes significantly to the development of soft skills such as communication, adaptability, teamwork, and work ethics, which employers consistently identify as important indicators of employability. Finally, industry alignment ensures that training remains responsive to current labor market needs and technological developments, reducing the mismatch between acquired competencies and actual workplace requirements.

Additionally, recent studies suggest that micro-credentialing can further strengthen the value of work experience by validating specific technical competencies acquired through applied learning. Specialized micro-credentials in areas such as digital diagnostics, automation maintenance, PCB assembly, and electronics troubleshooting provide measurable evidence of industry-relevant skills. These certifications enhance employability because they allow employers to identify specific competencies possessed by graduates beyond general national certification levels.

Overall, the literature confirms that work experience is a critical determinant of competency development and labor market success in TVET. Through internships, apprenticeships, and industry immersion, trainees gain practical knowledge, strengthen workplace skills, and improve employability outcomes. In the context of TESDA electronics qualifications, such as EPAS NC II and CES NC III, integrating structured work-based learning and micro-credentialing pathways can significantly improve the alignment between training outcomes and industry expectations.

Related Studies

Age

Age has consistently emerged as one of the most influential demographic variables in Technical and Vocational Education and Training (TVET) because it affects learners' participation, adaptability, competency acquisition, and transition into employment. In technology-oriented sectors such as electronics, age becomes even more important because training programs increasingly require digital literacy, analytical thinking, and continuous adaptation to technological advancements. Several empirical studies have examined how age shapes learners' experiences and employment outcomes within TVET systems.

According to the TESDA Study on the Employment of TVET Graduates (SETG), employment outcomes differ significantly across age groups. The report revealed that adult learners and mature trainees generally exhibit more stable employment patterns after completing technical-vocational programs. The study explained that older learners often possess prior workplace exposure, stronger work ethics, and greater task responsibility, which employers highly value in technical occupations. In electronics-related fields, employers tend to appreciate mature workers because they demonstrate discipline, reliability, and practical decision-making skills in servicing and troubleshooting activities. The SETG further noted that mature trainees are more likely to remain employed for longer periods compared to younger graduates because they already possess workplace familiarity and professional maturity.

Similarly, Orbeta and Corpus's (2024) study on issues in Philippine TVET Responsiveness to Industry Demand examined how demographic factors influence TVET participation and labor market outcomes in the Philippines. Their study found that younger learners are generally more adaptable to digital learning platforms, simulations, and emerging technologies because they are more exposed to modern technological environments. This adaptability becomes particularly advantageous in electronics training, where learners must understand digital circuits, automated diagnostic systems, software-based troubleshooting, and computer-assisted servicing tools. However, the same study also emphasized that younger graduates often experience difficulty securing long-term employment due to limited practical experience and weaker professional networks. In contrast, adult learners may adapt more slowly to new technologies but compensate through practical workplace knowledge and stronger employment readiness.

In addition, Mariano and Tantoco's (2023) Assessment of Employability Skills of TVET Graduates conducted a tracer study among TVET graduates and observed that younger trainees demonstrated higher engagement with digital tools and technology-enhanced learning systems. According to the study, younger learners tend to adjust more easily to blended learning, virtual simulations, and computer-assisted instruction because they are more accustomed to digital environments. Nevertheless, the researchers also found that older trainees often demonstrate stronger persistence, commitment, and workplace responsibility, which positively influence employability and job retention. This finding suggests that age contributes differently to competency development and workplace readiness.

Furthermore, Pascual's (2024) Impact Assessment of TESDA TVET Programs on Employment Opportunities investigated the employment trajectories of TESDA graduates and reported that trainees aged 30 to 45 years old generally achieved more stable employment outcomes compared to younger graduates. The study explained that adult learners are often motivated by economic responsibilities and career advancement goals, which encourage stronger commitment to training and employment. Additionally, mature trainees frequently possess informal technical experience before enrolling in TVET programs, enabling them to connect theoretical instruction with real-world applications more effectively.

Moreover, international studies reinforce the importance of age-responsive TVET systems. The Organisation for Economic Co-operation and Development (OECD) emphasized that younger learners are more adaptable to emerging technologies and digital systems, whereas older learners benefit from experiential knowledge and practical understanding. Likewise, the International Labour Organization (ILO) stressed that age influences labor market integration because employers often associate maturity with responsibility and workplace discipline. Meanwhile, UNESCO (2021) TVET Regional Synthesis recommended the implementation of flexible and inclusive training approaches that accommodate learners across different age groups. These approaches include modular instruction, refresher courses, digital literacy enhancement, and workplace immersion opportunities that support lifelong learning.

Additionally, the World Economic Forum Future of Jobs Report 2023 explained that rapid technological transformation continuously reshapes labor market demands, particularly in electronics and automation sectors. The report emphasized that regardless of age, workers must continuously upgrade their competencies to remain employable in increasingly digitalized industries. Consequently, TVET institutions are encouraged to develop adaptive training systems that recognize the strengths and learning needs of both younger and older learners.

Synthesis on Age

The reviewed studies consistently establish that age significantly influences participation, learning adaptability, competency acquisition, and employability outcomes in TVET. Younger learners tend to demonstrate stronger digital adaptability and faster engagement with emerging technologies, making them highly responsive to technology-enhanced instruction. On the other hand, older learners contribute practical workplace knowledge, discipline, and stronger professional responsibility, which positively affect job retention and workplace performance. In electronics-related qualifications such as EPAS NC II and CES NC III, age becomes a critical factor because competencies increasingly require both technological adaptability and practical troubleshooting skills. Collectively, the studies suggest that age-responsive training strategies, scaffolded instruction, and flexible learning systems are essential in ensuring that trainees across different age groups acquire relevant competencies and successfully transition into sustainable employment.

Sex

Sex is another significant demographic variable examined in TVET research because it influences training participation, access to opportunities, competency development, and employment outcomes. Numerous studies reveal that technical and industrial TVET programs, particularly electronics and engineering-related qualifications, remain predominantly male-oriented despite ongoing efforts to promote gender inclusivity.

According to Trasmonte and Fajardo's (2023) Gender Nuances in TVET Skills Training, male learners continue to dominate technical-vocational programs such as electronics, welding, automotive servicing, and electrical installation. Their study found that female learners are more likely to enroll in service-oriented programs because societal expectations and traditional gender roles still influence career choices. The researchers further explained that many women perceive technical occupations as physically demanding or male-dominated, discouraging participation in electronics-related fields. These findings are highly relevant to the present study because EPAS NC II and CES NC III are qualifications situated within the traditionally male-oriented electronics sector.

Similarly, Orbeta and Corpus's (2024) Issues in Philippine TVET Responsiveness to Industry Demand observed that gender disparities remain evident in Philippine TVET participation. Their study emphasized that cultural stereotypes continue to shape learners' perceptions regarding "appropriate" occupations for men and women. In industrial sectors such as electronics and manufacturing, male trainees dominate because technical servicing roles are often associated with machine handling, repair work, and physically intensive activities. Consequently, female participation in electronics-related TVET programs remains limited despite increasing institutional efforts toward inclusivity.

In support of these findings, the TESDA Research and Employment Reports consistently indicate higher male enrollment and employment rates in electronics and engineering qualifications. TESDA reports reveal that males comprise the majority of graduates in electronics servicing programs, while female enrollment remains comparatively lower. However, the reports also suggest that female participation increases when institutions provide gender-sensitive environments, mentorship opportunities, and equal access to laboratory facilities and technical equipment.

Moreover, international studies emphasize that sex influences not only participation but also learners' confidence in performing technical competencies. According to the UNESCO-UNEVOC TVET Reports, women in STEM-related TVET programs often experience lower confidence in handling machinery and digital systems despite possessing equivalent academic abilities. The report explained that this confidence gap is largely caused by societal perceptions and limited female representation in technical industries. Nevertheless, the same report stressed that female learners perform equally well in technical competencies when given adequate support, mentorship, and inclusive classroom experiences.

Furthermore, studies in ASEAN TVET systems found that female trainees who receive targeted technical exposure and supportive learning environments demonstrate strong competency acquisition and employability outcomes. Employers increasingly recognize that women can perform technical servicing tasks effectively, particularly in precision-oriented and technology-based occupations. However, workplace stereotypes and employer biases continue to affect hiring opportunities in male-dominated industries such as electronics and engineering.

Synthesis on Sex

The reviewed studies consistently demonstrate that sex significantly affects participation, access, and employability within TVET programs. Male learners continue to dominate electronics and other technical qualifications because of societal expectations, occupational stereotypes, and traditional gender norms. Although female learners possess comparable technical potential and competency capabilities, structural and cultural barriers continue to limit their participation in electronics-related occupations. The findings highlight the need for gender-responsive policies, inclusive training environments, mentorship programs, and equitable access to technical resources to improve participation and employment opportunities for both male and female learners in the electronics sector.

Educational Background

Educational background is widely recognized as a major factor influencing competency acquisition, academic performance, training completion, and employability outcomes in Technical and Vocational Education and Training (TVET). In technology-intensive qualifications such as electronics servicing, learners' prior educational preparation significantly affects their ability to understand technical concepts, operate equipment, and adapt to rapidly evolving industry requirements. Several empirical studies have emphasized the relationship between educational attainment and successful participation in TVET programs.

According to Mariano and Tantoco's (2023) Assessment of Employability Skills of TVET Graduates, TVET graduates with higher educational attainment demonstrated stronger employability skills, communication abilities, and workplace readiness compared to those with limited academic backgrounds. The study found that learners who completed secondary or tertiary education adapted more effectively to competency-based instruction because they already possessed foundational literacy, numeracy, and analytical skills. In electronics servicing programs, these competencies are highly important because trainees are required to interpret schematics, understand technical manuals, analyze circuits, and apply troubleshooting procedures. The researchers emphasized that educational preparation strengthens learners' confidence in handling both theoretical and practical tasks.

Similarly, Pascual's (2024) Impact Assessment of TESDA TVET Programs on Employment Opportunities revealed that educational attainment positively affects employment outcomes among TESDA graduates. According to the study, graduates with stronger educational foundations were more likely to obtain employment aligned with their technical specialization and perform effectively in workplace settings. Pascual explained that educational background contributes to learners' ability to understand digital systems, follow technical procedures, and adapt to technological advancements in the workplace. Consequently, trainees with higher educational attainment often transition more smoothly into electronics-related occupations.

Moreover, Orbeta and Corpus's (2024) Issues in Philippine TVET Responsiveness to Industry Demand highlighted that individuals with limited educational attainment frequently encounter difficulties in completing TVET programs and obtaining quality employment. Their study emphasized that foundational competencies such as reading comprehension, mathematical reasoning, communication skills, and problem-solving are essential in competency-based training environments. Learners lacking these foundational skills often struggle to comprehend technical instructions, interpret diagrams, and complete competency assessments effectively. The study further noted that weak academic preparation may contribute to skills mismatch and limited employability, particularly in highly technical fields such as electronics.

In support of these findings, Fatokun and Gumbo's (2024) electrical and electronics technology education studies explained that learners enrolled in electrical and electronics technology programs require strong academic preparation in mathematics, science, and digital literacy to successfully understand automation systems, programmable devices, and advanced electronic circuits. Their study found that students with stronger educational backgrounds adapted more quickly to Industry 4.0 technologies and digitalized learning systems. Additionally, learners with prior exposure to computer applications and analytical problem-solving demonstrated stronger competency acquisition in diagnostics and troubleshooting tasks.

Furthermore, the Organisation for Economic Co-operation and Development (OECD) Skills Studies emphasized that educational attainment significantly influences labor market competitiveness and lifelong learning capacity. According to the OECD, individuals with stronger educational foundations are more capable of adapting to technological changes, pursuing advanced certifications, and engaging in continuous skills upgrading. This finding is particularly relevant to the electronics sector because technological innovations continuously reshape industry standards and workplace requirements.

Likewise, UNESCO-UNEVOC TVET Reports emphasized that integrating academic and vocational competencies strengthens learners' employability and labor market relevance. UNESCO stressed that technical qualifications should not only focus on practical skills but also reinforce foundational competencies such as communication, analytical reasoning, and digital literacy. This integration becomes increasingly important in electronics servicing because modern workplaces demand workers who can interpret technical data, operate computerized systems, and solve complex technical problems.

Synthesis on Educational Background

The reviewed studies consistently establish that educational background significantly affects learners' competency acquisition, training performance, and employability outcomes in TVET. Learners with stronger academic preparation demonstrate greater understanding of technical instruction, improved analytical abilities, and stronger adaptability to technology-driven environments. In electronics-related qualifications such as EPAS NC II and CES NC III, educational attainment becomes particularly important because technical servicing increasingly requires mathematical reasoning, digital literacy, and problem-solving competencies. Collectively, the studies suggest that strengthening foundational academic competencies and providing bridging or remedial instruction are essential strategies in supporting learners with varying educational backgrounds and improving their success in technical-vocational training.

Work Experience

Work experience has consistently been identified as one of the strongest predictors of competency development, employability, and workplace readiness in Technical and Vocational Education and Training

(TVET). Empirical studies emphasize that learners who engage in practical exposure, internships, apprenticeships, and enterprise-based training acquire stronger technical competencies and adapt more effectively to actual workplace demands. In electronics-related programs, work experience becomes especially critical because competencies involve hands-on servicing, diagnostics, troubleshooting, and equipment handling.

According to the TESDA Study on the Employment of TVET Graduates (SETG), enterprise-based training and industry-linked programs consistently produce higher employment rates compared to purely institution-based approaches. The report explained that trainees who participate in actual workplace exposure develop stronger technical confidence, workplace adaptability, and practical problem-solving abilities. In electronics servicing, work immersion enables learners to apply classroom knowledge to real servicing environments involving diagnostics, repairs, installations, and preventive maintenance. TESDA further reported that graduates with industry exposure transition more smoothly into employment because they already possess familiarity with workplace systems, tools, and professional expectations.

Similarly, Pascual's (2024) Impact Assessment of TESDA TVET Programs on Employment Opportunities found that graduates with prior work experience or structured on-the-job training demonstrated higher employability and faster labor market integration compared to those without practical exposure. The study emphasized that work experience allows trainees to strengthen technical proficiency, improve troubleshooting capabilities, and gain confidence in handling equipment and servicing tasks. Employers also perceived experienced trainees as more prepared and reliable in performing technical responsibilities.

Moreover, Mariano and Tantoco's (2023) Assessment of Employability Skills of TVET Graduates reported that employers highly value practical exposure and workplace experience among TVET graduates. Their study revealed that graduates who underwent internships or enterprise-based learning exhibited stronger communication skills, teamwork, workplace adaptability, and technical servicing competence. The researchers noted that technical knowledge alone is often insufficient if learners lack actual exposure to workplace situations and equipment handling.

Likewise, Orbeta and Corpus (2024) emphasized that weak industry engagement and limited workplace exposure contribute to skills mismatch among TVET graduates. Their study explained that learners who receive inadequate practical exposure often struggle to meet industry expectations despite possessing certification credentials. Consequently, the researchers recommended stronger collaboration between training institutions and industries to ensure that training content reflects actual workplace standards and technological requirements.

Furthermore, Billett (2022) demonstrated through international TVET research that apprenticeships, internships, and enterprise-based learning significantly improve employability outcomes and competency retention. According to Billett, workplace exposure allows learners to connect theoretical instruction with real-world applications while simultaneously developing professional behavior, communication skills, and industry awareness. These experiences strengthen graduates' ability to perform technical tasks independently and confidently.

Additionally, Fatokun and Gumbo's (2024) electrical and electronics technology education studies found that learners in electronics and electrical technology programs achieve stronger competency development when training includes actual equipment handling, diagnostics, and servicing simulations. The study highlighted that practical experience is essential in mastering advanced electronics competencies because learners must repeatedly apply troubleshooting procedures and servicing techniques to real or simulated workplace conditions.

Synthesis on Work Experience

The reviewed studies strongly establish that work experience significantly enhances competency acquisition, technical proficiency, workplace adaptability, and employability among TVET graduates. Learners who participate in internships, apprenticeships, and enterprise-based training demonstrate stronger confidence, better troubleshooting skills, and greater readiness for employment. In electronics-related qualifications such as EPAS NC II and CES NC III, practical exposure becomes especially important because competencies require actual equipment handling, diagnostics, servicing, and application of technical knowledge in real workplace environments. Collectively, the studies suggest that strengthening industry partnerships and integrating structured work-based learning opportunities are essential strategies in improving the effectiveness and relevance of electronics-related TVET programs.

Relevance of the National Certification Program for the Electronics Sector (EPAS NC II and CES NC III)

The relevance of TESDA National Certification programs in the electronics sector has become increasingly important due to rapid technological advancements, globalization, automation, and changing industry demands. Several empirical studies have examined the effectiveness, alignment, and employability outcomes of electronics-related qualifications such as Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III. These studies provide valuable insights into how national certifications contribute to workforce readiness, competency development, and labor market alignment.

According to the TESDA Training Regulations and SETG Reports, national certifications in electronics servicing remain highly relevant because they provide industry-recognized competencies that support employment in electronics manufacturing, servicing, diagnostics, and maintenance. TESDA reported that graduates possessing electronics-related certifications demonstrate stronger employability outcomes compared to individuals without formal competency recognition. The reports further emphasized that competency-based certifications improve employers' confidence because certified graduates have undergone standardized assessment procedures aligned with national industry standards.

Similarly, Valenzuela et al. (2023) – TVET Transitions in Electronics and Manufacturing Industries examined the labor market outcomes of graduates in electronics and manufacturing programs and found that learners with specialized and industry-aligned certifications achieved faster employment placement and longer job retention. Their study revealed that electronics qualifications focusing on diagnostics, servicing, and digital systems were particularly valuable because industries increasingly demand workers capable of operating and maintaining automated and technology-driven systems. The researchers also noted that certification specificity contributes significantly to employability, suggesting that focused qualifications such as EPAS NC II and CES NC III provide clearer competency signaling to employers.

Moreover, Rivera and Molina's (2022) Vertical Articulation in Philippine TVET Programs investigated the progression of competencies across TVET qualification levels and identified gaps between foundational and advanced certifications. Their study revealed that learners often experience difficulty transitioning from basic servicing competencies toward advanced diagnostics and troubleshooting tasks because of weak curriculum articulation. In the context of EPAS NC II and CES NC III, the researchers observed that foundational competencies in assembly and servicing are not always adequately scaffolded toward the advanced competencies required for higher-level diagnostics and repair procedures. This finding highlights the need for stronger vertical articulation between qualification levels.

Likewise, Nguyen et al.'s (2024) Vertical Progression in Electro-Technical Qualifications Across ASEAN found that competency gaps in electronics qualifications frequently result from misalignment between curriculum standards, assessment methods, and industry expectations. Their comparative study across ASEAN TVET systems emphasized that successful vertical articulation requires progressive sequencing of competencies, industry participation in curriculum development, and scaffolded learning support. The study strongly supports the importance of aligning EPAS NC II and CES NC III competencies to ensure continuity in learning and employability progression.

Furthermore, Haque and Islam's (2025) Competency Transition Challenges in TVET Programs documented that learners who lack structured competency progression often struggle with advanced technical assessments and workplace performance. Their research found that technical qualifications become more effective when competency standards are clearly sequenced from foundational to advanced levels. This finding is directly relevant to the current study because CES NC III requires higher-order diagnostics and troubleshooting skills that should logically build upon competencies developed in EPAS NC II.

Additionally, ADB's (2022) TVET Systems and Labor Market Alignment emphasized that national certification programs remain relevant only when competencies continuously align with current industry technologies and labor market demands. The report stressed that electronics-related programs must regularly integrate emerging technologies such as automation, programmable devices, IoT systems, and digital diagnostics to remain responsive to industry needs. Without continuous curriculum updating and competency enhancement, certifications risk becoming outdated and less valuable to employers.

Synthesis on the Relevance of EPAS NC II and CES NC III

The reviewed studies consistently demonstrate that TESDA national certifications in the electronics sector remain highly relevant because they provide industry-recognized competencies that support employability and workforce readiness. However, the studies also reveal challenges related to vertical articulation, curriculum sequencing, and alignment with emerging technologies. EPAS NC II effectively provides foundational competencies in assembly and servicing, while CES NC III focuses on advanced diagnostics and troubleshooting skills. Nevertheless, several studies indicate that competency progression between the two qualifications requires stronger alignment and scaffolded learning support to ensure continuity in technical skill development. Collectively, the findings suggest that enhancing curriculum integration, strengthening industry collaboration, and incorporating emerging technologies are essential strategies in improving the relevance, effectiveness, and employability outcomes of EPAS NC II and CES NC III qualifications.

Synthesis of Studies

The reviewed studies collectively emphasize that demographic and experiential factors such as age, sex, educational background, and work experience significantly influence participation, competency acquisition, employability, and career progression within Technical and Vocational Education and Training (TVET). Across the four themes, the literature consistently highlights that successful technical-vocational education depends not only on curriculum design and industry relevance but also on the characteristics and preparedness of learners entering the training system.

In terms of age, studies reveal that younger learners tend to demonstrate stronger adaptability to digital technologies, simulations, and technology-enhanced instruction, making them highly responsive to modern electronics training environments. Conversely, older learners contribute practical workplace experience, stronger responsibility, persistence, and professional discipline, which positively affect workplace performance and job retention. These findings suggest that effective TVET programs must adopt flexible and age-responsive instructional approaches that accommodate varying learning needs and technological adaptability.

Regarding sex, the literature consistently shows that electronics and other industrial TVET qualifications remain male-dominated because of traditional gender stereotypes, occupational perceptions, and limited female exposure to technical fields. Although female learners possess equal technical potential, participation in electronics-related programs continues to be constrained by cultural and structural barriers. The studies therefore underscore the importance of gender-inclusive policies, mentorship opportunities, scholarships, and supportive learning environments to improve female participation and representation in the electronics sector.

The reviewed studies further establish that educational background strongly affects learners' ability to understand technical concepts, complete competency-based training, and transition into employment. Learners with stronger academic foundations demonstrate better analytical reasoning, digital literacy, communication skills, and problem-solving abilities, which are essential in electronics servicing and troubleshooting. On the other hand, trainees with limited educational preparation may struggle with technical instruction and competency assessments. These findings highlight the importance of integrating foundational academic competencies, remedial instruction, and learner support mechanisms within TVET programs.

Finally, the studies consistently identify work experience as one of the strongest contributors to employability and workplace readiness. Learners with prior industry exposure, internships, apprenticeships, or enterprise-based training demonstrate stronger technical confidence, troubleshooting skills, workplace adaptability, and professional competence. In electronics-related qualifications, practical exposure is particularly critical because competencies require actual equipment handling, diagnostics, and servicing experience. Consequently, the literature strongly recommends strengthening industry partnerships and expanding work-based learning opportunities to bridge the gap between classroom instruction and workplace demands.

Overall, the reviewed studies suggest that effective TVET implementation requires holistic and learner-responsive strategies that recognize the influence of demographic, educational, and experiential factors on competency development and employability. In the context of EPAS NC II and CES NC III, the findings imply that vertically articulated and industry-aligned training programs must integrate flexible instruction, gender inclusivity, academic support, and workplace immersion to ensure that trainees acquire relevant competencies and remain competitive in the rapidly evolving electronics industry.

Conceptual Framework

This study is anchored on an Input–Process–Output (IPO) conceptual framework, which provides a systematic approach to analyze the content and job relevance of the TESDA National Certification Program for the electronics sector: input for Micro-credentialing program.

Input

The input component consists of variables identified in Chapter I, which serve as the foundation of the study. These include the profile of trainees in terms of age, sex, educational background, and work experience, as these factors influence learning readiness, skill acquisition, and employability. It also includes the vertical articulation of EPAS NC II and CES NC III content, which refers to the sequencing, continuity, and progression of competencies across qualification levels. Lastly, the relevance of the national certification program to industry needs is considered, focusing on alignment with current electronics sector standards and labor market requirements.

Process

The process component describes the methods used to analyze the inputs. This involves a documentary analysis of existing TESDA training regulations and competency standards for EPAS NC II and CES NC III to assess alignment and progression. It also includes the administration of survey questionnaires to trainees, trainers, and employers to gather quantitative data on training relevance and outcomes, as well as interviews to obtain qualitative insights on competency application, workplace performance, and employment experiences.

Output

The output component represents the expected results of the study. These include enhanced national certificate content that reflects improved vertical articulation and industry alignment, and a program regulation and articulation improvement plan that may seek.

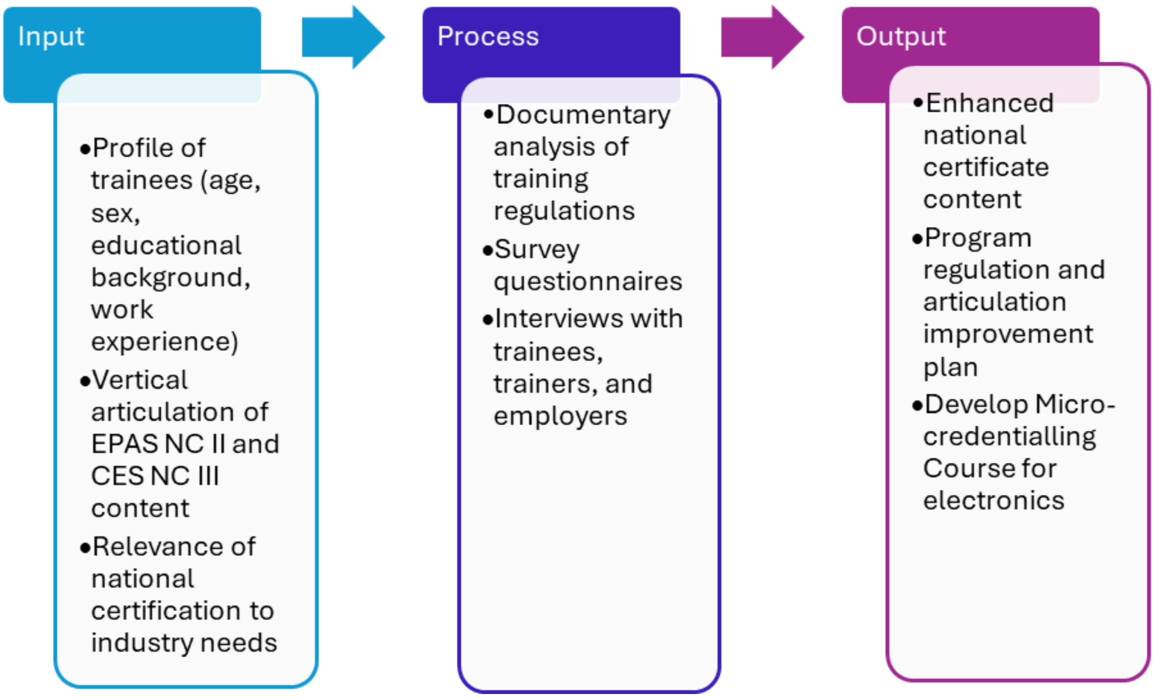

Figure 1

Paradigm of the Study

Definition of Terms

Age refers to the chronological age of the trainees enrolled in Technical Education and Skills

Development Authority (TESDA) electronics programs. Age is considered a demographic factor that may influence learning readiness, adaptability to technical skills, and employability outcomes. According to TESDA trainee profiling practices and educational research, age categories are commonly used to assess variations in performance, participation, and employment potential among learners in technical-vocational education and training (TVET) programs (Creswell & Creswell, 2018).

Certification Content refers to the specific knowledge, skills, attitudes, and competencies outlined in the training regulations and competency standards prescribed by TESDA for electronics sector qualifications. Certification content encompasses the technical and practical modules that trainees are expected to master in order to obtain a National Certificate (NC), ensuring that graduates meet industry standards and workplace requirements established under the Philippine TVET system.

Educational Background refers to the highest level of formal education attained by the trainees prior to enrolling in TESDA programs, which may include high school graduates, college undergraduates, and college graduates. Educational background is recognized in educational research as a significant factor influencing trainees' preparedness for technical training, comprehension of course content, learning performance, and employability outcomes (Creswell & Creswell, 2018).

Micro-credential refers to a record of focused learning achievement that verifies what a learner knows, understands, or can do, based on clearly defined standards and assessment processes. According to UNESCO (2022), micro-credentials are designed to be flexible, stackable, competency-based, and aligned with quality assurance frameworks, allowing them to complement larger qualifications and support lifelong learning and professional development.

Micro-Credential Course refers to industry-recognized and/or qualification-related skill-specific training and certification that is shorter in scope and coverage compared to a full qualification or TESDA-prescribed cluster of units of competency. Based on TESDA Circular on micro-credentialing, the curriculum of a micro-credential course does not necessarily require the inclusion of basic and common competencies, focusing instead on specialized and assessable technical skills relevant to industry demands.

Program Regulation refers to the policies, rules, standards, and guidelines established by TESDA governing the implementation, delivery, assessment, and certification of National Certification programs. Program regulations define requirements for trainee eligibility, competency-based instructional methods, assessment procedures, trainer qualifications, and alignment with industry standards to ensure that TVET programs remain relevant, effective, and standardized.

Sex refers to the biological classification of the trainees as male or female. Sex is considered an important demographic variable in educational and labor-force studies because it may influence access to technical education, participation in skills training, and opportunities for employment, particularly within traditionally male-dominated sectors such as electronics and industrial technology (Philippine Statistics Authority, 2023).

Vertical Articulation refers to the systematic sequencing and progression of competencies across different certification levels within the Philippine TVET framework, particularly from Electronics Products Assembly and Servicing (EPAS) NC II to Consumer Electronics Servicing (CES) NC III. According to TESDA competency standards, vertical articulation ensures that foundational competencies acquired at the entry level are further developed into more advanced technical skills, thereby supporting continuous learning, qualification progression, and professional growth.

Work Experience refers to the prior employment history or occupational exposure of the trainees, whether related or unrelated to TESDA training programs. Work experience is considered a significant factor influencing competency acquisition, practical application of technical knowledge, workplace readiness, and employability outcomes, as prior exposure to work environments may enhance learners' adaptability and performance in skills training programs (International Labour Organization, 2021).

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CHAPTER III

METHODS OF RESEARCH

This chapter presents methodology, population and sample, research instruments, construction and validation of instruments, data gathering procedure and data analysis, and interpretation and statistical treatment of data employed in the study.

Research Design

This study employed a concurrent mixed-methods research design, in which quantitative and qualitative data were collected simultaneously and analyzed in parallel to provide corroborative evidence for the findings. Concurrent mixed methods allow the researcher to validate results generated by one method through evidence obtained from the other, thereby strengthening the credibility of the study (Kroll et al., 2005).

Consistent with the IPO framework, quantitative data addressed the input and output variables of the study, while qualitative data explained and contextualized the processes through which these variables interact. Documentary analysis was conducted to examine the vertical articulation of the Training Regulations (TRs) for Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III. At the same time, survey questionnaires were administered to collect quantitative data from graduates, trainers, and employers. Selected respondents subsequently participated in interviews to explain, validate, and expand on their survey responses.

Quantitative data consisted of close-ended items measuring respondent profile, employment status, and employer satisfaction using rating scales and structured indicators. These data were statistically analyzed to answer the research questions related to employability and program relevance. Qualitative data consisted of open-ended responses obtained through interviews, which were analyzed through thematic coding to capture participant lived experiences, perceptions of vertical articulation, and assessments of program relevance. By integrating quantitative and qualitative approaches, the study achieved both breadth and depth of understanding while enabling triangulation across data sources.

Moreover, competency gap mapping was conducted to analyze the content and job relevance of the TESDA national certification program for the electronics sector: input for micro-credentialing program.

Population and Sample of the Study

The respondents of the study consisted of three groups: twenty-five (25) graduates who completed training and national assessment in both EPAS NC II and CES NC III at the TESDA Regional Training Center–Mariveles, Bataan; twenty-five (25) trainers; and twenty-five (25) employers of the graduates.

Total enumeration was employed to ensure representation from each respondent group that includes graduates, trainers and employers. Inclusion criteria for graduate respondents included: completion of training and successful national assessment in both EPAS NC II and CES NC III; an electronics-related educational background; and current employment in an occupation related to the qualifications. Exclusion criteria included graduates who completed only one qualification, those with non-electronics-related educational backgrounds, and those who were unemployed at the time of the study.

Total enumeration was used for the graduate respondents, as only twenty-five (25) individuals met all inclusion criteria based on TESDA–Mariveles records. Trainers and employers were selected purposively based on their direct involvement with the implementation and evaluation of the two qualifications.

Research Instruments

The concurrent mixed-method research design was utilized in this study. In concurrent mixed methods research strategies, qualitative and quantitative data were collected, as the name indicates, at the same time or in parallel. This design involved a single study containing qualitative and quantitative data collection which was conducted at the same time. The purpose of this type of investigation was to validate the findings generated by each method through evidence produced by the other (Kroll, et. al., 2005). In this study, a documentary analysis was utilized to examine the training regulations of EPAS NC II and CES NC

III. At the same time, a survey questionnaire was used to collect quantitative data from the respondents. Members of that group were selected for interviews where they explained and offered insights into their survey questionnaire answers.

Quantitative data included close-ended information such as that found to measure attitudes (e.g., rating scales), behaviors (e.g., observation checklists), and performance instruments. The analysis of this type of data consisted of statistically analyzing scores collected on instruments (e.g., questionnaires) or checklists to answer research questions or to test hypotheses.

Qualitative data consisted of open-ended information that the researcher gathered through interviews, focus groups, and observations. The analysis of the qualitative data (words, text, or behaviors) typically followed the path of aggregating it into categories of information and presenting the diversity of ideas gathered during data collection.

By mixing both quantitative and qualitative research and data, the researcher gained breadth and depth of understanding and corroboration, while offsetting the weaknesses inherent to using each approach by itself. One of the most advantageous characteristics of conducting mixed methods research was the possibility of triangulation, i.e., the use of several means (methods, data sources, and researchers) to examine the same phenomenon. Triangulation allows one to identify aspects of a phenomenon more accurately by approaching it from different vantage points using different methods and techniques. Successful triangulation requires careful analysis of the type of information provided by each method, including its strengths and weaknesses.

The purpose of this study was to analyze the contents of the training regulations of the two programs through the use of documentary analysis and acquire the respondents' experiences from undertaking both TESDA qualifications in the electronics sector by using the survey questionnaire followed by the interview. The survey questionnaire provided the respondents to accurately analyze the program using pre-determined indicators. Afterward, an interview was conducted to further elaborate on their experiences as indicated by the result of the survey questionnaire.

In this study, concurrent mixed method research was used since the documentary analysis of the training regulations was utilized by the researcher while the respondents used a survey questionnaire for initial data gathering. Further questions were added based only on clarification and not to mislead the respondents to achieve the desired answers.

Survey-Questionnaire

Three sets of survey questionnaires were administered. The first set gathered data on the respondents' profile in terms of age, sex, educational background, and work experience. The second set measured the employment outcomes of graduates, including employment status and job relevance to the qualifications obtained. The third set assessed employer satisfaction with graduates' technical competencies, work readiness, and job performance.

Documentary Analysis

Documentary analysis was conducted using the official TESDA Training Regulations for EPAS NC II and CES NC III obtained from the TESDA website and verified through hard copies provided by TESDA–Mariveles. This instrument examined content alignment, competency progression, and vertical articulation between the two qualifications.

Interview Protocol

A semi-structured interview guide was used to elicit in-depth perspectives from trainees, trainers, and industry representatives regarding the vertical articulation, relevance, and application of competencies acquired from EPAS NC II and CES NC III.

The interview questions were developed through an extensive review of literature on TVET articulation, employability, and competency-based training. A preliminary interview was conducted to refine the questions, ensure clarity, and establish content validity prior to final administration.

Construction and Validation of Instruments

For the first set of questionnaires, the researcher created a questionnaire that measured and described the profile of the trainees in terms of age, sex, educational background, and work experience. On the other hand, the second set of questionnaires was used to measure the employment rate of the graduates. Lastly, the third set of questionnaires was adapted and made by Eric Van Vulpen (2021) with a Cronbach's alpha > 0.8 to describe the feedback of the employers' satisfaction with the skills of the graduates. Vulpen stressed that all scales have a certain reliability, which is a measure that indicates to what extent the scale will produce similar results under consistent conditions. This will result in measuring performance with accuracy.

Data Gathering Procedure, Ethical Considerations, and Consent

Permission to conduct the study was obtained from TESDA–Mariveles. Written informed consent was secured from all respondents in accordance with graduate school research ethics guidelines. The consent form included the study title, purpose, instruments used, assurance of confidentiality, voluntary participation, and researcher contact information.

This study utilized a descriptive mixed-method approach. The quantitative method included data collection through the use of a survey questionnaire that involves the profile of students and, the depth of vertical alignment of EPAS NC II and CES NC III in terms of content, relevance, and application. The survey questionnaire is a type of data-gathering method that is utilized to collect, analyze, and interpret the different views of a group of people from a particular population. The survey questionnaire has been used in different fields such as research, marketing, political views, psychology, and so on. People use survey questionnaires to gather information that is beneficial to a group of individuals. The survey questionnaire uses statistical analysis to collect data, and the result of it will be used in the development of an individual or a community.

The next phase of data collection employed a qualitative approach through in-depth interviews, focusing on capturing and interpreting the lived experiences of the respondents. Qualitative inquiry emphasizes understanding meanings, perspectives, and contexts from the participants' point of view. Contemporary qualitative research identifies interviews, document analysis, observations, and audio-visual materials as the primary sources of qualitative data, with interviews remaining the most effective method for eliciting personal narratives and experiential insights (Creswell & Poth, 2021).

In this study, interviews were conducted in an informal and non-threatening environment to encourage openness and authenticity, allowing respondents to freely articulate their training, assessment, and employment experiences. This approach is consistent with narrative and phenomenological inquiry, which values participants' own words as the primary source of meaning-making (Saldaña & Omasta, 2018).

During the interview process, the researcher carefully listened to respondents' accounts, captured their interpretations of training relevance, and explored how their TESDA qualifications influenced their employment outcomes. Qualitative interviewing aims to understand social reality from the participants' perspectives, uncovering meanings prior to theoretical explanation or generalization (Brinkmann & Kvale, 2018). The depth of understanding gained through this process depends on the researcher's ability to listen attentively, ask probing questions, and remain reflexive throughout the interaction.

Furthermore, qualitative interviews are recognized as a systematic method for exploring how individuals perceive and give meaning to their experiences across educational and workplace contexts. The effectiveness of this method relies not only on well-constructed questions but also on the researcher's capacity to build rapport, demonstrate ethical sensitivity, and accurately interpret participants' narratives (Rubin & Rubin, 2012). The questionnaire will be shredded after the studies for following the data privacy act of 2012.

Survey-Questionnaire Process

On the first appointment with the trainees, the researcher coordinated with the training center and trainers. The researcher informed all of the respondents that the platform for the orientation and interview was Google Meet and Google Forms for the survey questionnaire. Afterward, the researcher gave a short orientation about the study and explained to the respondents the conduct of the study. Instructions were clearly explained to address the questions of the respondents. The researcher provided a consent form that described the study and each respondent was asked to read and sign it before the survey began. The researcher outlined information regarding the benefits of participating in this research project along with any possible risks. The researcher assured all respondents of confidentiality throughout the study. The respondents informed that they were free to end the interview or ask questions at any time. Then, survey questionnaires were given to the respondents, who were given ample time to complete the survey questionnaires. After collecting the forms, initial interviews were conducted with the respondents.

Interviewing Process

The design of the interviews was explanatory with open and semi-structured questions. Based on the recommendations of Arbor (2008) regarding the interpersonal approach necessary in conducting a good interview, the researcher modeled clear and concise questions through gentle delivery adopted a self-paced type, and listened carefully for subtle meanings.

The researcher was filled with know-how about the study. As a teacher and coordinator, the researcher was very familiar with proper handling and providing appropriate encouragement for the respondents. This knowledge helped when interviewing the students; and helped the researcher to know when to investigate deeper into a response. The researcher understood the subject area to direct the participant into the area of knowledge. The researcher needed to keep being open-minded when interviewing participants. However, critical inquiry required that the researcher could not take all responses at face value. This study required the respondents to recall their past experiences and time that may have altered their memory. The researcher used follow-up questions to probe for consistency in the response and tested or re-examined an area to check for consistency.

In conducting the interview, it was very significant to take notes of all data to recall information. In addition, the researcher took down notes and referred to them throughout the interview. The researcher was able to illuminate what the participants shared and tested the answers of the participants for the accuracy of the paraphrasing.

First Interview. An initial online conversation was conducted after school hours using Google Meet. The interview questions were broad in scope to induce the participants to tell their stories. The purpose of the first interview was to begin the discussion of the respondents' knowledge of both qualifications. These interviews lasted for approximately 20 to 30 minutes. Determined by the time constraints, some of the participants needed to finish the interview but were subjected to rescheduling to fully accommodate all respondents.

Reflective Journaling. Following the first online interviews, the researcher asked each respondent to reflect deeper upon the impact of their experiences on their underpinning knowledge. Each participant needed to take the time to reflect upon their prior answers to recollect events, beliefs, or impressions over a longer period. Enough time allowed respondents to examine sources of information that may prompt memories, which would add to the insight into the respondents' narratives.

Second Interview. A follow-up interview allowed the researcher to check the accuracy of the notes taken, clarify the respondents' responses, and ask any follow-up questions that arose after reviewing the transcripts from the first interview. This meeting was between 45 minutes and an hour long. Respondents received a draft copy of their stories before the meeting.

Transcribing

Transcription is a critical analytic step in qualitative research, as it transforms audio or video data from interviews into written text for systematic examination. Contemporary qualitative research emphasizes that transcription is not a purely mechanical process but an interpretive act that requires deliberate decisions regarding the level of detail, inclusion of pauses or emphases, and treatment of non-verbal cues (Braun & Clarke, 2021).

Recent methodological literature highlights that transcription serves as the initial phase of qualitative data analysis, allowing researchers to become immersed in the data and begin identifying patterns, meanings, and emerging themes. Different transcription approaches may be adopted depending on the research purpose and methodological orientation, reinforcing that transcription itself contributes to data interpretation and representation (Creswell & Poth, 2021).

In this study, transcribing the interviews immediately after each session facilitated systematic data management and enabled early familiarization with respondents' narratives. This process supported the preliminary identification of emerging themes and ensured accuracy and consistency in capturing participants' experiences related to training, assessment, and employment outcomes. Timely transcription also enhanced analytic rigor by allowing the researcher to reflect on interview content while the interaction was still recent and contextually grounded (Saldaña, 2021).

Coding

Coding individual transcripts is an essential part of describing, classifying, and interpreting the data. Pattern coding involves recognizing explanatory or inferential codes, ones that can classify an emergent theme, configuration, or explanation. Pattern coding is supportive of the reduction of large amounts of data into related themes. To this end, each transcript will be coded, and emerging themes will be used to create individual narratives.

Constructing Narratives

Written transcripts were used to identify discrete narrative segments of text in which the participants talked about a particular experience. The researcher reviewed the transcripts for instances where there was a significant change from one narrative segment to another. The researcher rearranged the segments to create a logical sequence or story. Individual segments were used to demonstrate particular themes. The construction of the narrative provided a sequence of experiences that reflected the respondents' experiences and the themes that emerged from each experience. Member checking with the participants added accuracy to attest to the reconstruction of these experiences.

Data Confidentiality and Consent Handling

Ethical integrity is maintained through a rigorous informed consent process, where all participants including trainees, trainers and employers are briefed on the study's purpose and their right to withdraw at any time without penalty. Data confidentiality is enforced through a de-identification method; all personal identifiers are replaced with alphanumeric codes (e.g., Participant A-1) during the transcription and analysis phases. This ensures that expert opinions or sensitive industrial feedback cannot be traced back to specific individuals or companies, protecting the professional standing of all contributors.

Storage and Disposal of Research Assets

To prevent unauthorized access, all digital files, including audio recordings and interview transcripts, are stored in encrypted, password-protected cloud folders accessible only to the primary researcher. Physical documents, if any, are kept in a locked filing cabinet within a secure facility. In accordance with standard research ethics, all raw data including transcripts and recordings will be permanently disposed of after a period of five years (or upon the completion and defense of the study). Digital files will be subjected to secure binary wiping, and physical papers will be shredded to ensure that no sensitive information remains retrievable once the research objectives have been met.

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CHAPTER IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF RESULTS

This chapter includes the analysis, presentation, and interpretation of the findings resulting from this study. The analysis and interpretation of data are explained using qualitative and quantitative approaches concurrently. The qualitative part, which is based on the documentary analysis of the training regulations of EPAS NC II and CES NC III, and also the results of the interview, deals with the qualitative analysis of data. The quantitative part, which is based on the results of the questionnaire, is the quantitative interpretation.

Quantitative Interpretation of Results

From the total respondents of twenty-five (25) trainees, twenty-five (25) trainers, and twenty-five (25) employers, all of the questions were answered under the supervision of the researcher. The data gathered through the survey questionnaire were subjected to frequency counts. In other words, the respondents' responses for each item were added together to find the highest frequency of occurrence (i.e., the number of times that a particular response occurs). These responses to the questions, which are quantified, are then presented in percentage form and weighted mean accordingly. The analysis is presented in tabular form.

The quantitative analysis of data includes the profile of the trainees, including age, sex, educational background, and work experience. It also includes the employability rate of the trainees. It also includes employers' satisfaction with the skills of the graduates based on employee performance and job behavior.

Profile of the Trainees

The researcher included age, sex, educational background, and work experience. **Table** 1 presents the trainee-respondents' profile in terms of age.

Table 1

Age

Age Group	Frequency	Percentage
20-25	7	28.00%
26-30	9	36.00%
31-35	2	8.00%
36-40	3	12.00%
41-45	4	16.00%
Total	25	100.00%

Table 1 shows that out of the twenty-five trainee-respondents, seven trainees, or 28.00%, belong to the age group of 20-25 years old, while nine trainees, or 36.00%, belong to the age group of 26-30 years old. This was followed by two trainee respondents, or 8.00%, who belonged to the age group of 31-32 years old, three trainee respondents, or 12.00%, who belonged to the age group of 36-40 years old, and four trainee respondents, or 16.00% belong to the age group of 41-45 years old.

Based on the table, it can be generalized that the majority of the respondents belong to the age group of 26-30 years old. This means that most of the trainees' ages correspond to the age level where trainees have already completed their basic education.

Siivonen (2016) underlined that to become successful in one's own life is the willingness to invest in continuous learning and education, especially at an age that is no less important for an older adult, willing to enhance her/his employability and stay actively involved in working life.

Table 2 presents the trainee-respondents' profile in terms of sex.

Table 2

Sex

Sex	Frequency	Percentage
Male	25	100.00%
Female	0	0.00%
Total	25	100.00%

Table 1 shows that out of the twenty-five trainee-respondents, twenty-five trainees or 100.00% are male.

Based on the table, it can be presented that the respondents are dominated by male trainees.

Cheryan et. al. (2022) emphasized that a common explanation is that women are less interested than men in computer science and engineering or even electronics-related fields. This explanation is technically accurate and supported by women's and men's responses. Focusing the explanation on currently existing interests suggests that most women prefer qualifications where their interest is highly developed and applied more effectively. The male-oriented image and cultures of engineering and computer science indeed add to this discrepancy in trainees but the only way to have a significant change depends mostly on how the females view their roles in the said sector and make changes if they prefer to.

Table 3 presents the trainee-respondents' profile in terms of educational background.

Table 3

Educational Background

Educational Background	Frequency	Percentage
Highschool Graduate	6	24.00%
College Level	8	32.00%
College Graduate	11	44.00%
Total	25	100.00%

Table 3 shows that out of the twenty-five trainee-respondents, six trainees, or 24.00%, have completed high school level, eight trainees, or 32.00% have attained college level, while eleven trainees, or 44.00%, have completed college level.

Based on the table, it can be generalized that the majority of the respondents belong to a college graduate level. This means that most of the respondents' educational background corresponds to the level where respondents have already completed basic education.

Odwald-Egg et al. (2021) emphasized the fact that vocational educational training proceeding higher education has clear effects on labor market outcomes and employment, including employability, wage level, and promotion.

Table 4 presents the trainee-respondents profile in terms of work experience after the completion of training.

Table 4

Work Experience

Work Experience	Frequency	Percentage
None	3	12.00%
TESDA Related	5	20.00%
Non-TESDA Related	17	68.00%
Total	25	100.00%

Table 4 shows that out of the twenty-five trainee-respondents, three trainees, or 12.00%, have not had work experience after training, five trainees, or 20.00% have had work experience that is related to their training, while seventeen trainees, or 68.00%, have had work experience that is not related to their training.

Based on the table, it can be generalized that the majority of the respondents have had work experience after training, but most of the respondents had work experience in other qualifications or fields that are not related to EPAS NC II and CES NC III.

The International Labour Organization (2020) defined skills mismatch as a discrepancy between the skills that are sought by employers and the skills that are possessed by individuals. Simply put, it is a mismatch between skills and jobs. This means that education and training are not providing the skills demanded in the labour market, or that the economy does not create jobs that correspond to the skills of individuals.

Most employees are recruited to work for companies not based on the skills that they acquired from training, but only by the availability of any occupation in any field that the employees need to have an income. They chose a job because it is not only one of the available jobs but also because it is what they were trained for.

Table 5

Relevance of National Certification for the Electronics Sector

Relevance	Frequency	Percentage
None	3	12.00%
Become employed	20	80.00%
Promoted in my current job	0	0.00%
Received incentives/awards in my current job	1	4.00%
Put up my business/Entrepreneurship	1	4.00%
Total	25	100.00%

Table 5 shows that out of the twenty-five trainee-respondents, three trainees or 12.00% have no career development, while twenty trainees or 80.00% became employed. This was followed by one trainee or 4.00% who received incentives or awards in the current job, and one trainee or 4.00% who started their own business or became an entrepreneur.

Based on the table, it can be generalized that the majority of the respondents developed a career or improved their current employment by becoming employed after training. It shows the significance of acquiring the needed training in order to achieve the targeted output.

National certification is the critical catalyst for success in the electronics sector, providing a government-verified benchmark of technical proficiency that dramatically increases employability, with certified graduates often securing roles as assembly or service technicians in less than a year. For those already in the workforce, it serves as a formal basis for promotion and career mobility, shifting workers from entry-level production to supervisory and quality control roles. The certification also unlocks various incentives, including eligibility for specialized scholarships, high-paying overseas opportunities through international mutual recognition arrangements, and government tax incentives for participating enterprises. Furthermore, for the aspiring entrepreneur, it provides the foundational technical credibility and legal documentation required to open accredited service centers, ensuring customers of high-quality, standardized repair and maintenance services.

Documentary Analysis of Training Regulation of EPAS NC II and CES NC III

Documentary analysis serves as the critical investigative foundation for educational and institutional reform, primarily by providing an objective, "non-reactive" baseline of current standards. Its core purpose is to systematically review existing records, such as Training Regulations (TRs) and Competency Assessment Tools, to identify exactly what is being taught versus what the industry currently requires. By evaluating these formal documents against modern industry roadmaps, researchers can pinpoint specific "knowledge gaps" or instances of technological obsolescence that may not be immediately apparent through interviews alone.

Beyond identifying gaps, documentary analysis is essential for data triangulation, allowing researchers to verify if the feedback from employers aligns with the official curriculum requirements. For instance, if an industry partner claims graduates lack troubleshooting skills, a close reading of the assessment documents can reveal whether the testing criteria overemphasize manual assembly at the expense of diagnostic logic. Ultimately, this method transforms static records into actionable evidence, tracking the evolution of a program and providing the empirical justification needed to update training standards, justify new budget allocations, and ensure the curriculum remains relevant in a rapidly shifting labor market.

The Electronic Products Assembly and Servicing (EPAS) NC II serves as the foundational blueprint for a career in the electronics industry. Regulated by TESDA, this qualification transforms a general interest in technology into a standardized, professional skill set. It is designed to produce technicians who are not just "handy" with tools, but are technically proficient in the assembly, maintenance, and repair of modern electronic systems.

At its core, the program is built on three pillars of competency. First is Product Assembly, where students move beyond simple hobbyist electronics to master industrial standards. This includes reading complex schematic diagrams, etching Printed Circuit Boards (PCBs), and performing precision soldering. The second pillar is Consumer Servicing, focusing on the diagnostic and repair cycles for household items like audio-video systems and domestic appliances. Finally, the program covers Industrial and Mobile Servicing, introducing the technician to the specialized world of cellular phone repair and factory-grade electronic modules.

Beyond the technical "hard skills," EPAS NC II emphasizes a professional methodology. Students are trained in Quality Control, ensuring that every repair meets safety standards to prevent electrical hazards. They also learn the critical importance of using specialized diagnostic tools—such as digital multimeters and oscilloscopes—to identify "root cause" failures rather than simply replacing parts at random.

The Consumer Electronics Servicing (CES) NC III represents the professional evolution of an electronics technician, moving beyond basic repairs into the realm of complex system diagnostics and industrial applications. While the NC II level focuses on the "how" of assembly and standard servicing, CES NC III is designed for those who seek to master the "why" behind sophisticated electronic architecture. It is the gold standard for technicians aiming for supervisory roles or specialized technical positions in high-tech environments.

The core of the CES NC III curriculum is built upon advanced analytical competencies that distinguish a specialist from a general practitioner. A primary pillar of this qualification is the Servicing of Microprocessor-Based Systems. Unlike standard appliances, these systems require a deep understanding of digital logic, firmware, and the interaction between hardware and software. Students learn to troubleshoot programmable controllers and complex data processing units, skills that are essential in the modern era of "smart" technology and automated systems.

Furthermore, CES NC III expands the technician's reach into Industrial Electronics Modules. This transition is critical, as it moves the scope of work from the living room to the factory floor. Technicians are trained to maintain and repair the heavy-duty electronic controls that power manufacturing lines, including sensors, power supplies, and motor controllers. This requires a higher level of precision and the ability to use advanced diagnostic tools, such as high-frequency oscilloscopes and logic analyzers, to trace signals through multi-layered circuits where a single millivolt of deviation can cause a system-wide failure.

Beyond the technical repairs, the Level III certification emphasizes Design and Fabrication. Rather than simply replacing a broken part, a CES NC III professional is expected to be capable of fabricating printed circuit board (PCB) designs and modifying existing circuits to improve performance or adapt to new requirements. This creative and analytical approach ensures that the technician can provide custom solutions in an industrial or research-and-development setting.

Table 6

Core Competency Alignment Matrix

EPAS NC II (Foundational/Intermediate)	CES NC III (Advanced/Specialize)	Alignment/Progression Note
Assemble Electronic Products	Fabricate PCB Designs	Shifts from manual assembly to designing and etching custom circuits.
Service Consumer Electronic Products (Audio/Video)	Service Industrial Electronics Modules	Moves from household appliances to complex PLC and industrial control systems.
Service Domestic Appliances	Service Microprocessor-Based Systems	Transitions from mechanical/thermal repairs to digital logic and programming.
Maintain/Repair Cellular Phones	Service Advanced Communication Systems	Scales up from mobile hardware to broader network and transmission systems.
Basic Troubleshooting	Advanced Signal Tracing & Diagnostics	Uses more sophisticated equipment (e.g., Logic Analyzers, High-End Oscilloscopes).

Table 6 implies a profound misalignment in their core objectives, cognitive demands, and professional environments. Rather than a simple linear upgrade, the transition between these two qualifications represents a fundamental shift from manual dexterity to high-level systemic analysis, effectively moving the technician into an entirely different industrial tier.

The most striking misalignment lies in the depth of theoretical application. EPAS NC II is fundamentally grounded in the physical world of discrete components; it is a qualification of "identification and replacement." A technician at this level is trained to spot a leaking capacitor or a cold solder joint and rectify it through manual skill.

However, CES NC III largely abandons this component-level focus in favor of Electronic Data Analysis. At this advanced stage, the technician is no longer looking for a "blown fuse." Instead, they are tasked with tracing invisible signal flows and analyzing data packets across integrated circuits. This is a leap from a mechanical mindset to an algorithmic one, where the "problem" is often a logic failure rather than a physical break.

This theoretical gap creates a corresponding misalignment in equipment sophistication. The tools of the EPAS NC II trade the multimeter and the soldering iron—are the tactile extensions of a repairman's hands. They are used to measure presence or absence: Is there voltage? Is there continuity? CES NC III, however, introduces a suite of "smart" tools, including Programmable Logic Controllers (PLCs) and advanced diagnostic software.

At the NC III level, the technician must move beyond measuring static values to interpreting dynamic code and software-driven logic. This shift requires a level of computer literacy and abstract thinking that is almost entirely absent from the foundational NC II curriculum.

Finally, the two qualifications are misaligned in their market destination. EPAS NC II is inherently "consumer-facing," designed for the neighborhood service center or the cellular phone repair shop. It deals with the gadgets of domestic life—devices with predictable, modular failures. CES NC III, conversely, is "industrial-facing." It bridges the gap into the high-stakes world of manufacturing and automation, where a technician is responsible for the massive, interconnected systems of a factory floor or a high-tech R&D lab.

Table 7

IJRP.ORG
International Journal of Research Publications
ISSN: 2708-3578 (Online)

Redundancy Index Table

Competency Area	Redundancy Level	Logic / Transition
Basic Soldering	High (80%)	The physical act of soldering is the same, though NC III moves toward finer SMT (Surface Mount Technology) and micro-soldering.
Component Testing	Medium (50%)	NC II focuses on "Good vs. Bad" testing. NC III focuses on "Performance within a complex circuit" (Parametric testing).
Schematic Reading	Medium (40%)	NC II reads point-to-point wiring. NC III reads logic flow, bus lines, and microprocessor architecture diagrams.
Standard Tool Use	High (90%)	Using a Multimeter or Oscilloscope is a carry-over skill, though NC III requires more advanced settings (logic analysis).
Safety & 5S	Total (100%)	Workshop safety, grounding (ESD), and organization is identical across all levels.

In Table 7, the transition from EPAS NC II to CES NC III is often misunderstood as a simple continuation of the same technical path. However, a rigorous analysis of the "skill jump" required between these two levels reveals a profound cognitive misalignment. While the physical tools for the soldering irons and multimeter remain largely the same, the mental framework required to use them shifts so radically that the two qualifications exist in different intellectual spheres.

The primary misalignment is found in the move from "Parts" to "Systems." In the foundational EPAS NC II, there is a high focus on discrete components; the technician spends hundreds of hours mastering the behavior of individual resistors, capacitors, and transistors. Yet, in CES NC III, the redundancy of this knowledge is nearly zero. The advanced curriculum assumes basic component literacy as a mere prerequisite and immediately pivots to System-on-Chip (SoC) architecture and microprocessor modules. Here, the technician is no longer looking at a collection of parts, but at a singular, integrated intelligence where the failure is often not a physical component, but a breakdown in systemic communication.

This leads to a secondary, even sharper misalignment in troubleshooting methodology. EPAS NC II relies on a "Symptom-to-Component" logic a linear process where a lack of power leads a technician to check a fuse or a filter capacitor. In contrast, CES NC III operates on a "Signal-to-Logic" basis. The technician is no longer hunting for a "broken" part; they are analyzing data bus timing or navigating a PLC program ladder. This is a shift from mechanical repair to algorithmic diagnosis, where the problem is often invisible to the naked eye and can only be "seen" through the lens of logic analyzers and software interfaces.

The statistical reality of this misalignment is stark. While there is a 75% redundancy in physical skills meaning the "hand work" of soldering carries over well— there is a meager 20% redundancy in theory. This suggests that almost 80% of what is taught in CES NC III regarding data analysis and microprocessors is brand-new information. The equipment redundancy of 60% is also misleading; while a technician might use the same multimeter, they are now tasked with adding "smart" diagnostic tools that require a completely different set of digital literacies.

Ultimately, the "verdict" for any technician in Balanga City or beyond is clear: EPAS NC II only completes about one-third of the journey toward an NC III. The remaining two-thirds is not an extension of what they already know, but a steep, difficult climb into the abstract world of digital logic and industrial automation. To succeed in CES NC III, one must be prepared to stop thinking like a mechanic and start thinking like a systems engineer.

As shown in Table 8, the transition from EPAS NC II to CES NC III is best characterized not as a gradual climb, but as a profound "technical leap" that redefines the relationship between a technician and the hardware they manipulate. This evolution is most visible in the physical shift of the work itself: in the foundational EPAS level, a technician handles discrete, tangible components, individual resistors, capacitors, and transistors that can be seen and touched. By contrast, the NC III specialist deals with these same elements after they have been shrunk and integrated into "complex brains," where thousands of functions are packed into a single, microscopic silicon chip.

Table 8

Competency Mapping: Alignment vs. Misalignment

Category	EPAS NC II (Foundational)	CES NC III (Specialized)	Alignment / Misalignment Status
Circuit Construction	Manual PCB Etching & Through-hole Assembly	Multi-layer PCB Design & SMT (Surface Mount)	Aligned in Craft: Both require soldering, but NC III moves to microscopic precision.
Logic Framework	Linear/Hardware: Component A connects to Component B.	Algorithmic/Software: Logic Gate A triggers Software Interrupt B.	Misaligned: A total shift from physical connections to digital logic.
Primary Goal	Restoration: Making a "dead" consumer device work again.	Optimization/Integration: Programming and tuning industrial modules.	Misaligned: Moves from "repairing gadgets" to "managing systems."
Documentation	Schematic Diagrams (Wiring/Voltage)	Block Diagrams & Flowcharts (Data/Logic)	Aligned in Literacy: Both require reading blueprints, but the "language" of the prints changes.
Troubleshooting	Symptom-Based: "No sound? Check the speaker/amp."	Signal-Based: "No output? Check the data bus timing/PLC code."	Deep Misalignment: Requires a leap from sensory diagnosis to abstract data analysis.

This leap creates a unique paradox of "Hand" Alignment versus "Brain" Misalignment. Physically, the two certifications are highly compatible; there is a roughly 75% redundancy in manual skills. An expert who has mastered precision soldering and multimeter usage in EPAS NC II has already acquired the physical "muscle memory" required for the advanced level. However, the intellectual framework required to apply those skills is nearly 80% new. The "Brain" Misalignment is absolute: the linear flow of electricity in a consumer appliance like a microwave is fundamentally different from the way an industrial machine "thinks." In the world of Programmable Logic Controllers (PLCs), the technician is no longer managing current; they are managing logic.

This shift in thinking is mirrored by a significant Tool Gap. While the multimeter remains a staple in the technician's belt, the NC III level introduces a more sophisticated arsenal designed for "eavesdropping" on digital conversations. Tools like Logic Analyzers and Protocol Sniffers become essential. At this stage, the technician's role evolves from a simple repairman measuring voltage to a digital detective who monitors the high-speed communication between chips.

Ultimately, the leap to CES NC III requires a technician to accept that their "hand" skills are merely the entry ticket. The real work lies in mastering an entirely new language of industrial automation and digital logic, moving from the visible world of electricity into the invisible world of data.

Qualitative Interpretation of Results

To clarify the results and to fill other significant gaps left in the questionnaire, the qualitative approach was used. This kind of technique looks more likely to give more substance and to divulge detailed information. Qualitative research is concerned with trying to achieve a clearer understanding of the problem under review in a more complex way than in the generalized way that is the outcome of questionnaires. This methodology is used to get information about how people think, feel, and act and what they know. This section of the research was conducted through individual interviews consisting of a trainee and a trainer. The information collected was presented in a narrative form that includes the description and analysis of data.

This section reflects on the results of the interviews with the trainees and trainers. It presents the analysis of their verbal responses during the interviews. Long and informal interviews were carried out with respondents regarding the satisfaction of the program based on its content, which affects its effectiveness in providing relevant training and the applicability of the skills for industry employment. The purpose was to find out how trainers evaluate the vertical articulation of EPAS NC II and CES NC III, and also, how the trainees regard the effectiveness of training in the actual field. About the design of a proposed enhancement plan.

In the interview with trainers, the questions were designed to discover the knowledge and experience of the trainers about the content and effectiveness of the training regulations of EPAS NC II and CES NC III.

Topics discussed during the interviews included the following questions:

1. What are your findings about the vertical articulation of the training regulations of EPAS NC II and CES NC III?

A. The titles of both qualifications do not match in terms of competencies. Both belong to the same sector but differ in proficiencies.

Most of the trainers said that the titles of the qualifications of EPAS NC II and CES NC III provide an overview that the content does not match in the majority of the competencies. Based on TESDA Circular 23 s. 2017, CES NC II was migrated to EPAS NC II. This means that trainees who acquired EPAS NC II can only continue their training to CES NC III.

Respondent no. 1 said: *"Sa title pa lang hindi na sila align even though parehas sila na electronics. Sa TR ang pre-requisite ng CES NC III ay CES NC II na wala na ngayon. Pinalit ang EPAS NC II."*

B. The assessment of CES NC III concentrates more on managerial or supervisory skills rather than training, which is what EPAS NC II offers.

One of the most notable findings of the trainers is the difference in content with regard to expected training, where EPAS NC II focused on skills in the assembly of electronics products, while CES NC III focused on managerial or supervisory training of trainees. This means that an EPAS NC II graduate will know how to assemble and troubleshoot electronic products, while a CES NC II graduate will know how to handle personnel or a business.

Respondent no. 5 said: "*Sa assessment naman ng CES NC III, supervisory ang dating. Or yung pagiging manager. If kukuha ka ng assessment ng CES NC III need mong gumawa ng plan on how to manage your subordinates/tao. Which is hindi nagagamit dahil after mo ng assessment at mag apply ka agad manager. Or magtayo ka ng shop mo na ikaw ang manager which is kulang pa rin knowledge mo on how to do it. In short, hilaw ang training ng CES NC III to be a supervisor or tech supervisor."*

Respondent no. 13 said: *"Ang assessment ng EPAS NC II, nakalagay pre-requisite ang mga COC ng CES NC II. Eh, wala na naman yun now. Na-remove na ang TR. Sa EPAS NC II assessment, only COC 3 siya."*

C. The duration and coverage of training of EPAS NC II do not cover all competencies that are required for a trainee to be competent based on industry needs. CES NC III, which is the continuation of EPAS NC II does not comprise the training that the previous qualification lacks.

According to respondents nos. 2, 4, 7, and 9, the nominal hours needed to complete EPAS NC II are not enough to have the essential knowledge and skills to become effective in assembling or troubleshooting electronic products. According to respondents nos. 13, 14, 18, 19, 23, and 24, the equipment used in training does not comprise all the equipment currently used in the real world.

Respondent no. 12 said: *"COC1: Assemble electronic products, very narrow din ang assessment. Sa COC2: Service electronic products, audio, video and washing machine naman. Sa training hindi naman mai-cover lahat ng yan. Kaya ang tinuturo ng karamihan yung related na sa assessment, hindi talaga training. Saka maraming brand and model. Sa COC3 ng EPAS, service industrial electronic products and system. Ang tunay na assessment ay malayo sa actual. Service digital system (led lighting controller) ang actual na assessment at assembly pa rin ng night switch product. Halos same lang ng COC1 na mag assemble din."*

2. How do you think this finding(s) affect the training of the trainees?

A. Most of the trainees do not pass the assessment in CES NC III because the training regulations in EPAS NC II that should complement its succeeding qualification do not match.

Respondent no. 3 said: *"Sa overall assessment and personal evaluation as per result. Marami pa ring bumabagsak sa COC1 kaysa sa COC2, which is not good kasi mas mahirap ang COC2 sa COC1 na basic assembly lang."*

B. Regarding training continuity, there is no real alignment.

Respondent no. 20 said: *"Sa EPAS na naka-graduate at nag-enroll ng CES NC III, mahihirapan kasi it is not align."*

Respondent no. 25 said: *"Sa CES NC III, all core units in NC II, plus yung nasa CES NC III (wala n* *po ang CES NC II) so I clear. Dapat na included lang na lahat ng Core ng EPAS NC II without the cellular phone (kasi sa EPAS wala nman ang cellular phone na core) medyo gray yung part na yan sa conduct ng assessment ng CES NC III, need gumawa ng Project Plan eh. Sa 260 hours ng EPAS NC II training hindi nman sila naturuan ng Project Planning (supervisor or manger work) although may mga basic and common cores. Pero d pa rin sila makagawa dahil hindi nga po aligned."*

C. One of the assessment requirements for EPAS NC II is also the same in another qualification (EIM NC II), making it redundant.

Respondent No. 25 said: *"Set up a CCTV system. Meron nman n rin sa EIM ang CCTV installation. May redundancy na. Saka very basic ang installation."*

Based on Amo (2019), employees can contribute to the success of a company when they are trained to perform their jobs according to industry standards. Training, which is essential for management as well as staff, typically consists of several classes onsite or at a different location during orientation. Some companies consider in-depth training an unnecessary expense and expect new employees to learn on the job from supervisors and older employees. However, this type of training is often inadequate and creates problems for the business.

3. What possible suggestion(s) can you think of to remedy if ever your findings have negative effects on the training outcome?

A. Most of the trainees do not pass the assessment in CES NC III because the training regulations in EPAS NC II that should complement their succeeding qualification do not match.

All respondents believe and recommend that there should be immediate action regarding the vertical articulation of EPAS NC II and CES NC III since the electronics sector is one of the most dynamic sectors that, when left unchecked, can further cause more problems, especially in the training needs of future trainees.

Respondent no. 1 said: *"Sa vertical articulation. I reccommend na re-allign na ang CES NCIII into EPAS NC III. Pero not manager or supervisory function. Ang EPAS NC III would be a COC1 designer or* *circuits and COC2 software application."*

Respondent no. 17 said: *"Ang recommendation ko po is high time to review the TR of EPAS NC II, Gawing COC1: Assemble electronics product, COC2: Maintain and repair electronics products, COC3: Circuit designing and troubleshooting."*

Respondent no. 19 said: *"Develop EPAS NC III which includes the COC1 for circuit designing using software designing (eCAD, like Eagle CAD, free software like Express pcb) and Programming (C, C++ language)"*

In the interview with trainees, the questions were designed to discover their insights and experience after completing their training under EPAS NC II and CES NC III.

Topics discussed during the interviews included the following questions:

1. How does your national certificate program in electronics help you in your career?

A. The national training program can be a vital factor in the development of knowledge and skills based on the preferred skills of any trainee. However, in the application of competencies in the particular electronic sector or industry, the opportunities are very limited based on the availability of a progressive market and the lack of efficient training and resources.

Out of the twenty-five trainees, seventeen of the respondents (1, 2, 3, 5, 6, 7, 10, 11, 12, 14, 15, 16, 19, 20, 21, 23, and 25) retorted that their training did not help in their career based on the relationship with the electronics sector. The trainees may have gained minimal knowledge and skills in electronic product assembly but most of the career or employment opportunities that were given were not related to their training. Based on their experience, they still lack the needed skills, especially in repairing since the electronics sector is a dynamic field.

Respondent no. 1 said: *"No po. Not related to my work po ngaun."*

Respondent no. 5 said : *"Hindi po. Hindi naman po ako hinanapan ng experience or training. Hindi po kasi related sa work ko."*

Respondent no. 12 said: *"No po. Kasi po sa CES NC III, wala po tumanggap sa akin as supervisor* *dahil kulang po ako sa kaalaman dito."*

Respondent no. 23 said: *"Maybe po, kasi nakita nila ang training certificates at NC II ko po. Pero hindi nga lang po need ngayon sa work ko."*

Respondent no. 25 said: *"No, hindi ko po nagamit kasi. Konte lang electronics shop. Sa company po, mahirap makapasok kasi nnaghahanap po mas malawak na training."*

B. The training program can only meet the demands of the needs of the trainees if the trainees have enough capital to start their own business or have already prior experience in the electronics field that includes advanced training.

Five of the respondents (4, 8, 13, 18, and 24) answered positively since their training was utilized in several ways. Three of the respondents were able to open their own business that is based on their expertise. One respondent was able to apply for work wherein the trainee was able to apply his training. One respondent articulated that his certificate was used by his employer to acquire a permit to open a business.

Respondent no. 8 said: *"Yes, mas dumagdag siguro po yung pagtiwala ng customer."*

Respondent no. 18 said: *"Yes po pero hindi pa rin po dumamin ang customer."*

C. The training program lacks the needed resources to assist the trainees in starting their businesses or in providing available employment opportunities.

Three of the respondents (9, 17, and 22) have no answer since they are still unemployed. The trainees also do not have the capital to open their businesses.

Respondent no. 9 said: *"Kahit nakapagtapos po sa training, wala pa rin pang puhunan pa sa sariling business o shop."*

2. Suggest how the implementation of the national certification program for electronics can be improved.

A. The current training regulation under these qualifications can be effectively used as introductory training for electronic products, but another qualification must be implemented for new electronic products.

Most of the respondents agree that the national certification program, particularly under EPAS NC II and CES NC III needs to be aligned.

Respondent no. 7 said: *"I-align po ang EPAS sa CES na NC."*

Respondent no. 16 said: *"I align po sana ang course naming EPAS NC II. Dapat EPAS NC III, hindi po CES NC III."*

Respondent no. 22 said: *"I-remove po sana yung course na CES NC III, gawing EPAS NC III para mas mahaba ang training."*

Respondent No. 23 said: *"More on hands-on training."*

Grensing-Pophal (2020) stressed that training with a focus on industry strategy and goals ensures employees are best prepared to carry out that strategy on a tactical, day-to-day level and ensures the employees are focused on those goals. Once the needed skills are identified, it should be fairly straightforward to develop a training program to help employees learn the required skills. Chances are, other organizations have already conducted such training; there's likely to be plenty of existing material to review and draw from.

3. What are your professional needs or training that you prefer to take after the training?

A. The current training regulations under these qualifications do not meet the current industry needs because of misalignment, regressed technology, and lack of time.

Most of the respondents agree that the national certification program, particularly under EPAS NC II and CES NC III lacks the needed time and resources to make the trainee competent enough to become readily employed or competitive in the real world.

Respondent No. 1 said: *"PCB designing and training."*

Respondent No. 6 said: *"Troubleshooting techniques."*

Respondent no. 10 said: *"Advanced and bagong technology in repairing like LED TV, Android at laptops."*

Respondent no. 19 said: *"Modern technology po sana ang ituro."*

Seismic.com (2020) accentuates that training leads to better processes and business growth. In today's ever-changing marketplace, the importance of job training has never been greater. Workforce training is an indispensable way to keep your organization competitive. Employees are human; most will have weaknesses or gaps in their professional skills. Furthermore, most professional people are specialists of one kind or another. Much of what goes on in your organization is likely to fall outside of the training each worker already has.

Themes Derived from the Qualitative Interpretation of Results

Trainers

1. What are your findings about the vertical articulation of the training regulations of EPAS NC II and CES NC III?

A. The titles of both qualifications do not match in terms of competencies. Both belong to the same sector but differ in proficiencies.

B. The assessment of CES NC III concentrates more on managerial or supervisory skills rather than training, which is what EPAS NC II offers.

C. The duration and coverage of training of EPAS NC II do not cover all competencies that are required for a trainee to be competent based on industry needs. CES NC III, which is the continuation of EPAS NC II does not comprise the training that the previous qualification lacks.

2. How do you think this finding(s) affect the training of the trainees?

A. Most of the trainees do not pass the assessment in CES NC III because the training regulations in EPAS NC II that should complement their succeeding qualification do not match.

B. Regarding training continuity, there is no real alignment.

C. One of the assessment requirements for EPAS NC II is also the same in another qualification (EIM NC II), making it redundant.

3. What possible suggestion(s) can you think of to remedy if ever your findings have negative effects on the training outcome?

A. Most of the trainees do not pass the assessment in CES NC III because the training regulations in EPAS NC II that should complement their succeeding qualification do not match.

Trainees

1. How does your National Certificate in electronics help you in your career?

A. The national training program can be a vital factor in the development of knowledge and skills based on the preferred skills of any trainee. However, in applying competencies in the specific electronic sector or industry, opportunities are very limited due to the lack of a progressive market and efficient training and resources.

B. The training program can only meet the needs of the trainees if the trainees have enough capital to start their own business or have already prior experience in the electronics field that includes advanced training.

C. The training program lacks the needed resources to assist the trainees in starting their businesses or in providing available employment opportunities.

2. Suggest how the implementation of the national certification program for electronics be improved.

A. The current training regulation under these qualifications can be effectively used as introductory training for electronic products, but another qualification must be implemented for new electronic products.

3. What are your professional needs or training that you prefer to take after the training?

A. The current training regulations under these qualifications do not meet the current industry needs because of misalignment, regressed technology, and lack of time.

Table 9

Joint Interpretation of EPAS NC II and CES NC III Vertical Articulation

This table integrates the statistical data (quantitative) with the thematic insights from interviews (qualitative) to provide a comprehensive meta-inference of the training programs.

Key Dimension / Indicator	Quantitative Result (From Tables 1-8)	Qualitative Result (From Themes)	Selection	Integrated Interpretation (Meta-Inference)
Program Alignment & Progression	Table 6 & 8 show a "Technical Leap" from manual assembly to algorithmic logic and industrial automation.	Trainers state the qualifications "do not match" in competencies and there is "no real alignment" in training continuity.	Divergent	While the curriculum assumes a linear progression, the actual skills required shift so radically (from "parts" to "systems") that the programs function as two different sectors rather than a vertical ladder.
Employment & Market Relevance	Table 4: 68% of graduates are in Non-TESDA related jobs. Table 5: 80% used the NC primarily to "become employed."	Trainees report limited opportunities in the specific electronics sector and a "mismatch" with current industry needs.	Convergent	The NC is valued as a general credential for entry into the labor market, but fails to place graduates in specialized electronic roles due to a lack of industrial demand and regressed technology.
Competency & Assessment Success	Table 7: Only 20% redundancy in theory between levels. Table 3: 44% are college graduates, yet face a "steep climb."	Trainers note that most trainees fail CES NC III because EPAS NC II does not provide the necessary foundational "complementary" skills.	Convergent	The high theoretical gap (80% new info at NC III) creates a barrier to entry; the foundational training (NC II) is insufficient for the high-level diagnostic demands of the advanced certification.
Gender & Demographics	Table 2: 100% Male distribution. Majority are 26-30 years old (Table 1).	Trainees suggest women may prefer qualifications where interest is "highly developed" and view the field as "male-oriented."	Convergent	The electronics sector remains a male-dominated field, likely due to cultural perceptions of the "mechanic" vs. "technician" roles and a lack of targeted recruitment for women.
Tools & Technology	Table 7: 60% equipment redundancy, but Table 8 notes a	Trainees and Trainers both mention "regressed technology" and a "lack of resources" to meet	Divergent	Quantitatively, the physical tools overlap, but qualitatively, the *application* of those tools

	shift to "Smart" tools (PLCs, Logic Analyzers).	modern industry standards.		is obsolete. Trainees are using basic tools for advanced problems, leading to a "skills mismatch."

The integration of quantitative and qualitative results from Table 9 highlights several critical insights:

1. **Structural Disconnect in Vertical Articulation**

    - EPAS NC II successfully introduces learners to general electronics and assembly skills. However, CES NC III demands a substantial shift toward algorithmic, automated, and systems-level competencies.
    - The curriculum assumes linear progression, but the "technical leap" creates a two-tier system, where NC II graduates struggle to adapt to NC III requirements.
    - Bridging modules, scaffolding, and competency mapping are essential to enable smooth progression.

2. **Employment and Market Misalignment**

    - Quantitative evidence shows high general employment but low sector-specific placement.
    - Qualitative feedback confirms trainees experience difficulty finding electronics-specific jobs.
    - NC programs are valued for labor market entry but fail to deliver sectoral competence, suggesting a need to align curriculum with Industry 4.0 electronics requirements.

3. **Competency Gaps and Assessment Challenges**

    - Minimal redundancy (20%) between levels means NC III content is almost entirely new, producing a steep learning curve.

- Foundational skills from NC II are insufficient, increasing the likelihood of failure at NC III.
- Addressing the theoretical and practical gaps requires integrated assessment strategies and pre-certification support.

4. **Gender and Demographic Implications**

- Male dominance in the program highlights cultural biases and recruitment gaps.
- Age concentration suggests programs primarily cater to young adults.
- Inclusive recruitment, mentorship, and adaptive instruction could broaden access and diversity.

5. **Technology and Equipment Gaps**

- Despite available tools, trainees face obsolete technologies that hinder real-world readiness.
- The curriculum must incorporate modern PLCs, logic analyzers, and industrial automation devices to match Industry 4.0 standards.
- Equipment and lab modernization are crucial for practical competency acquisition.

The analysis reveals a misalignment between NC II and NC III vertical progression, compounded by outdated equipment, gender disparity, and employment mismatch. While NC II provides general technical employability, NC III demands high-level diagnostics, automation, and digital competencies that are inadequately scaffolded. Bridging the gap requires curriculum redesign, updated lab resources, gender-responsive strategies, and industry-aligned assessments, ensuring that TESDA graduates meet the demands of modern electronics industries.

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CHAPTER V

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions, and recommendations made in the study.

Summary

The general problem of the study is to analyze the content and job relevance of the TESDA national certification program for the electronics sector: input for the micro-credentialing program for the school year 2019-2020.

Specifically, the study sought answers to the following questions:

1. What is the profile of the trainees in terms of:

    1.1. age,

    1.2. sex,

    1.3. educational background, and

    1.3. work experience?

2. How may the relevance of a national certification program for the electronics sector be described?

3. How may the vertical articulation of EPAS NC II and CES NC III content be evaluated?

4. What micro-credentialing program may be designed based on the results of this study?

5. What is the implication of the result of the study?

The concurrent mixed method research design, which used documentary analysis, a survey questionnaire, and interviews, was conducted at the TESDA Regional Training Center in Mariveles, Bataan. The respondents of the study comprise twenty-five (25) trainees who have undergone training and assessment for both Electronic Products Assembly and Servicing (EPAS) NC II and Consumer Electronics Servicing (CES) NC III from TESDA Regional Training Center Mariveles, twenty-five (25) trainers in the electronics sector and twenty-five (25) current employers of the said trainees. Stratified sampling was employed in the selection of the samples.

The research focuses on evaluating trainee profiles, vertical articulation between certifications, employment relevance, content, and regulatory gaps, and the overall implications for modernization and industry alignment.

Summary of Findings

1. Profile of Trainees

Age. The majority of trainees are early- to mid-career adults, with 36% aged 26–30 years and 28% aged 20–25 years. A smaller proportion, 28%, were aged 31 years and above. This distribution indicates that TESDA programs attract both first-time entrants into the workforce and mid-career professionals seeking reskilling or career transition opportunities. The presence of older trainees underscores the importance of lifelong learning initiatives in technical education, highlighting the need for differentiated instructional approaches to accommodate varying prior knowledge, learning pace, and technical adaptability

Sex. All trainees in the study were male, revealing a significant gender imbalance in enrollment. Qualitative feedback suggests that cultural perceptions, lower exposure to electronics-related fields, and limited awareness discourage female participation. The absence of female trainees emphasizes the need for targeted gender-inclusive strategies, including scholarships, mentorship programs, awareness campaigns, and inclusive learning environments. Research indicates that gender diversity fosters innovation, creativity, and problem-solving, which are critical in the electronics sector and Industry 4.0 contexts.

Educational Background. Trainees exhibited diverse educational attainment: 44% were college graduates, 32% college undergraduates, and 24% high school graduates. This reflects that TESDA programs attract learners with a strong academic foundation, capable of engaging with both theoretical concepts and hands-on technical skills. Tailoring instructional approaches based on educational background and providing supplemental support for learners with lower prior education can enhance overall competency acquisition and employability outcomes.

Work Experience. Most trainees (68%) reported prior work experience outside TESDA-relevant industries, 20% had TESDA-relevant experience, and 12% had no prior experience. This mixed experience profile indicates that TESDA programs serve as both career entry points and upskilling opportunities. Prior work experience contributes to technical proficiency, problem-solving, and workplace adaptability, highlighting the need to integrate experiential learning and practical exercises into training programs.

2. Relevance of a national certification program for the electronics sector

Employers, trainers, and trainees generally agreed that TESDA NC programs are relevant for operational-level electronics employment. Graduates develop competencies in assembly, servicing, and handling electronic equipment, making them employable at entry-level positions. However:

- Employer satisfaction was moderate (weighted mean 3.09), suggesting that while graduates meet fundamental job requirements, they may lack competencies in emerging technologies such as automation, digital electronics, and Internet of Things (IoT) systems.
- The absence of exposure to advanced technologies may limit graduates' career mobility and competitiveness in modern electronics industries.

This indicates that while TESDA NC programs provide a solid foundation, alignment with Industry 4.0 demands remains partial and requires curriculum updates and the integration of real-world learning.

3. Vertical Articulation of EPAS NC II and CES NC III

Vertical articulation evaluates whether foundational skills from EPAS NC II adequately prepare trainees for CES NC III. Findings revealed:

- EPAS NC II equips trainees with basic competencies in assembly, soldering, and diagnostic procedures, forming a necessary foundation for advanced training.
- CES NC III develops advanced competencies, including system troubleshooting, component-level repairs, and customer service skills.
- Despite these linkages, qualitative feedback highlighted gaps in the progression, with EPAS NC II providing insufficient scaffolding for some advanced CES NC III skills. Trainees often encountered

challenges in transitioning due to the lack of structured bridging modules or competency reinforcement.

This finding underscores the need for competency-based progression, structured learning pathways, and bridging modules to ensure smooth advancement from basic to advanced levels, minimizing learning discontinuities and enhancing trainee confidence and employability.

4. Micro-credentialing program

The study identified key gaps in curriculum content and regulatory frameworks:

- Curriculum Content: Current NC programs lack modules on modern technologies, including automation, embedded systems, and digital electronics. Soft skills such as problem-solving, critical thinking, and customer service are also insufficiently emphasized.
- Regulatory Limitations: Rigid regulations hinder curriculum updates, elective certifications, and integration of industry-aligned competencies.
- Industry Collaboration: Limited partnerships with employers reduce opportunities for hands-on, real-world learning, such as internships, simulations, and capstone projects.
- Trainer Constraints: Trainers reported restricted access to modern tools and equipment, limiting effective skills transfer.

These gaps highlight the need for modernization, flexibility, and stronger industry engagement to maintain program relevance and responsiveness to sector demands.

Conclusion

Based on the findings, the study concludes that TESDA electronics programs successfully attract a diverse trainee population, serving both new entrants and mid-career professionals seeking reskilling or technical specialization. There exists a critical gender disparity, as no female trainees participated, emphasizing the urgent need for inclusive recruitment and gender-sensitive policies.

Vertical articulation between EPAS NC II and CES NC III is partially effective; gaps in skill scaffolding hinder smooth progression and reduce learning efficiency. TESDA NC programs are relevant for entry-level employment, but graduates may lack competencies in emerging technologies, limiting their competitiveness in the modern electronics industry. Modernization of curriculum content, regulatory flexibility, trainer development, and industry partnerships are essential to ensure alignment with evolving demands in the electronics sector and Industry 4.0 trends.

Recommendations

1. Curriculum Modernization:

- Integrate topics on automation, Internet of Things (IoT), embedded systems, and digital electronics.
- Incorporate soft skills such as critical thinking, problem-solving, and customer service.
- Develop micro-credential courses to supplement EPAS NC II competencies for advanced CES NC III preparation.

2. Vertical Articulation and Bridging Modules:

- Introduce transition units or bridging modules linking NC II to NC III.
- Conduct comprehensive curriculum mapping to ensure logical, competency-based progression.
- Pilot bridging modules to assess trainee readiness and improve skill scaffolding.

3. Industry-Based Learning:

- Institutionalize internships, simulations, capstone projects, and real-world assessments.
- Establish continuous partnerships with electronics industry stakeholders to ensure curriculum relevance.

4. Gender-Inclusive Strategies:

- Implement targeted recruitment campaigns, scholarships, mentorship programs, and awareness initiatives to encourage female participation.
- Promote inclusive learning environments and challenge stereotypes in technical fields.

5. Trainer Development:

- Provide continuous upskilling, industry immersion, and workshops to ensure trainers remain current with modern electronics technologies.
- Encourage adoption of innovative teaching strategies for diverse learners.

6. Regulatory Flexibility and Monitoring:

- Introduce adaptive policies allowing curriculum updates and elective certifications.
- Implement systematic monitoring and evaluation, gathering feedback from employers, alumni, and trainers to guide program improvement.

7. Continuous Industry Alignment:

- Periodically review and revise program content to reflect technological advancements and labor market needs.
- Ensure trainees acquire current, practical, and transferable skills across electronics subfields.

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