

“DESIGN AND ANALYSIS OF IMPORTANCE-PERFORMANCE MAP ANALYSIS (IPMA)FOR MULTI-DETRIMENTAL FACTORS OF TECHNOLOGY-INDUSTRIAL ARTS TRAINERS:A PRIORITIZATION FRAMEWORK”

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ABSTRACT; *This study investigated the institutional factors that influence the performance of Technology-Industrial Arts (TIA) trainers in Cagayan de Oro using Partial Least Squares Structural Equation Modeling (PLS-SEM) integrated with Importance-Performance Map Analysis (IPMA). The six factors were: facilities and equipment, teaching and staffing, curriculum-industry alignment, professional development opportunities, employment stability, and student competency outcomes. Results revealed that while respondents moderately agreed on out-of-field teaching and staffing, employment stability, and curriculum-industry alignment, outdated facilities and equipment, and limited professional development opportunities. Among the factors, student competency outcomes demonstrated a statistically significant positive influence on trainer performance ($\beta = 0.569$, $p < 0.001$), highlighting the importance of student achievement in shaping trainers' performance. Meanwhile, facilities and equipment, professional development, and employment stability had shown positive but non-significant influences. The IPMA results highlighted student competency outcomes as the most important factor, marking it as a priority area for institutional intervention. The findings also emphasize the need for educational institutions to invest in upgrading facilities, expanding professional development opportunities, and strengthening curriculum-industry linkages to ensure that the trainers are effective in preparing students for the labor market and industry demands.*

Keywords: Importance-Performance Map Analysis, Institutional factors, technology-industrial arts, trainer performance, student competency outcomes

INTRODUCTION

The continuous transformation of the global workforce due to digitalization, automation, and smart technologies in industries has pushed advanced countries like Singapore, Japan, and the United States to proactively align their educational systems with the changes and ensure that technical-vocational graduates are equipped with the skills and competencies needed in the workplace [1]. As industrial sectors become competitive, vocational and technical education has expanded with trainers as a link between the academe and industry practice [2]. This trend highlights the necessity of strengthening the Technology- Industrial Arts curriculum.

However, in developing countries like the Philippines, vocational and technical education face persistent challenges [3]. While the Technical Education and Skills Development Authority (TESDA), Department of Education (Dep.Ed.), and Higher Education Institutions (HEIs) have introduced training standards and competency-based curriculum, the gaps remain between industry demands and institutional capacity [4]. The issues, such as outdated facilities and equipment, inadequate staffing, and limited access to professional development, hindered trainers from delivering industry-aligned instruction [5, 6]. In addition, employment uncertainty had also undermined the trainers' commitment and morale [7]. These difficulties affect not only instructional delivery but also student competency outcomes, weakening the responsiveness of technology-industrial arts to the labor market.

Moreso, the National Certification (NC) system by the Technical Education and Skills Development Authority (TESDA), is a benchmark for competency-based standards in the technical vocational education in the Philippines.

The NCs from Level 1 to IV define the responsibilities, scope and autonomy of individuals who are performing technical tasks in varied industries. NC I represents routine and supervised operations, NC II covers different tasks with limited complexity, NC III encompasses independent and more complex work and supervision of others, and NC IV is performing higher-order responsibilities such as problem solving, analytical and evaluative

functions, and leadership. The recertifications ensure that trainers and trainees demonstrate measurable competencies that will meet the national standards and industries needs. Consequently, the trainers' performance in giving instructions aligns with the NC standards is said to determine the readiness and employability of graduates [8].

Hence, the trainer's performance significantly affects students' competency outcomes, yet remains underexplored. Previous research focuses only on students' achievement, skills mismatches, and academic deficiencies, but does not examine how institutional factors shape trainers' performance. Studies have acknowledged that facilities, curriculum, staffing, training, employment stability, and student achievement influence the quality of education, but few have investigated these factors within a unified framework.

The absence of this analysis limits evidence-based interventions. Hence, this study used the Importance Performance Map Analysis (IPMA) to investigate the factors such as facilities and equipment, teaching and staffing, curriculum-industry alignment, professional development opportunities, employment stability, and student competency outcomes as influences on trainer performance. Emphasizing the trainer's performance as a pivotal but underexamined dimension advances the theoretical understanding and practical policymaking.

BACKGROUND OF THE STUDY

Industrial and technological advancements continue to redefine the demands of the technology-industrial arts under the standard of industries [9]. Advanced countries demonstrate progressiveness in their educational systems with the evolving technological landscapes, ensuring that training programs equip students with the skills and competencies needed for the modern workforce [10]. As the industry continuously changes, it is indeed imperative for educational institutions to adapt to the technological changes, especially for the industrial arts courses [11]. However, the Philippines continues grappling with challenges in aligning educational programs with industry demands and standards [12]. The gap between workplace requirements and academic training has resulted in mismatches, underemployment of graduates, and low performance in national competency assessments [13];

14]. Meanwhile, TESDA, HEIs, and DepEd schools offering industrial-technology arts courses face pressures [15;16]. Integrating competencies into the National certifications underscores the need for curricular responsiveness. However, issues like inadequate training equipment and facilities, lack of qualified trainers, and limited access to continuous development

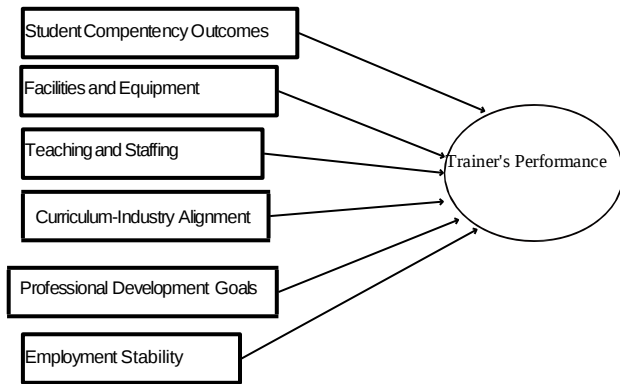


Figure 1. The conceptual framework

hinder the institutions' ability to provide quality training [17].

These institutional difficulties have affected the performance of the trainers serving as the link between curriculum standards and student competency outcomes.

The TESDA's National Certification covering NC I to IV, standardizes the qualifications of trainers and students within technical-vocational education. Each level corresponds to a progression of skills from basic to advanced analytical and supervisory skills. Its training regulations outline the required competencies, assessment and performance criteria which guide the trainers in curriculum development and implementation [18]. However, despite the clear standards, gaps remain to fully deliver NC-based instruction due to limited training resources, lack of qualified trainers and outdated facilities and equipment [19]. This situation highlights the need to examine the institutional factors that shape trainer performance and their competencies to uphold the standards prescribed by the NC framework.

Moreover, research shows that trainer performance is shaped by the institutions' teaching capability and structural and organizational factors [20]. The outdated equipment and insufficient facilities limit the provision of hands-on training; the out-of-field teaching assignments also weaken the quality of instruction; the misalignment of curricula with industry needs lessens the relevance of training; the lack of professional development among trainers and teachers reduces their ability to keep up with technological innovations [21]; and the instability of employment also erodes motivation and commitment. When these factors are present, they compromise the trainers' performance, trailed by low student competency and outcomes in the technology-industrial sector.

This study addresses the identified gaps by investigating how equipment and facilities, teaching and staffing, alignment of curriculum and industry standards, opportunities for professional development, employment stability, and student performance influence the trainer performance. By introducing a framework, this study provided actionable insights for HEIs, Dep. Ed. schools that offer Technology - Industrial Arts Track, and TESDA, to review policies that strengthen trainer performance, and alignment of technology-industrial arts education with Industry standards.

THEORETICAL FRAMEWORK OF THE STUDY

This study was anchored to the four interrelated theories that

explain how institutional, organizational, and motivational factors influence trainer performance in TIA education.

Systems theory is the work of Ludwig von Bertalanffy, which is adapted by different disciplines, emphasizing that academic institutions operate as interconnected structures where inputs like facilities, staffing, curriculum, and professional development affect student competency and trainer performance [22]. In this context of TIA, resource deficits disrupt the entire system, resulting in weak instructional delivery and graduate readiness [23]. This theory highlights the importance of seeing trainer performance as a systemic outcome shaped by the conditions in an institution or school.

The Job Demands-Resource (JD-R) Model by Bakker and Demerouti (2007) explains how job demands, in this case, the out-of-field teaching, inadequate facilities, and unstable employment, and job resources like professional development training influence employee performance [24;25]. In this study, the JD-R model frames trainer performance as a balance between institutional support and work pressures. Hence, an excessive demand with insufficient resources can lead to demotivation, burnout, and reduced productivity.

The Expectancy Theory of Motivation [26] posits that trainers are motivated to perform when they perceive that it will lead to performance that results in valued outcomes [27;28]. For TIA trainers, motivation is linked to the expectation of stable employment or career advancement. If these outcomes are uncertain, such as cases of contractual employment, trainers' efforts and commitment may be reduced, which will influence the quality of instruction and productivity.

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Taking the theories together has provided a multidimensional foundation in this study. Systems theory situates trainer performance within institutional structures, while the JD-R model explains the relationship of job demands and available resources; expectancy theory underscores the motivational dynamics behind the trainer's efforts, and constructivist learning theory connects the trainer's performance to meaningful student outcomes.

These collectively guided the investigation into how institutional factors influence trainer performance and how these factors can be prioritized through Importance-Performance Map Analysis (IPMA).

CONCEPTUAL FRAMEWORK OF THE STUDY

The Importance-Performance Map Analysis (IPMA) is an extension

of Partial Least Squares Structural Equation Modeling (PLS-SEM) that enables researchers to identify the statistical significance of predictors and evaluate their relative importance and performance in influencing an outcome variable. Figure 1 shows the conceptual framework of the study.

The framework shows the six key predictors identified: Student Performance, Facilities and Equipment, Teaching and Staffing, Curriculum–Industry Alignment, Professional Development Goals, and Employment Stability. Rectangular boxes represent each of these predictors to symbolize distinct latent constructs measured through multiple indicators in the study. The arrows drawn from each predictor toward the outcome variable illustrate these factors' hypothesized direct causal influence on Trainers' Performance. The one-way direction of the arrows signifies that the predictors are expected to influence the outcome construct. This structure reflects the assumption that institutional, instructional, and contextual factors collectively shape the overall performance of trainers.

Lastly, an oval represents the Trainers' Performance. This captures the effectiveness of trainers in areas such as instruction, skills transfer, and student engagement, making it the focal point of the analysis. By positioning Trainers' Performance as the outcome, the framework underscores the primary objective of the study: to identify which factors exert the most significant influence and how they perform in real practice. Through IPMA,

3. Do the perceived factors significantly influence Trainer Performance in terms of:

- a. Facilities and Equipment
- b. Out-of-Field Teaching and Staffing
- c. Curriculum–Industry Alignment
- d. Professional Development Opportunities
- e. Employment Stability
- f. Student Competency Outcomes

4. How important are the Perceived Institutional Factors in influencing Trainers' Performance?

5. How do the Perceived Institutional Factors perform in influencing Trainers' Performance?

HYPOTHESIS

The perceived factors do not significantly influence Trainer Performance in terms of:

- a. Facilities and Equipment
- b. Out-of-Field Teaching and Staffing
- c. Curriculum–Industry Alignment
- d. Professional Development Opportunities
- e. Employment Stability
- f. Student Competency Outcomes

SCOPE AND LIMITATION

The scope of this study encompassed a detailed investigation into the factors affecting alignment to the industry demand of State Universities and Colleges (SUCs), Technical Education, Skills Development Authority (TESDA), and the Department of Education (DepEd) that offers technology-industrial arts courses within the city of Cagayan de Oro. To comprehensively examine, the study employed the Importance- Performance Map Analysis (IPMA) model to identify and prioritize the critical multi-dimensional factors influencing trainer performance. The IPMA approach enabled a strategic assessment by mapping identified variables' importance and performance, thereby guiding targeted improvements and resource allocation within educational institutions.

the model validates the predictors of Trainers' Performance and provides actionable insights by ranking the factors that should be prioritized for institutional support and policy intervention.

STATEMENT OF THE PROBLEM

Although several schools are offering Technology-Industrial Arts, inadequate training equipment and facilities, a lack of qualified trainers, and limited access to continuous development hinder the institutions' ability to provide quality training, which has affected the performance of the trainers who are serving as the link between curriculum standards and student competency outcomes. Hence, this study examined the degree to which factors are perceived as significantly influencing the performance of Technology-Industrial Arts trainers.

RESEARCH QUESTIONS

Specifically, it answered the question:

1. What are the Perceived Institutional Factors influencing Trainers' Performance in terms of:

- a. Facilities and Equipment
- b. Out-of-Field Teaching and Staffing
- c. Curriculum–Industry Alignment
- d. Professional Development Opportunities
- e. Employment Stability
- f. Student Competency Outcomes

2. What is the perceived trainers' performance of the respondents?

However, the study had several limitations. The respondents of this study were limited only to schools that offered technology-industrial arts courses within Cagayan de Oro. The findings may be constrained by the sample size and the representativeness of the respondents, which could affect the broader applicability of the results. Moreover, only six common factors were confined to this framework: Facilities and Equipment; Out-of-Field Teaching and Staffing; Curriculum–Industry Alignment; Professional Development Opportunities; Employment Stability; and Student Competency Outcomes.

DEFINITION OF TERMS

The following terms are operationally defined to establish consistency and clarity in the usage within the context of this study.

Curriculum–Industry Alignment: This refers to the degree to which the Technology-Industrial Arts curriculum matches the current needs, practices, and standards of industries. This study measures how TIA courses respond to the demands of the labor market and prepare students with skills that are relevant, up-to-date, and employable.

Employment Stability: This refers to the security of employment experienced by trainers, which includes contractual status, tenure, and job regularization. In this study, it is a factor examined that which influences the trainers' commitment, motivation, and performance.

Facilities and Equipment: This refers to the physical resources and tools that are available in schools and institutions, which support hands-on instruction in TIA. In this study, it includes classrooms, laboratories, training centers, workshops, machines, equipment, and tools that are essential for skill training and competency development.

Importance-Performance Map Analysis (IPMA): This refers to the tool used to determine the direct influence of factors on trainer performance and each factor's relative importance and performance. It is used to identify priority areas for the policy review

of the technology-industrial arts curriculum and implementation factors.

National Certifications: This refers to the credentials given by authorized agencies like TESDA to certify an individual's skills and competencies in a specific TIA field. In this study, national certifications serve as benchmarks for assessing the competency of trainers and students in TIA.

Out-of-Field Teaching and Staffing: This refers to the assignment of trainers to teach subjects outside their area of specialization. In this study, it captures how mismatched staffing or insufficiently qualified trainers affect trainer performance.

Partial Least Squares Structural Equation Modeling (PLS-SEM): This refers to the statistical method of analyzing complex cause-and-effect relationships among variables. In this study, PLS-SEM is used as the analytical technique for testing the conceptual framework. In contrast, its extension, IPMA, is used to determine the importance and performance of the factors that influence trainer performance.

Professional Development Opportunities: This refers to the training, seminars, workshops, certifications, and learning opportunities made available to trainers. In this study, it highlights the importance of institutional support for trainers to keep abreast with industry standards and technological innovations.

Student Competency Outcomes: This refers to the knowledge, skills, and attitudes that learners are expected to demonstrate after training in technical-industrial arts. In this study, they represent one of the factors influencing the trainer's performance.

Technology-Industrial Arts: This refers to the field of specialization under Technical-Vocational Education (TechVoc) that encompasses skill-based and practical learning on areas such as: Automotive Servicing, Carpentry, Electrical Installation and Maintenance, Plumbing, Shielded Metal Arc Welding, Computer System Servicing, Visual Graphic Design, Technical Drafting, and Information Technology.

Trainers: This refers to the faculty handling technology-industrial Arts in TechVoc, who are responsible for facilitating practical skill development and ensuring that students acquire the industry-relevant skills. They serve as the respondents whose performance is assessed against the specified

REVIEW OF RELATED LITERATURE

This chapter presents a comprehensive review of the related literature that provides theoretical, empirical, and contextual support for the investigation. The review is organized into subheadings, with themes reflecting the institutional factors influencing trainer performance. Local and foreign literatures are integrated to highlight similarities, differences, and gaps. The review is subdivided into seven sections: Facilities and Equipment, Teaching and Staffing, Curriculum-Industry Alignment, Professional Development Opportunities, Employment Stability, Student Competency Outcomes, Importance-Performance Map Analysis (IPMA), and TESDA's National Certifications.

Literature Review

The effectiveness of Technology-Industrial Arts Education depends on the trainers' ability to connect the institutional resources with the changing demands of industries or labor markets [32]. Globally, vocational education is recognized as a driver of the workforce, specifically in rapidly evolving sectors [33]. In the Philippines, Technology-Industrial Arts Education trainers

are expected to provide technical knowledge and practical skills that are aligned to industry standards; however, the institutional context where they are affiliated often limits their performance due to material shortages and staffing issues, which undermine their role as facilitators of students' performance outcomes.

Despite the existence of many studies on vocational education, they have not yet integrated the six factors: Facilities and Equipment, Teaching and Staffing, Curriculum-Industry Alignment, Professional Development Opportunities, Employment Stability, and Student Competency Outcomes into a single evaluative model centered on trainer performance. There is also limited evidence on prioritizing these factors using the Importance-Performance Map Analysis (IPMA).

1. Facilities and Equipment

Adequacy of facilities and up-to-date equipment are crucial for effective Technology-Industrial Arts Education. State Universities and Colleges (SUCs), TESDA, and Department of Education schools have been criticized for their outdated laboratories and limited access to modern tools, which hamper the trainers' ability to deliver a quality learning experience [34]. The trainers were also often pushed to improvise with obsolete or makeshift equipment. The situation failed to provide learners with the required competencies in industry-standard workplaces. These insufficiencies are problematic where technological innovation rapidly outpaces institutional upgrades [35].

Moreover, the demands of industries underscore a growing divide between institutions that can adapt to rapid changes and those with minimal resources [36]. Studies have shown that the absence of smart technologies, laboratories for simulation, and operational systems hampers trainers' ability to integrate emerging practices into their teaching [37; 38]. This gap limits the students' preparedness for industries reliant on automation and digital integration. From the perspectives of Systems Theory, facilities are critical inputs; without adequate resources, the overall system's outputs and student and trainer performances are compromised [39].

Hence, while the importance of facilities is acknowledged in local and global studies, few have empirically linked them to trainer performance [40; 41; 42]. Most research focuses on students' skill development and acquisition, but not on how resource deficiencies have hindered trainers' teaching efficiency. This study addresses this gap by testing facilities and equipment as predictors of trainer performance.

2. Teaching and Staffing

Teaching and staffing assignments played a central role in identifying quality in instruction [43]. In the Philippines, trainers are assigned to subjects outside of their specialization, which results in mismatches that weaken classroom delivery [44]. Out-of-field teaching occurred due to a shortage of qualified trainers, which forces the schools to deploy available staff regardless of their expertise [45]. This situation not only compromises learning but also increases stress among trainers, as they grapple to deliver content not aligned to their expertise.

Research also highlights staffing concerns in vocational education. With the fast pace of technological changes, trainers are expected to be updated on new knowledge to remain effective [46]; however, a shortage of staffing leads to limited time for upskilling. The JD-R model explains this problem: when trainers face job demands due to mismatches and or shortages, while

resources needed also remain inadequate, resulting in burnout, demotivation, and compromised performance [47; 48; 49].

Although numerous studies focus on staffing shortage, few explicitly connect this to conditions of trainer performance in Technology- Industrial Arts contexts. They largely centered on student success and emphasized teacher workloads without integrating outcomes for trainers themselves. This study bridges this gap by situating teaching and staffing as factors of trainer performance, analytically assessed within the periodization framework.

3. Curriculum – Industry Alignment

A well-designed curriculum fosters training programs that meet the requirements of industries. TESDA's NC II has been disparaged for lagging behind industry needs [50]. Employers claimed that graduates lack the competencies required to contribute to the workplace, and highlighted the mismatch between what students learned and acquired and what the industry demands [51; 52]. These gaps continue despite the revisions or enhancements of curricula to modernize technical education. Moreover, curriculum misalignment remains a challenge across vocational systems. Studies note that as industries rapidly adopt new technologies, educational institutions take years to update their curriculum or programs [53; 54]. Employers in varied companies experience difficulty hiring graduates with the skills needed, reinforcing the problem. Further, the constructivist learning theory provided a lens highlighting that meaningful learning happens when training is done in an authentic, industry-relevant context [55; 56]. Without alignment, the curriculum risked producing graduates with theoretical knowledge but limited practical skills [57].

Most studies stop at diagnosing skills mismatches without linking curriculum alignment to trainer performance [58]. Moreover, few have investigated how trainers are affected when required to teach irrelevant or outdated curriculum [59;60]. Hence, this study addressed this gap by examining curriculum-industry alignment influencing trainer performance through IPMA.

4. Professional Development Opportunities

Professional development opportunities are crucial to trainers in technological-industrial arts fields [61]. Unfortunately, there is limited funding and support in Philippine TVET schools, constraining trainers' access to professional development opportunities such as immersion programs, workshops, and industry partnerships [62]. The trainers also recognized the importance of ongoing skill-updates, expressing intense demands to refine pedagogical and technical expertise [53]. Without opportunities, the trainers struggle to integrate new practices into their teaching.

Furthermore, most research highlighted the global importance of professional development in vocational education; as workplaces are shaped by the advancement of technologies, trainers are required to be exposed to continuous training with new processes and technologies [63]. When institutions fail to give access to professional development opportunities, trainers are left behind [64], which leads to a wide gap between what they teach and what the industries and employers practically need.

The expectancy theory explained that trainers' motivation to join professional developments is linked to their perceived outcomes [65]; when they see them as beneficial for career upgrade and recognition, trainers are eager to invest and give time

to it [66].

However, despite being known, most studies on student achievement have underscored the value of professional development without systematically measuring its effect on trainer performance. Few have examined how the absence or availability of professional development shapes the trainers' effectiveness in Technology-Industrial Arts. Hence, this study filled that gap by incorporating professional development as a predictor of trainer performance.

5. Employment Stability

Employment stability is important in trainer commitment and motivation [67]. Many Technology-Industrial Arts trainers remain in temporary positions, lack long-term jobs, and have no benefits. The uncertainty of their situation destabilized morale and discouraged them from investing in continuous development, as they see their employment as uncertain [68]. Contractualization is often justified as a budgetary measure and has long been complained about for reducing teaching quality and trainer retention [69].

Job insecurity is globally linked to higher stress levels and lower commitment among educators [70; 71]. Trainers with unstable employment are less likely to engage and view teaching as temporary than as a long-term path [72]. The JD-R model suggested that job insecurity increases the feeling of having higher job demands due to uncertainty [24;73], while eliminating the psychological resources that should be available for trainers. Similarly, expectancy theory posited that when reward and security are indefinite, the trainers are demotivated to put forth their best efforts and provide quality service [27].

Though the importance of employment stability is highlighted in broader perspectives on teacher performance studies, few have tested its direct impact on trainer performance in the technological-industrial arts context. Hence, this study filled the void by explicitly measuring employment stability as a factor of the trainer performance and situating it within a prioritization framework.

6. Student Competency Outcomes

Student competency outcomes are the most visible predictor of trainer performance [74; 75]. Many technological-industrial arts graduates demonstrate satisfactory theoretical knowledge but have fallen short with the practical skills required by industries [44]. The identified misalignment weakens the employability and reflects systemic weaknesses among training institutions. Moreover, employers expressed the need to provide additional hours of exposure or on-the- job training to compensate for the lack of readiness of graduates to real- life work [76;77].

Several studies also showed concerns, such as employers worldwide highlighting that vocational graduates lack problem-solving skills, adaptability, and advanced technical skills even though they have completed accredited programs [53]. The systems theory underpins that these outcomes reflect not only the student performance outcome but also the institutional inputs, such as staffing, curriculum, facilities, and trainer professional development [39; 78]. Henceforth, weak student outcomes point to systemic deficiencies in education.

While studies examine student outcomes in the vocational education context, few have linked these outcomes to trainer performance. Most research presents poor student competencies as a facility or curriculum issue, without exploring the trainers' role. This study included the student performance outcomes as an

institutional factor influencing trainer performance.

7. Importance–Performance Map Analysis (IPMA)

The IPMA provides a methodological innovation [79] for examining trainer performance. Unlike other models, which only assess the significance of predictors, IPMA evaluates the importance and performance, allowing institutions to prioritize factors with the highest impact [80]. This perspective is helpful in a resource-constrained environment like Philippine vocational education.

Moreover, IPMA has been applied in education to identify areas where reforms can create the most significant improvements, like curriculum relevance, institutional supports, and teacher training. IPMA equips schools and institutions with evidence-based insights for policy and resource prioritization by mapping which factors are most crucial but underperforming. Hence, its growing adoption in international research underscores its use in educational systems' decision-making.

However, despite its promising purpose, IPMA is not widely used in the Philippine education system, specifically in Technology-Industrial Arts contexts. It is observed that most local studies are focused on descriptive or correlational methods, which leaves a gap in prioritization frameworks. Thus, applying IPMA to evaluate the institutional factors offers theoretical contributions and practical guidance for educators and policymakers.

8. TESDA's National Certifications

The Technical Education and Skills Development Authority (TESDA) has established the National Certification System as a benchmark for competency in technical education. Each level corresponds to competencies and degrees of autonomy. NC I focuses on routine and tasks which are under supervision; NC II is broader but limited in decision making, NC III is complex and non-routine tasks which require independence; while NC IV performs analytical supervisory and leadership roles that contribute to the improvement of the standards [81].

Moreover, trainers are required to use the Training Regulations from the NC structure as the foundation for lesson planning, assessment, and curriculum development. TESDA also requires training institutions to implement competency-based learning approaches where mastery than time spent in training, will determine the certification eligibility [82].

For trainers, having an NC level and completing relevant training courses are prerequisites for teaching in accredited technical schools [15; 83]. This ensures that the delivered instruction is given by trainers who understand the competencies and effectively assess and certify learning based on TESDA guidelines. However, research and evaluations found challenges such as limited access to professional development, a scarcity of equipment and facilities, and inconsistent adherence to standards. These factors, among others, directly impact the trainer's ability to produce graduates who meet national competency standards.

Thus, integrating the NC framework into Technology-Industrial Arts education gives quality assurance and accountability on providing structured pathways for student progression and trainers' professional development. Yet, as issues continue to persist, aligning the delivery with NC I-IV standards remains a challenge for TESDA-accredited schools, HEIs, and the Department of Education. Addressing this gap is crucial to achieving the goal of producing competitive and industry-ready graduates.

Synthesis

The reviewed literature has consistently identified facilities, staffing, curriculum, professional development, employment stability, and student outcomes as factors influencing trainer performance. However, research gaps are cited as these factors are treated in isolation and not integrated into a single comprehensive model. In addition, only a few studies explicitly investigate how

these conditions collectively shape trainer performance in Technology-Industrial Arts.

Another is the limited use of IPMA in the Philippine vocational education setting. While IPMA has gained recognition internationally for its ability to generate actionable insights, it remains underutilized locally. Due to this, policymakers lack a structured framework for determining which institutional factors should be prioritized to improve the trainer performance. Thus, applying IPMA within the PLS-SEM framework to empirically test the six factors influencing trainer performance would address the gaps.

Moreover, this highlights that TEDA's National Certifications (NC I- IV) serves as instruments for ensuring competency alignment in training institutions and industry needs. NC framework also strengthens accountability and quality assurance which provide TIA instructions with measurable indicators for students and trainers. However, persistent issues undermine the implementation of the standards; addressing them is essential to uphold credibility and purpose of TESDA's certification system and the institutions that are offering Technology-Industrial Arts courses.

METHODOLOGY

Research Design

The study utilized a quantitative research design, which focused on the collection and analysis of numerical data to explain patterns, relationships, and effects among variables. This design emphasizes objectivity and replicability by employing structured instruments and statistical techniques that allow the researcher to measure constructs in a systematic manner [84]. With quantifiable data, the study was able to test hypotheses, evaluate relationships, and generate results that could be generalized to a broader population.

Specifically, the study will be anchored to the Importance–Performance Map Analysis (IPMA) model under the framework of Partial Least Squares Structural Equation Modeling (PLS-SEM). This design was chosen because it establishes the causal relationships among latent constructs, assesses measurement reliability, and identifies the relative importance and performance of multiple detrimental factors influencing the overall performance of Technology–Industrial Arts trainers [85]. By employing PLS-SEM, the study was able to handle complex models with multiple predictors and remained robust even with non-normally distributed data.

In addition to identifying significant causal paths, the design integrated the IPMA procedure, which extended the results of PLS-SEM by prioritizing the factors based on their importance and performance. This approach not only contributed to theoretical knowledge but also generated practical implications for policymakers, educational administrators, and trainers themselves [86]. The quantitative orientation ensured objectivity, replicability, and statistical rigor, making it highly suitable for producing a prioritization framework in technical and vocational education research.

Sample, Sample Size, and Sampling Technique

The study consisted of a minimum of 91 Technology–Industrial Arts trainers employed in both public and private Technical-Vocational and Senior High Schools offering TechVoc specializations. Given the specialized nature of the population and the need to obtain respondents with direct, relevant experience, the study adopted purposive sampling to select trainers who had at least one year of teaching experience in technology-industrial

subjects. Purposive sampling ensured that participants possessed the necessary contextual knowledge to provide valid responses about the multi-detrimental factors under investigation.

Sample size was determined using an a priori statistical power analysis performed in GPower v.3.1.9.x. The analysis used parameters appropriate for a multiple regression/PLS-SEM with an effect size of f^2

$= 0.15$ (medium effect), significance level $\alpha = 0.05$, desired statistical power $(1 - \beta) = 0.95$, and 6 predictors representing the key detrimental factors entered in the model. The GPower output showed a minimum required sample size of 89, which made the collected sample of 91 more reliable in ensuring adequate statistical power and robustness of IPMA results through PLS-SEM

Research Instrument

The study utilized a structured survey questionnaire as the primary research instrument. The instrument consisted of items adopted and modified from validated scales in previous studies on instructional performance, institutional support, and professional development. To ensure contextual relevance, modifications were made to align the items with the realities of Technology-Industrial Arts trainers, particularly referencing facilities, equipment, and curriculum-industry linkages. The final questionnaire consisted of 23 items focusing on the study constructs, was measured using a four-point Likert Scale.

Table 1. Likert Scale Interpretation		
Scale	Interval	Verbal Interpretation
1	1.00 to 1.75	Strongly Disagree
2	1.76 to 2.50	Disagree
3	2.51 to 3.25	Agree
4	3.26 to 4.00	Strongly Agree

Specifically, the predictors included Student Performance (4 items), Facilities and Equipment (3 items), Teaching and Staffing (3 items), Curriculum-Industry Alignment (3 items), and Professional Development Opportunities (3 items). The outcome construct, Trainer Performance, was measured through 4 items covering instruction, skills transfer, and student engagement. To ensure clarity and reliability, the questionnaire was validated and pilot tested with 15 respondents who were not part of the final sample [87]. The pilot test yielded Cronbach's alpha values ranging from 0.895 to 0.971, indicating that the constructs demonstrated reliability levels from Good to Excellent. This suggested that the researcher-made instrument was internally consistent in measuring the target constructs.

Table 2. Reliability Test Scores of the Instrument

Variable	Cronbach's Alpha	Excellent
Student Competency Outcomes	0.938	Excellent
Trainers' performance	0.971	Excellent
Facilities and Equipment	0.903	Excellent
Teaching and Staffing	0.930	Excellent
Curriculum-Industry Alignment	0.966	Excellent
Professional Development Opportunities	0.895	Good
Employment Stability	0.900	Excellent

RESULTS AND DISCUSSION

This section presents the results and discussion of the study. The analysis focuses on predetermined factors that are examined not only in terms of mean scores and interpretations but also its connection to existing studies that provide context and validation. The chapter also presents the Importance Performance Map Analysis result to show which factors significantly affect trainer performance and

identify priority areas for improvement. Moreover, this section provides a comprehensive understanding of the dynamics in shaping trainer effectiveness in Technology-Industrial Arts education.

Perceived Institutional Factors Influencing Trainers' Performance

Table 3 presents the Perceived Institutional Factors Influencing Trainers' Performance in terms of Student Competency Outcomes.

Table 3. Perceived Institutional Factors Influencing Trainers' Performance in terms of Student Competency Outcomes

Table 3. Perceived Institutional Factors Influencing Trainers' Performance in terms of Student Competency Outcomes			
	Mean	SD	VI
Excellent	2.45	1.11	Disagree
Excellent	2.52	1.21	Agree
Good	2.52	1.1	Agree
Excellent	2.53	1.11	Agree

Data collection

Data collection began with the distribution of survey questionnaires to the identified sample of trainers. Formal letters of request were sent to school administrators and training centers to secure permission for the participation of trainers in the study. Once approval was granted, the questionnaires were disseminated in both printed and online formats to maximize accessibility and response rates. Clear instructions were provided to all respondents, and participation was strictly voluntary, with informed consent obtained prior to answering the survey. Confidentiality and anonymity were also assured to encourage honest and unbiased responses.

To ensure data quality, all retrieved questionnaires underwent a systematic process of data cleaning and preparation. Incomplete, duplicate, or inconsistent responses were screened and removed to preserve data integrity. Responses were then centralized and encoded into a secure database to standardize data formatting, reduce entry errors, and prepare the dataset for statistical analysis, ensuring that the final dataset was accurate, reliable, and ready for PLS-SEM and IPMA analyses.

Data analysis

The study utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS software to analyze the data. Prior to the main analysis, the data underwent screening to check for missing values, outliers, and inconsistencies. Incomplete and duplicate responses were removed to preserve data quality. Descriptive statistics, including frequency counts, means, and standard deviations, were computed to summarize the respondents' demographic profile and the initial distribution of survey items.

The measurement model was assessed to establish reliability and validity. Reliability was confirmed through Cronbach's alpha, composite reliability (CR), and ρ_A , while convergent validity was evaluated using Average Variance Extracted (AVE). Meanwhile, discriminant validity was tested using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT). The results were tabulated to show that the indicators loaded strongly on their respective constructs and that the constructs were reliable and distinct. Following this, the structural model was analyzed to determine the hypothesized relationships among detrimental factors and trainer performance. Standardized path coefficients (β) were estimated, and their significance was tested through bootstrapping with 5,000 subsamples. Coefficient of determination (R^2) values were reported to indicate the explanatory power of the model, while

effect sizes (f^2) were computed to assess the contribution of each predictor. Predictive relevance (Q^2) was examined using the blindfolding procedure, and the Standardized Root Mean Square Residual (SRMR) was reported as a measure of model fit.

Finally, the study conducted Importance-Performance Map Analysis (IPMA) within SmartPLS to extend the findings. IPMA was applied to identify factors that had a strong total effect (importance) on trainer performance but relatively low performance scores. Importance values were based on the total effects of predictors, while performance scores were derived from the latent variable scores rescaled to a 0–100 range. The results were presented in tables and an IPMA map, which highlighted priority areas where improvements would yield the greatest impact. This analysis served as the basis for developing the proposed prioritization framework.

It can be seen that the highest mean score of 2.53 from the statement "My students consistently achieve satisfactory results in assessments and practical exams," interpreted as "Agree," suggesting confidence in students' ability to meet performance standards.

Conversely, the lowest mean, 2.45, "My students demonstrate the necessary technical skills required by the industry," interpreted as "Disagree," highlighting a perceived gap between students' acquired skills and industry requirements. Saro et al. (2025) [88] revealed that whereas educators evaluated student performance favorably in controlled assessment environments, they exhibited diminished confidence regarding the applicability of the same abilities in industry settings, highlighting a persisting disparity between academic success and job readiness.

This reflects the findings of the current study, which indicate that students demonstrate proficiency in tests yet remain deficient in technical, industry-specific abilities.

Table 4 shows the Perceived Institutional Factors Influencing Trainers' Performance in terms of Facilities and Equipment.

Table 4 shows the Perceived Institutional Factors Influencing Trainers' Performance in terms of Facilities and Equipment			
Institutional Factors	Mean	SD	VI
1.The tools and equipment available in the workshop are adequate for training	2.35	1.1	Disagree
2. The workshop environment meets safety standards and is conducive to learning	2.47	1.05	Disagree
3.The institution is equipped with modern	2.3	1.02	Disagree

It can be seen that the highest mean of 2.47 is from the statement "The workshop environment meets safety standards and is conducive to learning," which is interpreted as "Disagree." This implies that while safety measures exist, the learning environment may not be fully supportive. Furthermore, the lowest mean of 2.30 for "The institution is equipped with modern technological devices relevant to the industry," also interpreted as "Disagree," which reflects concerns over outdated technology. Cheah et al. (2022) [89] indicated that limited access to contemporary equipment diminished instructors' trust in providing industry-relevant training, corroborating the current findings that emphasize safety compliance yet reveal insufficient technological resources.

Table 5 presents the perceived institutional factors influencing trainers' performance in terms of Teaching and Staffing.

Table 5. Perceived Institutional Factors Influencing Trainers' Performance in terms of Teaching and Staffing			
Institutional Factors	Mean	SD	VI
1.My teaching assignments are aligned with my field of expertise.	2.71	1.23	Agree
2.The teacher–student ratio allows effective supervision and instruction	2.52	1.14	Agree
3. The reliance on part- time teachers affects continuity of instruction	2.47	1.15	Disagree
4. My students are employable and meet industry expectations upon graduation			

However, the lowest mean of 2.48 corresponds to "The training modules and materials I use are up-to-date and reflect current industry practices," interpreted as "Disagree," indicating that while the curriculum itself is aligned, the specific instructional materials may not fully reflect current industry practices

This is in accordance with Sarstedt et al. (2024) [91], who highlighted that although strategic alignment at the curriculum level is essential, discrepancies often persist regarding the timeliness and industry relevance of instructional materials, aligning with the current findings. Table 7 presents the perceived institutional factors influencing trainers' performance in terms of Professional Development Opportunities.

It can be seen on the table that the statement "My teaching assignments are aligned with my field of expertise" got the highest mean of 2.71, which has the interpretation "Agree," indicating trainers feel appropriately matched to their teaching roles.

In contrast, "The reliance on part-time teachers affects the continuity and quality of instruction" has the lowest mean of 2.47, which is interpreted as "Disagree," suggesting trainers do not perceive part-time staff as detrimental. Standard deviations of 1.23 and 1.15 suggest moderate consensus. This aligns with Amemisor et al. (2025) [90], who discovered that professional alignment significantly predicts teacher performance; however, the inclusion of part-time teachers does not inherently reduce instructional quality, corroborating the current study's conclusion of neutrality regarding part-time employment.

In contrast, "The reliance on part-time teachers affects the continuity and quality of instruction" has the lowest mean of 2.47, which is interpreted as "Disagree," suggesting trainers do not perceive part-time staff as detrimental. Standard deviations of 1.23 and 1.15 suggest moderate consensus. This aligns with Amemisor et al. (2025) [90], who discovered that professional alignment significantly predicts teacher performance; however, the inclusion of part-time teachers does not inherently reduce instructional quality, corroborating the current study's conclusion of neutrality regarding part-time employment. Table 6 presents the perceived institutional factors influencing trainers' performance in terms of Curriculum–Industry Alignment.

Table 6. Perceived Institutional Factors Influencing Trainers' Performance in terms of Curriculum–Industry Alignment			
Institutional Factors	Mean	SD	VI
1 The training modules and materials I use reflect industry practices.	2.48	1.17	Disagree
2.The curriculum effectively incorporates input from industry partners.	2.53	1.1	Agree
3.The pace of technological adoption in the curriculum is sufficient	2.53	1.04	Agree

Table 7. Perceived Institutional Factors Influencing Trainers' Performance in terms of Professional Development Opportunities				
Outcome Trainers' Performance	2.43	1.07	Disagree	
I am effective at managing my workshop and ensuring productivity.	2.42	1.05	Disagree	
I keep students engaged and motivated during training sessions	2.48	1.09	Disagree	

The statement "There is a system in place for regular upskilling to keep my skills and knowledge current," received the highest mean of 2.48, and the lowest mean, 2.43, for "There are sufficient opportunities for me to receive training directly from industry professionals," which both interpret as "Disagree." The results reflect that there are perceived deficiencies in structured professional development and reinforce the notion that hands-on industry engagement remains limited. A comprehensive study conducted by Liu et al. (2024) [92] utilizing PLS-SEM with over 16,000 STEM educators revealed that the quality of digital professional development is significantly influenced by teachers' involvement in professional learning communities; those without such engagement reported diminished opportunities for genuine, industry- professionals is regarded as inadequate.

Table 8 presents relevant upskilling. This corroborates the observation that, although certain upskilling programs are available, direct training with industry the perceived institutional factors influencing trainers' performance in terms of Employment Stability.

Table 8. Perceived Institutional Factors Influencing Trainers' Performance in terms of Employment Stability			
Institutional Factors	Mean	SD	VI
1. There are opportunities to receive training from industry professionals	2.43	1.07	Disagree
2. I receive regular training on modern pedagogical methods	2.42	1.05	Disagree
3. A system for regular upskilling is in place	2.48	1.09	Disagree

For Curriculum-Industry Alignment, the statement "The curriculum effectively incorporates input from industry partners," garnered the highest mean of 2.53, which is interpreted as "Agree," suggesting recognition of a strong curriculum-industry connection. . The statement "I feel secure in my current job and role at the institution," received the highest mean of 2.57, which is interpreted as "Agree." This indicates that trainers generally feel secure in their employment. Whereas the lowest mean of 2.49, for "The institution has a high turnover rate among trainers," which is interpreted as "Disagree," suggests that trainers disagree with the idea of high turnover, which supports the overall feeling of job security. A recent study conducted by Ghasemy and Yuan [93] on lecturers in Malaysian institutions revealed that the intention to remain, a facet of perceived job security, is a more robust predictor than turnover intention among academic personnel, especially in stable institutional environments. This corresponds with the findings that trainers express confidence in their positions and often contest the notion of significant turnover, indicating low turnover intention and substantial employment security. Table 9 presents a consolidated table of the perceived institutional factors influencing trainers' performance.

Table 9. Consolidated Means of the Perceived Institutional Factors Influencing Trainers' Performance

Table 9. Consolidated Means of the Perceived Institutional Factors Influencing Trainers' Performance				
Factors	Mean	SD	VI	Rank
1. Student Competency Outcomes	2.50	1.06	Agree	4th
2. Facilities and Equipment	2.37	1.02	Disagree	6th
3. Teaching and Staffing	2.57	1.08	Agree	1st
4. Curriculum-Industry Alignment	2.51	1.06	Agree	3rd
5. Professional development Opportunities	2.44	1.01	Disagree	5th
6. Employment Stability	2.54	1.03	Agree	2nd

The table shows Teaching and Staffing with a mean score of 2.57, Employment Stability with 2.54, Curriculum-Industry Alignment with 2.51, and Student Competency Outcomes with 2.50, which is interpreted as "Agree." These findings suggest that trainers generally feel secure in their employment, recognize the alignment of their teaching responsibilities with their expertise, and see efforts to integrate industry needs into the curriculum. They also express modest confidence in their students' ability to meet academic and practical standards. Ulfa et al. (2022)

[94] obtained similar findings, utilizing PLS-SEM to analyze institutional and instructional factors influencing teacher effectiveness in vocational education. Employment security, suitable teaching assignments, and curriculum conformity with industry were favorably correlated with teacher satisfaction and performance, although student competency outcomes received moderate ratings. This aligns with the present findings, where trainers recognize institutional and curricular strengths yet express reservations regarding students' preparedness. On the contrary, the factors Facilities and Equipment, with a mean score of 2.37, and Professional Development Opportunities, with a mean score of 2.44, are interpreted as "Disagree." These results point to a lack of adequate resources and modern technological tools within the institution, as well as limited opportunities for trainers to enhance their skills through systematic upskilling or direct training from industry professionals. Such deficiencies may hinder the capacity of trainers to deliver effective instruction that is aligned with current industry practices. A study conducted by Jiahui et al. (2022) [95] in Turkish vocational institutions similarly posited that inadequate technical infrastructure and insufficient Professional Development Opportunities significantly diminished teachers' perceived instructional efficiency. Their findings highlight that inadequacies in resources and organized upskilling hinder trainers' capacity to satisfy changing industry norms, aligning with the current results.

Perceived Level of Trainers' Performance

The same with Ismail et al. [96] who employed PLS-SEM to evaluate the performance metrics of vocational educators and discovered that performance perceptions could be consistently measured using numerous indicators, hence endorsing the methodology utilized in the current study. Table 5 presents the perceived trainers' performance of respondents.

Table 10 presents the perceived level of Trainers' Performance.

Table 10. Perceived Level of Trainers' Performance			
Institutional Factors	Mean	SD	VI
1. There are opportunities to receive training from industry professionals.	2.69	1.07	Agree
2. I receive regular training on modern pedagogical methods.	2.62	1.05	Agree
3. A system for regular upskilling is in place	2.60	1.09	Agree
I align my training content with industry needs	2.52	1.13	Agree
Overall	2.61	1.05	Agree

As can be seen on table, the statement "I am confident in the quality of my instructional delivery" received the highest mean score of 2.69, which was interpreted as "Agree." This indicates that trainers generally perceive themselves as effective in delivering lessons and are confident in the quality of their instructional methods. In contrast, the lowest mean of 2.52 was recorded for the statement "I align my training content with industry needs," also interpreted as "Agree." This suggests that while trainers acknowledge the importance of aligning content with industry requirements, they perceive challenges in fully meeting these standards. The overall mean of 2.61, which also interprets as "Agree," reflects that trainers generally view their performance positively despite the presence of improvements are needed in ensuring stronger industry alignment. Similar trends were observed by [97], who investigated vocational instructors' self-assessments of instructional efficacy. Their findings indicated that teachers often assessed their instructional delivery more favorably than their capacity to incorporate changing industry demands, implying confidence in pedagogy while acknowledging deficiencies in industry alignment. This reflects the current findings, wherein trainers exhibit confidence in lesson execution yet recognize difficulties in maintaining the training material's complete relevance to the industry.

Influence of the Perceived Institutional Factors on Trainer Performance

The statement "I feel secure in my current job and role at the institution," received the highest mean of 2.57, which is interpreted as "Agree." This indicates that trainers generally feel secure in their employment. Whereas the lowest mean of 2.49, for "The institution has a high turnover rate among trainers," which is interpreted as "Disagree," suggests that trainers disagree with the idea of high turnover, which supports the overall feeling of job security. A recent study conducted by Ghasemy and Yuan [93] on lecturers in Malaysian institutions revealed that the intention to remain, a facet of perceived job security, is a more robust predictor than turnover intention among academic personnel, especially in stable institutional environments. This corresponds with the findings that trainers express confidence in their positions and often contest the notion of significant turnover, indicating low turnover intention and substantial employment security.

Table 9 presents a consolidated table of the perceived institutional factors influencing trainers' performance.

Table 11 shows the outer loadings of indicators for each construct on the influence of the perceived institutional factors on trainer performance.

Indicators	CIA	EMS	FAE	PDG	SCO	TAS	TRP
CIA1	0.965						
CIA2	0.953						
CIA3	0.965						
EMS1		0.957					
EMS2		0.928					
EMS3		0.953					
FAE1			0.966				
FAE2			0.963				
FAE3			0.965				
PDO1				0.939			
PDO2				0.956			
PDO3				0.950			
SCO1					0.947		
SCO2					0.950		
SCO3					0.942		
SCO4					0.927		
TAS1						0.925	
TAS2						0.944	
TAS3						0.902	
TRP1							0.936
TRP2							0.952
TRP3							0.958
TRP4							0.959

Legends:

Curriculum–Industry Alignment (CIA), Employment Stability (EMS), Facilities and Equipment (FAE), Professional Development Opportunities (PDO), Student Competency Outcomes (SCO), Teaching and Staffing (TAS), Trainers' Performance (TRP)

As shown in the table, all indicators across the seven constructs—CIA, EMS, FAE, PDO, SCO, TAS, and TRP have high outer loadings, ranging from 0.902 to 0.965. These values exceed the commonly accepted threshold of 0.70, indicating strong indicator reliability, which implies that each item effectively measures its respective construct, further supporting the validity and consistency of the reflective measurement model used to assess the influence of perceived institutional factors on trainer performance.

Adler et al. [98] established that loadings beyond 0.90 indicate robust evidence of indicator reliability and convergent validity in the evaluation of reflective conceptions within educational research. This suggests that the current findings affirm that the indicators for CIA, EMS, FAE, PDO, SCO, TAS, and TRP accurately assess their respective constructs.

Table 12 presents the reliability and validity of constructs based on Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE).

Table 12. Reliability and Validity of Constructs Based on Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE)

	Cronbach's alpha	Composite reliability (pc)	Average variance extracted (AVE)
CIA	0.958	0.973	0.923
EMS	0.942	0.963	0.896
FAE	0.963	0.976	0.930
PDO	0.944	0.964	0.900
SCO	0.957	0.969	0.886
TAS	0.914	0.946	0.853
TRP	0.965	0.974	0.905

Legends:

Curriculum–Industry Alignment (CIA), Employment Stability (EMS), Facilities and Equipment (FAE), Professional Development Opportunities (PDO), Student Competency Outcomes (SCO), Teaching and Staffing (TAS), Trainers' Performance (TRP)

It can be gleaned in Table 12 that all constructs demonstrate excellent reliability and validity. Cronbach's alpha (α) values range from 0.914 to 0.965, exceeding the acceptable threshold of 0.70, indicating high internal consistency. Similarly, composite reliability (pc) values are all above 0.90, which confirms the constructs' reliability. The Average Variance Extracted (AVE) values range from 0.853 to 0.930, surpassing the recommended

0.50 cutoff, which signifies strong convergent validity for all constructs. The reported Cronbach's alpha, composite reliability, and AVE values exceed the recommended thresholds, aligning with recent findings by Hair et al. [99] suggesting that α and pc values above 0.70 and AVE values above 0.50 indicate robust construct reliability and convergent validity in PLS-SEM models. Table 13 shows the discriminant validity assessment using the Heterotrait-Monotrait Ratio (HTMT).

Table 13. Discriminant Validity Assessment Using Heterotrait-Monotrait Ratio (HTMT)

	CIA	EMS	FAE	PDO	SCO	TAS	TRP
CIA							
EMS	0.964						
FAE	0.892	0.823					
PDO	0.977	0.957	0.919				
SCO	0.939	0.913	0.958	0.938			
TAS	0.949	0.941	0.924	0.947	0.980		
TRP	0.945	0.948	0.904	0.954	0.989	0.980	

Legends:

Curriculum–Industry Alignment (CIA), Employment Stability (EMS), Facilities and Equipment (FAE), Professional Development Opportunities (PDO), Student Competency Outcomes (SCO), Teaching and Staffing (TAS), Trainers' Performance (TRP)

It can be seen in Table 12 that the HTMT values between constructs are mostly above the commonly recommended threshold

of 0.85 (and some even above 0.90), indicating potential issues with discriminant validity among several constructs. Specifically, high HTMT values such as 0.964 between CIA and EMS, and 0.980 between TAS and TRP suggest that these constructs may not be sufficiently distinct from each other. This implies a need to further evaluate the measurement model, possibly by revisiting indicator assignments or considering model respecification to ensure that each construct captures a unique concept. The heightened HTMT values align with the findings of Rasoolimanesh (2022) [100], where HTMT values exceeding 0.90 signify a deficiency in discriminant validity, implying that constructs may not be empirically distinct.

Table 14 shows the structural model fit indices as revealed by SRMR and R-squared values

Table 14. Structural Model Fit Indices as revealed by SRMR and R-Squared Values

Model Fit Indices	Value
SRMR	0.030
R ²	0.937
R ² Adjusted	0.943

It can be seen in the table that the model demonstrates excellent fit and explanatory power. The Standardized Root Mean Square Residual (SRMR) value is 0.030, which is below the recommended threshold of 0.08, indicating a good model fit. The R-squared value of 0.937 and the adjusted R-squared of 0.943 suggest that the model explains approximately 93.7% to 94.3% of the variance in the endogenous construct, which further implies a very strong predictive capability. Schamberger et al. (2022) [101] established that SRMR values around 0.08 signify a decent fit in PLS- SEM, whereas elevated R² values suggest substantial

Perceived Institutional Factors on Trainer Performance

explanatory power of the structural model. This affirms that the current study's finding shows that the model exhibits both resilience and significant predictive performance. Table 15 shows the path coefficients on the influence of the perceived institutional factors on trainer performance.

It can be seen in the table that among the variables influencing trainer performance, only the path from Student Competency Outcomes (SCO) to Trainer Performance (TRP) is statistically significant, with a coefficient of 0.569 and a p-value of 0.000.

This strong positive influence suggests that better student competency outcomes substantially enhance trainer performance.

The substantial positive impact of Student Competency Outcomes on Trainer Performance aligns with the findings of Suhayat et al. (2023) [102], which validate the determinants of teacher performance and identify student achievement indicators as among the most potent predictors of instructors' perceived effectiveness. This further suggests that augmenting student capabilities directly enhances perceived trainer performance.

The path from Curriculum-Industry Alignment (CIA) to trainer performance shows a very small coefficient of 0.003 and a high p-value of 0.977, indicating no significant influence. This indicates that alignment between curriculum and industry demands may not directly influence trainers' effectiveness within the current context suggesting that alignment with industry demands does not consistently correlate with perceived teacher or trainer performance.

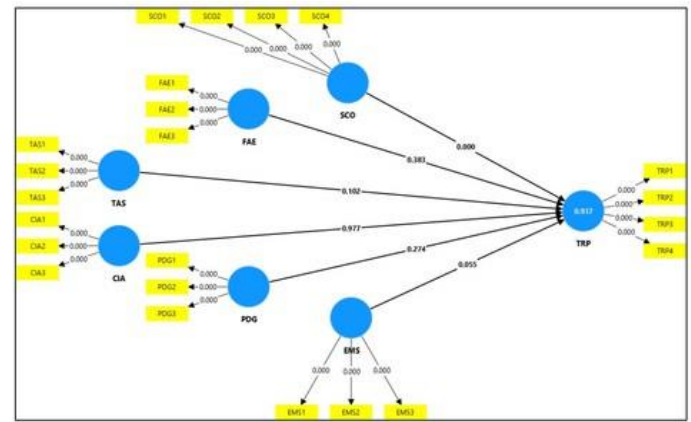


Figure 2. PLS-SEM Framework of the Influence of the

Table 15. Path Coefficients on the Influence of the Perceived Institutional Factors on Trainer Performance

Path	Coefficient	t-value	p-value	Significance
CIA → TRP	0.003	0.029	0.977	Not Significant
EMS → TRP	0.182	1.920	0.055	Not Significant
FAE → TRP	-0.088	0.872	0.383	Not Significant
PDO → TRP	0.164	1.094	0.274	Not Significant
SCO → TRP	0.569	4.799	0.000	Significant
TAS → TRP	0.169	1.637	0.102	Not Significant

Legends:-

Curriculum-Industry Alignment (CIA), Employment Stability (EMS), Facilities and Equipment (FAE), Professional Development Opportunities (PDO), Student Competency Outcomes (SCO), Teaching and Staffing (TAS), Trainers' Performance (TRP)

Table 16. Data of the importance-performance map for extended

Variables	Importance	Performance
CIA	0.003	50.047
EMS	0.128	51.317
FAE	0.088	45.784
PDO	0.164	48.114
SCO	0.569	50.081
TAS	0.169	52.296

Legends:-

Curriculum-Industry Alignment (CIA), Employment Stability (EMS), Facilities and Equipment (FAE), Professional Development Opportunities (PDO), Student Competency Outcomes (SCO), Teaching and Staffing (TAS), Trainers' Performance (TRP)

A study on Industry 4.0 mapping in Indian higher education institutions revealed that updating the curriculum to incorporate Industry 4.0 practices was significantly correlated with certain outcomes. However, its less direct or weaker associations with teaching quality in other areas of the model were not significant implying that, while curriculum congruence is essential, its direct impact on trainer performance may be constrained by contextual or mediating variables [103].

Employment Stability (EMS) has a coefficient of 0.182 with a p-value of 0.055, which is marginally above the conventional significance level. While the positive coefficient hints at a potential influence on trainer performance, this influence is not statistically significant, suggesting further investigation or a larger sample might be needed. Similarly, Mydin et al. [104] found that elements of professional learning communities, such as shared values, supportive leadership, and collective learning, had a positive correlation with teacher performance. This suggests that while an EMS (employment stability) assignment might indicate a mismatch for an educator, support from the institution can lessen its negative impact. This

institutional support could be the reason why the study's model shows that EMS has a positive, but not statistically significant, effect. In other words, the supportive environment is likely buffering any potential negative outcomes of the mismatch. Facilities and Equipment (FAE) exhibits a negative coefficient of -0.088 and a p-value of 0.383, showing no significant influence on trainer performance. This implies that variations in facilities and equipment do not meaningfully influence trainer performance in this model.

Kanya et al. [105] indicated that although facilities and infrastructure are crucial for the total learning environment, they did not directly forecast teacher performance in their PLS-SEM model. This implies that the findings show that discrepancies in facilities and equipment may not significantly affect trainer performance.

Professional Development Opportunities (PDO) has a positive but non-significant coefficient of 0.164 with a p-value of 0.274. This suggests that while professional development may contribute to trainer performance, the evidence here is insufficient to confirm a meaningful influence. This is supported by the study of Susanti et al. [106] suggesting that "teacher's opportunity" and "professional development" exhibited a positive yet statistically insignificant correlation with teacher performance in their model. Thus, professional development demonstrates potential although it lacks statistical significance in the setting.

Lastly, Teaching and Staffing (TAS) shows a coefficient of 0.169 with a p-value of 0.102, which is not statistically significant. While the positive trend suggests a link, the results do not confirm that Teaching and Staffing directly influence trainer performance. This suggests that the positive effect of teaching assignments on performance is indirect, perhaps working through other factors. This aligns with the findings of Maqableh et al. (2023) [107], who demonstrated that job assignments positively influence job satisfaction and decrease turnover intention. Therefore, the positive but non-significant trend of TAS on trainer performance in the current model may be mediated by other factors.

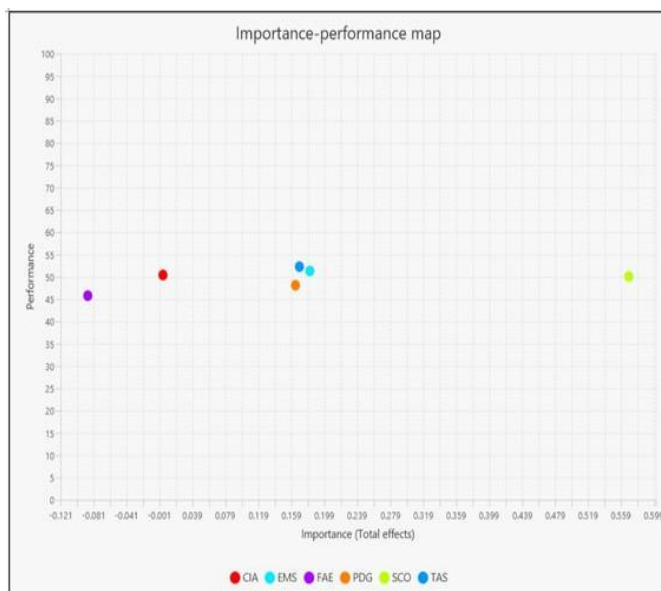


Figure 3. Importance-Performance Map

Table 16 and Figure 3 present the importance–performance map data, revealing strategic insights for improving the model's target construct. The most critical variable was SCO, with the highest

importance value (0.569), indicating it had the strongest positive influence. While important, its performance score (50.081) was only moderate, suggesting it is a key area for targeted improvement efforts. In contrast, FAE had a negative importance value (-0.088) and the lowest performance score (45.784), making it a low priority for intervention. The variable with the highest performance score was TAS (52.296), which also held a moderate level of importance (0.169), making it a relative strength to be maintained.

Similarly, the CIA had a very low importance value (0.003) but a moderate performance score (50.417), suggesting its current performance may be sufficient given its negligible impact. Overall, the findings suggest that the most effective strategy for enhancing the outcome variable is to focus resources on improving the performance of the highly influential (Student Competency Outcomes) SCO.

Hauff et al. (2024) [79] presented the combined importance–performance map analysis (cIPMA) and highlighted its effectiveness in pinpointing constructs that possess high significance and moderate performance as essential areas for enhancement. This closely corroborates the current finding that Student Competency Outcomes (SCO), as the most significant although only moderately effective construct, should be prioritized for enhancement.

SYNTHESIS

The results of the study revealed that the Importance–Performance Map Analysis (IPMA) is a powerful framework for identifying, prioritizing, and addressing the institutional factors that shape trainers' performance in Technology-Industrial Arts (TIA) education. By combining the dimensions of importance and performance, the IPMA provides a structured, data-driven basis for institutional planning, allowing decision-makers to sustain strengths, enhance moderate-performing but significant areas, and intervene in critical deficiencies.

The findings revealed that Teaching and Staffing and Employment Stability emerged as institutional strengths that support and sustain trainers' effectiveness. Trainers expressed that their teaching assignments align well with their expertise and that they enjoy a sense of job security and stability. To maintain these strengths, institutions must continue aligning teaching loads with trainers' specialization, preserve manageable student-teacher ratios, and strengthen recognition systems that promote morale and professional growth. Sustaining a supportive and secure work environment not only ensures continuity but also reinforces institutional commitment to quality and retention.

Also, the Student Competency Outcomes (SCO) dimension stood out as the most significant determinant of trainers' performance. Although trainers recognize that their students generally achieve satisfactory academic results, the moderate performance rating indicates a gap between classroom achievement and actual industry readiness. To improve this area, institutions should strengthen the integration of industry standards into the curriculum, expand partnerships with industry sectors for practical training and immersion programs, and adopt outcome-based assessments that emphasize real-world competencies. Regular monitoring of student outcomes and instructional feedback can further ensure that teaching practices remain relevant to industry expectations.

On the other hand, Facilities and Equipment and Professional

Development Opportunities emerged as the weakest institutional factors, indicating the need for targeted intervention. Trainers reported limited access to modern instructional tools and insufficient opportunities for professional growth. To address these issues, institutions should prioritize infrastructure modernization by investing in updated laboratory and workshop facilities aligned with industry technologies. Equally important is the establishment of continuous and structured professional development programs that expose trainers to new pedagogical innovations and technical advancements. Collaborations with local industries, government agencies, and professional organizations may also provide valuable avenues for resource sharing and capability building.

Based on these findings, the institution is recommended to maintain institutional strengths in teaching and employment stability, improve student competency outcomes to better align training with industry needs, and intervene in structural gaps related to facilities and professional development. Through this prioritization, the IPMA provided a strategic decision-making guide that supports evidence-based reforms, resource optimization, and the continuous enhancement of Technology-Industrial Arts education. Ultimately, this framework ensures that trainers remain competent, motivated, and well-equipped to deliver training that meets the evolving demands of the modern workforce.

Figure 4 shows the Prioritization Diagram for Technology-Industrial Arts Education in Cagayan de Oro City.

CONCLUSIONS AND RECOMMENDATIONS

Summary

This study had investigated the institutional factors that influence the trainers' performance of Technology- Industrial Arts using Partial Least Squares Structural Equation Modeling (PLS-SEM) integrated with Importance-Performance Map Analysis (IPMA). It assessed six factors, which are: facilities and equipment, teaching and staffing, curriculum- industry alignment, professional development, employment stability, and student competency outcomes.

The findings revealed that while respondents moderately agreed on the strengths of teaching and staffing, employment, stability, and curriculum- industry alignment, concerns arose about limited facilities, outdated equipment, and inadequate opportunities for professional development. Among the six factors, student competency outcomes showed a statistically significant and positive influence on trainer performance ($\beta = 0.569$, $p < 0.001$). While Facilities and equipment, professional development opportunities, curriculum-industry alignment, teaching and staffing, and employment stability showed positive but non-significant influence.

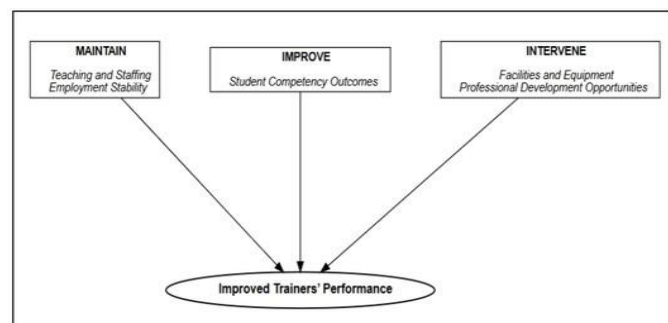


Figure 4 Prioritization Diagram for TIA CD

Moreover, the IPMA results underscored student competency outcomes as the most important factor, but with only moderate performance levels; yet, this is the highest-priority area. On the other hand, facilities and equipment, and professional development scored lowest, which highlights systemic weaknesses in institutional support

CONCLUSIONS

1. Perceived Institutional factors. The institutional support was found to be uneven across scopes: Teaching and Staffing, Employment Stability, Curriculum-Industry Alignment, and Student Competency Outcomes were perceived positively, which indicates strengths in job-role alignment, security of tenure, and curriculum responsiveness to the labor and industry demands. However, Facilities and Equipment and Professional Development Opportunities were perceived as less, showing scarce infrastructure and inadequate opportunities for efficient upskilling

2. Perceive Trainers' Performance. The trainers viewed themselves as effective, reflected in positive self-assessment of instructional delivery, classroom management, and engagement. However, they see the challenges in aligning fully the content with the industry standards, which signals a gap between classroom instruction and industry expectations. 3. Influence of Institutional Factors. Among six factors, only Student Competency Outcomes demonstrated a statistically significant influence with the highest importance value, on Trainers' performance. This showed that trainers' effectiveness is shaped by how their students acquire technical skills, demonstrate employability, and meet the labor market's expectations; meanwhile, other factors have no direct significant effect. 4. Importance of Institutional Factors. The Student Competency Outcomes came out as the most important determinant of Trainers' Performance. However, its moderate performance score indicates that this highly influential factor remains not up to standard, pointing to a crucial priority for institutional improvement.

5. Performance of Institutional Factors. The employment stability and Teaching and staffing ranked highest in performance, reinforcing the trainer's confidence in job security and teaching alignment. On the other hand, Facilities and Equipment and Professional Development Opportunities have the lowest performance levels, underscoring the need for investment in infrastructure and capacity-building initiatives.

Recommendations

In light of the conclusion, the following recommendations are proposed: 1. Institutions (TESDA-accredited training centers, HEIs, Senior High Schools offering TechVoc Strands) may prioritize upgrading Facilities and Equipment to meet safety and industry standards. Likewise, sustained programs for Professional Development Opportunities may be implemented to ensure that trainers have regular upskilling and exposure to modern pedagogical methods.

2. Curriculum developers, school administrators, and industry partners may reinforce curriculum-industry alignment through structured and sustained collaboration. The stakeholders may conduct regular curriculum reviews with industry input to align the instructional materials with the current practices in the workplace. Provisions on opportunities for industry-based training for trainers and students will help elevate their industry skills.

3. Institutions may prioritize the strengthening of Student Competency Outcomes, as this factor has the most significant influence and is found to be the most important domain

influencing the trainers' performance. This may be achieved through competency-based training, using performance-based assessments, enhancing internship programs, and creating strong linkages with the partner industries to ensure that student skills will meet labor market demands.

4. School deans, principals, and program heads may concentrate on upgrading resources to improve student competency outcomes, as this is a critical determinant of trainers' performance. The efforts should also include expanding access to modern facilities, an improved career guidance program, and a student support mechanism to ensure employability and technical readiness.
5. Institutions may strengthen the employment stability and teaching and staffing through sustaining policies that guarantee job security, workloads, and teaching alignment with trainer expertise. At the same time, they may invest in addressing weaker areas like Facilities and Equipment and Professional Development Opportunities to close the gaps in infrastructure and trainer capacity-building.
6. Future researchers may consider extending the model of this study by testing mediating variables like motivation or job satisfaction to provide more understanding of factors that indirectly influence trainer performance. They may also replicate this study in other technical-vocational institutions outside the research locale. Longitudinal research could also be explored to capture how sustained improvements in facilities, professional development, and curriculum alignment translate to long-term gains for trainers and students, which can also provide richer evidence for sustainable reforms for technology-industrial arts education.

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