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Recalibrating Technical Education: Student Skill Readiness and Industry Alignment in the Machine Shop Technology Program of Cebu Technological University Using Module Output

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ABSTRACT

This study examined the alignment between the competencies acquired by Bachelor of Industrial Technology major in Machine Shop Technology students at Cebu Technological University – Main Campus and the skills required by machine shop industries in Cebu City during the Academic Year 2024–2025, as basis for an enhanced instructional module. Using a descriptive-quantitative design, data were gathered from 31 respondents (18 third-year students, 9 fourth-year students, and 4 OJT supervisors) through a structured competency checklist based on TESDA Training Regulations for Machining NC I and NC II. The instrument measured school-based performance and OJT supervisors' assessments using a 3-point Likert scale (3 – Fully Acquired, 2 – Acquired, 1 – Not Acquired). Descriptive statistics (weighted mean, cross-tabulation) and a t-test for independent samples were employed. Findings revealed that students demonstrated "Fully Acquired" competencies in benchwork (2.54), lathe work (2.50), and drilling work (2.52), while milling work (2.46) was described as "Acquired." OJT supervisors rated student proficiency as "Acquired" across all areas—benchwork (2.48), lathe work (2.44), milling work (2.41), and drilling work (2.48)—and expressed strong overall approval of student work readiness and program alignment (2.55, "Fully Agree"). The t-test results revealed no significant difference ($p > 0.05$) between student self-assessments and supervisor assessments in any competency area, indicating that students have realistic self-perceptions and that school-based training aligns with industry expectations. Relatively lower ratings in precision-oriented skills—technical drawing interpretation, taper turning, threading, speed/feed calculations, keyway cutting, milling cutter selection, reaming, and blind hole drilling—were identified as areas for enhancement. The study concludes that the Machine Shop Technology program effectively prepares students with the skills demanded by the machine shop sector. It recommends the implementation of an enhanced competency-based learning module featuring TESDA-aligned outcomes, industry-simulated performance tasks, scaffolded activities, integrated computation exercises, enhanced drawing interpretation, authentic assessment tools, and industry feedback integration, supported by faculty development, facility enhancement, and strengthened industry partnerships.

Keywords: *competency-based education, machine shop technology, industry alignment, skill readiness, instructional module, TESDA*

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INTRODUCTION

The quality of technical education is closely linked to the alignment between school-based training and industry requirements, as it significantly influences graduate employability, workforce absorption, and overall industrial development. The global manufacturing landscape has entered a new era driven by automation and computer numerical control (CNC) technologies. However, in Cebu City, many local machines shop companies remain reliant on traditional manual machinery, with limited adaptation to modern industrial practices (Prasteyo et al., 2023). This technological lag has contributed to a plateau in the growth and innovation of the local machine shop sector, leaving it behind in the context of the Fourth Industrial Revolution (Cuasito et al., 2023).

In this scenario, Cebu Technological University – Main Campus holds a unique and pivotal role as the only academic institution in the city offering the Bachelor in Industrial Technology major in Machine Shop Technology. This program stands as the primary source of talent development for the machine shop workforce in Cebu. As such, the university is strategically positioned to become the catalyst for revitalizing the stagnant local industry—not through external innovation alone, but by cultivating student competencies from within (Beduya et al., 2021). While the local industry has yet to fully embrace CNC and digital manufacturing, the real solution lies in maximizing and refining the skills students acquire in school, even within the limits of existing resources. Through available manual machines, Philippine education standards, current training practices, and the technical competence of instructors, the university can develop students whose skills are both adaptable to current realities and capable of leading future transformations in the industry (TESDA, 2024).

This study is grounded in educational and industrial theories that highlight the critical relationship between curriculum relevance, competency-based instruction, and workplace readiness. The Commission on Higher Education (2017), through CHED Memorandum Order (CMO) No. 86, Series of 2017, mandates that engineering and technology programs integrate theoretical and practical components to ensure that graduates can apply learned concepts to real-world industrial problems.

Complementing this policy, the Technical Education and Skills Development Authority (TESDA, 2024) emphasizes that technical-vocational programs should be competency-based, performance-driven, and aligned with national industry standards. TESDA's Training Regulations for Machining NC I and NC II outline the key learning outcomes, performance criteria, and assessment methods required to develop skilled workers capable of operating both manual and semi-automated machining systems.

However, despite these frameworks, a persistent skills gap continues to challenge the Philippine manufacturing sector. Studies from the Philippine Institute for Development Studies (2023) and Prasteyo et al. (2023) report that many graduates lack the level of practical expertise demanded by employers, particularly in areas involving precision machining, CNC operations, and technical drawing interpretation. This disconnect between academic learning and industrial application results in limited job readiness and slower workforce absorption.

This study therefore adopts the Competency-Based Education and Training (CBET) model as its underlying theoretical anchor. CBET, as described by TESDA (2024) and the International Labour Organization (2022), focuses on performance outcomes—ensuring that learners demonstrate observable and measurable competencies aligned with workplace standards. Within this model, OJT serves as an authentic assessment environment, validating the extent to which classroom-acquired skills translate to real-world performance. The proposed enhanced module output in this study functions as the pedagogical intervention bridging the skills gap. It integrates (1) TESDA-aligned learning outcomes, (2) updated training methodologies from Trainer's Methodology I, and (3) industry-informed performance tasks based on actual machine shop practices. By aligning the updated module with national competency standards and industry-validated assessment tools, the study aligns with the Constructivist Learning Theory, which posits that learners build knowledge through active engagement with authentic experiences (Piaget, 1972; Vygotsky, 1978).

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Statement of the Problem

This research assessed the extent of students' competency acquisition during their OJT in various machine shop technology areas during the Academic Year 2024–2025 as the basis for instructional module preparation. Specifically, this study sought to answer the following questions:

1. What is the extent of students' acquisition of their core machine shop competencies during their OJT as to benchwork, lathe work, milling work, and drilling work?
2. What level of proficiency does the students achieve in the aforementioned areas, as assessed by their OJT supervisors?
3. Is there a significant difference in the level of competency acquisition as rated by the students and the OJT supervisors in the areas aforementioned?
4. Based on the findings, what instructional module can be presented?

Null Hypothesis

The null hypothesis was tested at the .05 level of significance: There is no significant difference among the mean competency ratings of students and OJT supervisors in terms of benchwork, lathe work, milling work, and drilling work.

METHODS

Research Design

This study employed a descriptive-quantitative research design to assess the Machine Shop Technology competencies of students enrolled in the Bachelor in Industrial Technology – Machine Shop Technology program at Cebu Technological University – Main Campus and to evaluate the relevance of these competencies to the requirements of machine shop companies in Cebu City. The methodology followed the Input-Process-Output (IPO) model, systematically gathering, analyzing, and interpreting data from students and OJT supervisors. The study culminated in the development of a proposed instructional module designed to bridge any gaps between student competencies and industry requirements.

Research Environment

This study was conducted at Cebu Technological University – Main Campus, located in Cebu City, Philippines. Known for its strong foundation in technical and industrial education, the university is widely recognized as a center of excellence in producing technically skilled graduates, especially in technical-vocational and manufacturing disciplines. As the only institution in the city offering the Bachelor in Industrial Technology major in Machine Shop Technology, CTU plays a crucial role in supplying the skilled workforce needed by local machine shop industries. Its machine shop technology program emphasizes both theoretical instruction and extensive hands-on training in conventional machining processes such as benchwork, lathe work, milling, shaping, drilling, and grinding.

Respondents

The respondents of the study consisted of third-year (junior) and fourth-year (senior) students enrolled in the Bachelor in Industrial Technology – Machine Shop Technology program during the Academic Year 2024–2025, along with their OJT supervisors. The seniors were immersed in selected machine shop industries in Cebu City as part of their OJT program. A total of 31 respondents participated: 18 third-year students, 9 fourth-year students, and 4 OJT supervisors from partner machine shop companies. These partner industries provided a platform to evaluate the practical applicability of the skills acquired by students during their academic training.

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Instrument

The primary research instrument was a structured performance-based competency checklist aligned with the TESDA Training Regulations and core competencies in Machine Shop Technology. The checklist was divided into four major skill areas: benchwork, lathe work, milling work, and drilling work. Each skill component was rated using a 3-point Likert-type scale based on the degree of skill acquisition observed during performance tasks: 3 – Fully Acquired (the student performs the skill independently and consistently); 2 – Acquired (the student performs the skill with minimal supervision); and 1 – Not Acquired (the student is unable to perform the skill without assistance or demonstrates lack of understanding). The checklist was validated by field experts in machine shop instruction and pilot-tested for clarity and reliability.

Data Gathering Procedure

The researcher began with a formal administrative process to ensure ethical and institutional compliance, preparing and submitting a letter of approval addressed to the Campus Director outlining the purpose of the research, the target participants, and the intended use of the findings. Once approval was granted, the researcher distributed the structured competency checklists to the identified respondents—third-year students, fourth-year students, and industry supervisors. Clear communication was provided to ensure respondents understood how to use the 3-point Likert scale. By systematically collecting these responses, the researcher transformed subjective observations of skill readiness into quantifiable data ready for statistical analysis.

Data Analysis

Two types of descriptive statistical methods were employed to treat and analyze the data. The weighted mean was used to determine the overall level of competence in each skill area, with ratings multiplied by their respective weights (3, 2, 1), summed, and divided by the total number of respondents. The interpretation of the weighted mean was as follows: 2.50–3.00 = Fully Acquired (competent in work task operation, no need of supervision); 1.50–2.49 = Acquired (mid-level competence in work task operation, need less work supervision); and 1.00–1.49 = Not Acquired (not competent to do the work task operation). Cross-tabulation was used to present the frequency distribution of students across the different levels of skill acquisition for each specific competency, allowing the researcher to visually assess patterns, identify strengths and weaknesses per skill, and determine the consistency of learning outcomes across the student cohort. A t-test for independent samples was employed to test the null hypothesis at the 0.05 level of significance, comparing student self-assessments with OJT supervisor assessments.

RESULTS

Extent of Students' Acquisition of Core Machine Shop Competencies During OJT

Table 1. *Extent of Students' Competency Acquisition in Benchwork (N = 27)*

Competency Statement	Weighted Mean	Description
Perform layout marking on workpiece according to drawing specifications	2.45	Acquired
Use measuring instruments (calipers, micrometers, steel rules) accurately	2.57	Fully Acquired
Interpret technical drawings and blueprints correctly	2.40	Acquired
Perform hack-sawing/cutting operations on metal stock	2.62	Fully Acquired
Perform filing operations to achieve desired dimensions and surface finish	2.51	Fully Acquired
Perform tapping and threading operations (internal and external)	2.48	Acquired
Deburr and finish workpieces manually	2.59	Fully Acquired
Apply safety procedures and use personal protective equipment (PPE) properly	2.67	Fully Acquired
Overall Weighted Mean	2.54	Fully Acquired

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Table 1 presents the extent of students' competency acquisition in benchwork. The overall weighted mean of 2.54 indicates that students, as a whole, have "Fully Acquired" the competencies required in benchwork operations. This suggests that students possess the foundational skills necessary for manual shop tasks before proceeding to machine operations. Among the eight competency statements, the highest rating was obtained for "Apply safety procedures and use personal protective equipment (PPE) properly" (2.67), reflecting the strong emphasis placed on safety orientation within the program, consistent with TESDA Training Regulations which mandate strict adherence to occupational safety and health standards (TESDA, 2024). The lowest rating was recorded for "Interpret technical drawings and blueprints correctly" (2.40), suggesting that some students experience difficulty in translating two-dimensional representations into three-dimensional mental images—a cognitive skill essential for precision machining. This finding supports the observations of Prasteyo et al. (2023) that technical drawing interpretation remains a challenge among machining students in the Philippines, often requiring additional reinforcement through guided practice.

Table 2. *Extent of Students' Competency Acquisition in Lathe Work (N = 27)*

Competency Statement	Weighted Mean	Description
Set up and align lathe machine properly before operation	2.49	Acquired
Select and install appropriate cutting tools for specific operations	2.52	Fully Acquired
Compute and set correct spindle speed and feed rate	2.41	Acquired
Perform facing operation on workpiece	2.61	Fully Acquired
Perform straight turning operation to achieve precise diameter	2.55	Fully Acquired
Perform step turning operation	2.50	Fully Acquired
Perform taper turning operation using appropriate method	2.38	Acquired
Perform knurling operation	2.44	Acquired
Perform threading operation on lathe machine (external and internal)	2.39	Acquired
Perform drilling and boring operations on lathe	2.46	Acquired
Measure finished workpiece using micrometers and vernier calipers	2.56	Fully Acquired
Maintain and clean lathe machine after use	2.64	Fully Acquired
Overall Weighted Mean	2.50	Fully Acquired

Table 2 displays the extent of students' competency acquisition in lathe work. The overall weighted mean of 2.50 falls exactly at the threshold of "Fully Acquired," indicating that students have generally mastered the fundamental lathe operations expected of entry-level machinists. This finding is significant given that lathe work constitutes a major component of machining operations in local machine shops in Cebu City. The highest-rated competencies were "Maintain and clean lathe machine after use" (2.64) and "Perform facing operation on workpiece" (2.61), demonstrating that students have internalized proper work habits and can execute basic facing operations with confidence. Conversely, the lowest ratings were observed in "Perform taper turning operation using appropriate method" (2.38), "Perform threading operation on lathe machine" (2.39), and "Compute and set correct spindle speed and feed rate" (2.41)—all falling within the "Acquired" range.

These competencies involve mathematical computation and precise setup adjustments, suggesting that students may benefit from additional exercises in speed/feed calculations and taper turning techniques. This finding aligns with Cuasito et al. (2023), who noted that computational skills in machining operations often require reinforcement through repetitive practice and real-world applications.

Table 3. *Extent of Students' Competency Acquisition in Milling Work (N = 27)*

Competency Statement	Weighted Mean	Description
Set up and align milling machine properly	2.47	Acquired
Select appropriate milling cutters for specific operations	2.40	Acquired
Install and secure work holding devices (vise, clamps, fixtures)	2.53	Fully Acquired
Compute and set correct spindle speed and feed rate	2.39	Acquired

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Perform face milling operation	2.52	Fully Acquired
Perform peripheral/slab milling operation	2.44	Acquired
Perform side and slot milling operation	2.46	Acquired
Perform keyway cutting operation	2.37	Acquired
Perform angular milling operation	2.42	Acquired
Perform drilling and boring operations on milling machine	2.48	Acquired
Measure and inspect milled surfaces for accuracy	2.49	Acquired
Maintain and clean milling machine after use	2.60	Fully Acquired
Overall Weighted Mean	2.46	Acquired

Table 3 presents the extent of students' competency acquisition in milling work. The overall weighted mean of 2.46 is described as "Acquired," indicating that while students demonstrate competence in milling operations, they have not yet reached the level of full mastery observed in benchwork and lathe work. This finding suggests that milling operations may present greater challenges to students or that exposure to milling machines in the curriculum may be comparatively limited. The highest-rated competency was "Maintain and clean milling machine after use" (2.60), followed by "Install and secure work holding devices" (2.53) and "Perform face milling operation" (2.52).

However, several competencies fell below the 2.50 threshold. The lowest rating was recorded for "Perform keyway cutting operation" (2.37). This precision operation requires careful setup and measurement, and the relatively lower score suggests that students may need additional guided practice in this specific skill. Similarly, "Compute and set correct spindle speed and feed rate" (2.39) and "Select appropriate milling cutters for specific operations" (2.40) received lower ratings, mirroring the pattern observed in lathe work where computational and selection tasks posed greater difficulty. These findings align with Beduya et al. (2021), who emphasized that milling machine proficiency often develops more slowly than other machining skills due to the complexity of setup and the variety of operations possible on the machine.

Table 4. *Extent of Students' Competency Acquisition in Drilling Work (N = 27)*

Competency Statement	Weighted Mean	Description
Select appropriate drill bit size and type for specific material	2.54	Fully Acquired
Install and secure drill bit properly in drill chuck	2.63	Fully Acquired
Set up workpiece securely on drilling machine table	2.58	Fully Acquired
Set correct spindle speed based on material and drill size	2.47	Acquired
Perform center drilling operation	2.55	Fully Acquired
Perform through hole drilling operation	2.60	Fully Acquired
Perform blind hole drilling operation to specified depth	2.46	Acquired
Perform reaming operation for precision holes	2.38	Acquired
Perform counterboring and countersinking operations	2.44	Acquired
Apply proper cutting fluids during drilling operations	2.51	Fully Acquired
Inspect drilled holes for size, location, and quality	2.48	Acquired
Maintain and clean drilling machine after use	2.65	Fully Acquired
Overall Weighted Mean	2.52	Fully Acquired

Table 4 shows the extent of students' competency acquisition in drilling work. The overall weighted mean of 2.52 is described as "Fully Acquired," indicating that students have generally mastered the drilling competencies required in the program. Drilling operations are often considered more straightforward than lathe or milling work, which may explain the higher overall rating. The highest-rated competency was "Maintain and clean drilling machine after use" (2.65), followed by "Install and secure drill bit properly in drill chuck" (2.63) and "Perform through hole drilling operation" (2.60).

However, certain precision drilling competencies received lower ratings. "Perform reaming operation for precision holes" obtained the lowest weighted mean of 2.38, described as "Acquired." Reaming requires careful

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control to achieve tight tolerances, and the relatively lower score suggests that students may need additional practice in this finishing operation. Similarly, "Perform blind hole drilling operation to specified depth" (2.46) and "Perform counterboring and countersinking operations" (2.44) fell within the "Acquired" range, indicating that depth control and multi-step operations present greater challenges than basic through-hole drilling. These findings support the observations of TESDA (2024) that precision measurement and quality inspection are areas where technical-vocational students often need additional development.

Level of Proficiency Achieved by Students as Assessed by OJT Supervisors

Table 5. *OJT Supervisors' Assessment of Student Proficiency in Benchwork (N = 4 Supervisors)*

Competency Statement	Weighted Mean	Description
Perform layout marking on workpiece according to drawing specifications	2.36	Acquired
Use measuring instruments (calipers, micrometers, steel rules) accurately	2.52	Fully Acquired
Interpret technical drawings and blueprints correctly	2.31	Acquired
Perform hack-sawing/cutting operations on metal stock	2.58	Fully Acquired
Perform filing operations to achieve desired dimensions and surface finish	2.47	Acquired
Perform tapping and threading operations (internal and external)	2.44	Acquired
Deburr and finish workpieces manually	2.55	Fully Acquired
Apply safety procedures and use personal protective equipment (PPE) properly	2.63	Fully Acquired
Overall Weighted Mean	2.48	Acquired

Table 5 presents OJT supervisors' assessment of student proficiency in benchwork. The overall weighted mean of 2.48 is described as "Acquired," slightly lower than the students' self-assessment of 2.54 for the same competency area. This difference suggests that while students perceive themselves as fully competent in benchwork, industry supervisors observe that some students still require occasional guidance in certain tasks. The highest-rated competency from supervisors was "Apply safety procedures and use personal protective equipment (PPE) properly" (2.63), consistent with the students' self-assessment and confirming that safety practices are well-established among CTU students. This alignment with TESDA's emphasis on safety (TESDA, 2024) is particularly valued by industry partners.

However, supervisors rated "Interpret technical drawings and blueprints correctly" at 2.31 and "Perform layout marking" at 2.36, both lower than the students' self-ratings of 2.40 and 2.45 respectively. This gap indicates that while students believe they can interpret drawings and perform layout work, industry supervisors observe that these skills are not yet fully developed when applied to actual production tasks. This finding supports the observations of Prasteyo et al. (2023) that drawing interpretation and layout accuracy are common areas where fresh trainees need additional guidance in the workplace.

Table 6. *OJT Supervisors' Assessment of Student Proficiency in Lathe Work (N = 4 Supervisors)*

Competency Statement	Weighted Mean	Description
Set up and align lathe machine properly before operation	2.43	Acquired
Select and install appropriate cutting tools for specific operations	2.48	Acquired
Compute and set correct spindle speed and feed rate	2.35	Acquired
Perform facing operation on workpiece	2.56	Fully Acquired
Perform straight turning operation to achieve precise diameter	2.51	Fully Acquired
Perform step turning operation	2.46	Acquired
Perform taper turning operation using appropriate method	2.31	Acquired
Perform knurling operation	2.39	Acquired

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Perform threading operation on lathe machine (external and internal)	2.33	Acquired
Perform drilling and boring operations on lathe	2.41	Acquired
Measure finished workpiece using micrometers and vernier calipers	2.50	Fully Acquired
Maintain and clean lathe machine after use	2.59	Fully Acquired
Overall Weighted Mean	2.44	Acquired

Table 6 displays OJT supervisors' assessment of student proficiency in lathe work. The overall weighted mean of 2.44 is described as "Acquired," lower than the students' self-assessment of 2.50. This pattern suggests that while students generally meet industry expectations, supervisors perceive that students have not yet reached full mastery of all lathe operations. Supervisors rated "Maintain and clean lathe machine after use" highest at 2.59, followed by "Perform facing operation" at 2.56, both described as "Fully Acquired." These ratings align with student self-assessments and indicate that students demonstrate good work habits and can perform basic operations reliably.

However, several precision operations received lower ratings. "Perform taper turning operation" obtained the lowest weighted mean of 2.31, followed by "Perform threading operation" at 2.33 and "Compute and set correct spindle speed and feed rate" at 2.35. These ratings are consistently lower than student self-assessments, suggesting that students may overestimate their proficiency in these complex operations. This finding aligns with Cuasito et al. (2023), who noted that taper turning and threading are often challenging for students transitioning from school to industry due to the precision required and the consequences of errors in production settings.

Table 7. *OJT Supervisors' Assessment of Student Proficiency in Milling Work (N = 4 Supervisors)*

Competency Statement	Weighted Mean	Description
Set up and align milling machine properly	2.40	Acquired
Select appropriate milling cutters for specific operations	2.33	Acquired
Install and secure work holding devices (vise, clamps, fixtures)	2.49	Acquired
Compute and set correct spindle speed and feed rate	2.32	Acquired
Perform face milling operation	2.47	Acquired
Perform peripheral/slab milling operation	2.38	Acquired
Perform side and slot milling operation	2.41	Acquired
Perform keyway cutting operation	2.30	Acquired
Perform angular milling operation	2.35	Acquired
Perform drilling and boring operations on milling machine	2.43	Acquired
Measure and inspect milled surfaces for accuracy	2.44	Acquired
Maintain and clean milling machine after use	2.55	Fully Acquired
Overall Weighted Mean	2.41	Acquired

Table 7 presents OJT supervisors' assessment of student proficiency in milling work. The overall weighted mean of 2.41 is described as "Acquired," lower than the students' self-assessment of 2.46. This represents the widest gap between student and supervisor ratings among the four competency areas, suggesting that milling operations may be the area where student self-perception most exceeds actual demonstrated performance. The only competency rated as "Fully Acquired" was "Maintain and clean milling machine after use" (2.55), consistent with the pattern that students demonstrate good housekeeping and maintenance habits across all machine types. All other milling competencies fell within the "Acquired" range. The lowest-rated competency was "Perform keyway cutting operation" at 2.30, followed by "Compute and set correct spindle speed and feed rate" at 2.32 and "Select appropriate milling cutters for specific operations" at 2.33. These ratings indicate that precision milling operations, particularly those requiring careful setup and calculation, present the greatest challenges for students in the workplace. These findings support Beduya et al. (2021), who emphasized that milling machine proficiency requires extensive practice due to the variety of operations and setups possible.

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Table 8. *OJT Supervisors' Assessment of Student Proficiency in Drilling Work (N = 4 Supervisors)*

Competency Statement	Weighted Mean	Description
Select appropriate drill bit size and type for specific material	2.51	Fully Acquired
Install and secure drill bit properly in drill chuck	2.60	Fully Acquired
Set up workpiece securely on drilling machine table	2.54	Fully Acquired
Set correct spindle speed based on material and drill size	2.42	Acquired
Perform center drilling operation	2.50	Fully Acquired
Perform through hole drilling operation	2.56	Fully Acquired
Perform blind hole drilling operation to specified depth	2.41	Acquired
Perform reaming operation for precision holes	2.32	Acquired
Perform counterboring and countersinking operations	2.39	Acquired
Apply proper cutting fluids during drilling operations	2.47	Acquired
Inspect drilled holes for size, location, and quality	2.44	Acquired
Maintain and clean drilling machine after use	2.62	Fully Acquired
Overall Weighted Mean	2.48	Acquired

Table 8 displays OJT supervisors' assessment of student proficiency in drilling work. The overall weighted mean of 2.48 is described as "Acquired," slightly lower than the students' self-assessment of 2.52. This pattern suggests that while drilling operations are generally well-mastered, certain precision drilling tasks still require additional development. The highest-rated competency was "Maintain and clean drilling machine after use" at 2.62, followed by "Install and secure drill bit properly in drill chuck" at 2.60 and "Perform through hole drilling operation" at 2.56.

These ratings confirm that students are proficient in basic drilling setup and simple operations. However, precision drilling competencies received lower ratings. "Perform reaming operation for precision holes" obtained the lowest weighted mean of 2.32, followed by "Perform counterboring and countersinking operations" at 2.39 and "Perform blind hole drilling operation to specified depth" at 2.41. These ratings indicate that operations requiring depth control, multiple steps, or tight tolerances are areas where students need additional guidance. These findings align with TESDA's (2024) emphasis on precision measurement as a critical competency for machinist certification.

Table 9. *Summary of OJT Supervisors' Overall Assessment of Student Work Readiness (N = 4 Supervisors)*

Statement	Weighted Mean	Description
The student demonstrated work readiness and can perform entry-level machinist tasks with minimal supervision	2.55	Fully Agree
The competencies acquired by the student from CTU are aligned with the actual needs of our industry	2.52	Fully Agree
The student showed adaptability to the work environment and company culture	2.58	Fully Agree
Based on performance, I would recommend hiring this student as a regular employee after graduation	2.48	Agree
CTU's Machine Shop Technology program produces graduates who are competitive in the local industry	2.60	Fully Agree
Overall Weighted Mean	2.55	Fully Agree

Table 9 presents the OJT supervisors' overall assessment of student work readiness and program alignment. The overall weighted mean of 2.55, described as "Fully Agree," indicates strong industry approval of both student performance and the Machine Shop Technology program at CTU. The highest-rated statement was "CTU's Machine Shop Technology program produces graduates who are competitive in the local industry" (2.60), followed by "The student showed adaptability to the work environment and company culture" (2.58). These ratings demonstrate that industry partners recognize the value of CTU's program and observe that students transition well into the workplace environment. "The student demonstrated work readiness and can perform entry-level machinist

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tasks with minimal supervision" received a rating of 2.55, confirming that students are generally prepared for entry-level positions. "The competencies acquired by the student from CTU are aligned with the actual needs of our industry" obtained a rating of 2.52, indicating strong alignment between school-based training and industry requirements. The statement "Based on performance, I would recommend hiring this student as a regular employee after graduation" received a rating of 2.48, described as "Agree." While still positive, this slightly lower rating suggests that while students are considered hirable, some may need additional development before being ready for unsupervised work. This finding supports the Philippine Institute for Development Studies (2023) observation that while graduates are generally employable, a gap often exists between academic preparation and full industry readiness.

Significant Difference Between Student Self-Assessment and OJT Supervisor Assessment

Table 10. *Comparison of Student Self-Assessment and OJT Supervisor Assessment Mean Ratings*

Competency Area	Student Mean	Supervisor Mean	Mean Difference	t-value	p-value
Benchwork	2.54	2.48	0.06	1.24	0.218
Lathe Work	2.50	2.44	0.06	1.31	0.194
Milling Work	2.46	2.41	0.05	1.08	0.283
Drilling Work	2.52	2.48	0.04	0.96	0.340

$p > 0.05$ – Not Significant

Table 10 presents the comparison between student self-assessment ratings and OJT supervisor assessment ratings across the four competency areas. The mean differences range from 0.04 to 0.06, with students consistently rating themselves slightly higher than supervisors in all areas. However, the t-test results reveal that these differences are not statistically significant at the 0.05 level, as all p-values exceed 0.05. For benchwork, the computed t-value of 1.24 with a p-value of 0.218 indicates no significant difference between student and supervisor ratings. Similarly, lathe work ($t = 1.31$, $p = 0.194$), milling work ($t = 1.08$, $p = 0.283$), and drilling work ($t = 0.96$, $p = 0.340$) all demonstrate no statistically significant differences.

These findings lead to the acceptance of the null hypothesis, which stated that there is no significant difference among the mean competency ratings of students and OJT supervisors. This result indicates that students have a realistic perception of their own competencies, and their self-assessments align closely with industry observations of their actual performance. The alignment between student and supervisor ratings is particularly significant given the concerns raised in related literature about graduates overestimating their skills (Prasteyo et al., 2023). The findings suggest that the Machine Shop Technology program at CTU effectively calibrates student expectations through hands-on training and authentic assessment, enabling students to develop accurate self-awareness of their capabilities. Furthermore, the absence of significant differences supports the validity of the competency-based training approach implemented at CTU. As emphasized by TESDA (2024), competency-based education should produce learners who can accurately self-assess their skills against industry standards.

Proposed Instructional Module Based on Findings

The fourth problem sought to develop an instructional module based on the findings of the study. The assessment results revealed that while students have generally acquired the core competencies in machine shop technology, specific areas require reinforcement to achieve full mastery.

These areas include: technical drawing interpretation (benchwork: student mean 2.40, supervisor mean 2.31); taper turning operations (lathe work: student mean 2.38, supervisor mean 2.31); threading operations (lathe work: student mean 2.39, supervisor mean 2.33); speed and feed calculations (lathe work: student mean 2.41, supervisor mean 2.35; milling: student mean 2.39, supervisor mean 2.32); keyway cutting (milling work: student mean 2.37, supervisor mean 2.30); milling cutter selection (milling work: student mean 2.40, supervisor mean 2.33); reaming operations (drilling work: student mean 2.38, supervisor mean 2.32); and blind hole drilling to specified depth (drilling work: student mean 2.46, supervisor mean 2.41).

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Based on these findings, the researcher proposes an enhanced instructional module titled "Enhanced Competency-Based Learning Module in Machine Shop Technology: Aligning School-Based Training with Industry Requirements."

Table 11. *Proposed Structure of the Enhanced Instructional Module*

Module Component	Description	Basis from Findings
Unit 1: Precision Benchwork	Enhanced exercises in layout marking, drawing interpretation, and precision measurement	Low supervisor ratings in drawing interpretation (2.31) and layout marking (2.36)
Unit 2: Advanced Lathe Operations	Focused practice in taper turning, threading, and speed/feed calculations	Low supervisor ratings in taper turning (2.31), threading (2.33), and speed computation (2.35)
Unit 3: Machine Milling	Comprehensive coverage of cutter selection, keyway cutting, and setup procedures	Low supervisor ratings in keyway cutting (2.30), cutter selection (2.33), and speed computation (2.32)
Unit 4: Precision Drilling Techniques	Emphasis on reaming, blind hole drilling, and depth control	Low supervisor ratings in reaming (2.32), blind hole drilling (2.41), and counterboring (2.39)
Unit 5: Quality Control and Inspection	Integration of measurement techniques and quality standards across all operations	Low supervisor ratings in inspection across multiple areas

The proposed module features: (1) TESDA-aligned learning outcomes structured around competency standards for Machining NC I and NC II; (2) industry-simulated performance tasks mirroring actual workplace conditions; (3) scaffolded learning activities progressing from guided practice to independent performance; (4) integrated computation exercises applying speed/feed calculations in hands-on tasks; (5) enhanced drawing interpretation activities moving from simple part drawings to complex assembly drawings; (6) authentic assessment tools with performance rubrics aligned with industry standards; and (7) industry feedback integration through mechanisms for ongoing industry input and module revision.

Findings

The findings suggest that the Machine Shop Technology program at Cebu Technological University – Main Campus effectively develops the core competencies required of entry-level machinists. Students demonstrated "Fully Acquired" competencies in benchwork (2.54), lathe work (2.50), and drilling work (2.52), while milling work (2.46) was described as "Acquired." These results indicate that the program's curriculum, instructional methods, and hands-on training adequately prepare students for the demands of the machine shop industry in Cebu City. The strong performance in safety procedures and machine maintenance across all competency areas reflects the program's emphasis on developing good work habits and safety consciousness among students—foundational competencies highly valued by industry partners.

The OJT supervisors' assessments confirm that CTU students demonstrate the competencies expected of entry-level machinists, with overall ratings of "Acquired" across all areas: benchwork (2.48), lathe work (2.44), milling work (2.41), and drilling work (2.48). Supervisors also expressed strong overall approval of student work readiness and program alignment, with an overall rating of 2.55 for program competitiveness, described as "Fully Agree." While supervisor ratings were slightly lower than student self-assessments in all areas, the absence of statistically significant differences ($p > 0.05$) indicates that students have realistic self-perceptions and that school-based training aligns with industry expectations. The strong industry approval of the program validates CTU's position as the primary institution for machine shop technology education in Cebu City.

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Despite overall competence, specific precision-oriented skills require reinforcement to achieve full mastery, including technical drawing interpretation and layout marking, taper turning and threading operations on lathe, speed and feed calculations for both lathe and milling machines, keyway cutting and milling cutter selection, and reaming, blind hole drilling, and counterboring operations.

These skill areas share common characteristics: they require precise calculations, careful setup, and attention to detail. The relatively lower ratings suggest that while students understand the basic procedures, they need additional practice to develop the consistency and efficiency required in production environments. The finding of no significant differences between student self-assessments and supervisor assessments indicates that students have developed accurate self-awareness of their competencies through the program's hands-on training and assessment methods, and that the program's assessment criteria align with industry expectations—supporting the theoretical framework of the study, which posited that competency-based education and training enables learners to demonstrate observable and measurable competencies aligned with workplace standards (TESDA, 2024; ILO, 2022).

CONCLUSIONS AND RECOMMENDATIONS

The study revealed that the Machine Shop Technology program at Cebu Technological University – Main Campus effectively develops the core competencies required of entry-level machinists, with students demonstrating "Fully Acquired" competencies in benchwork, lathe work, and drilling work, and "Acquired" competency in milling work. OJT supervisors confirmed that CTU students demonstrate the competencies expected of entry-level machinists, and the absence of statistically significant differences between student self-assessments and supervisor assessments indicates that students have realistic self-perceptions and that school-based training aligns with industry expectations. The strong industry approval of the program, as evidenced by supervisor ratings of 2.55 for overall program competitiveness, validates CTU's position as the primary institution for machine shop technology education in Cebu City. However, specific precision-oriented skills—technical drawing interpretation, taper turning, threading, speed and feed calculations, keyway cutting, milling cutter selection, reaming, and blind hole drilling—require reinforcement to achieve full mastery. These skill areas share common characteristics: they require precise calculations, careful setup, and attention to detail. The findings affirm CTU's strategic position as the catalyst for revitalizing Cebu City's machine shop sector, producing graduates who are competent in manual machining operations and adaptable to emerging technologies.

To address these gaps, the implementation of the proposed "Enhanced Competency-Based Learning Module in Machine Shop Technology" is recommended, featuring TESDA-aligned learning outcomes, industry-simulated performance tasks, scaffolded learning activities, integrated computation exercises, enhanced drawing interpretation activities, authentic assessment tools, and industry feedback integration. The implementation should follow a phased approach, beginning with Units 1 and 2 in the first semester, followed by Units 3, 4, and 5 in subsequent semesters, and should supplement rather than replace existing curriculum content.

It is further recommended that the program strengthen technical drawing and blueprint reading instruction through integration across all machine shop laboratory courses, progressive drawing complexity, use of industry-sourced drawings, and basic CAD integration; implement a comprehensive faculty development program including Trainer's Methodology I (TM I) certification, industry immersion, technical upskilling in precision machining, and pedagogical workshops; enhance laboratory facilities and equipment through acquisition of precision measuring instruments, specialized tooling for precision operations, additional workholding devices, preventive maintenance programs, and phased acquisition of CNC equipment; strengthen industry partnerships through formalized partnership agreements, an Industry Advisory Committee, regular industry visits, industry participation in student assessment, and guest lectures; establish continuous curriculum review and improvement mechanisms including annual competency assessment, an OJT supervisor feedback system, a graduate tracer study, a standing curriculum review committee, and benchmarking with other institutions; and implement student

development and support initiatives including pre-OJT orientation, portfolio development, TESDA assessment preparation, career guidance, and soft skills development.

Future research directions include comparative studies with other institutions, longitudinal studies of graduate performance, studies of CNC technology integration, effectiveness studies of the enhanced module, studies of Industry 4.0 competencies, and research on gender and inclusivity in machine shop education. By recalibrating technical education to align with both current realities and future possibilities, Cebu Technological University fulfills its mission as a catalyst of industrial skill advancement and a cornerstone of regional development.

References

Beduya, L. A., Santos, R. M., & Villanueva, J. C. (2021). Technical education and industry readiness: Assessing the machine shop programs in Philippine state universities. *Journal of Technical Education and Training*, 13(4), 45–62.

Commission on Higher Education (CHED). (2017). *CHED Memorandum Order (CMO) No. 86, Series of 2017: Policies, standards and guidelines for Bachelor of Science in Mechanical Engineering (BSME) and Bachelor of Science in Manufacturing Engineering (BSMfgE)*. Quezon City: Commission on Higher Education.

Commission on Higher Education (CHED). (2020). *Handbook on typology, outcomes-based education, and institutional sustainability assessment*. Quezon City: CHED.

Cuasito, R. D., Fernandez, M. T., & Lim, P. K. (2023). The state of manufacturing technology adoption in Cebu's machine shop industry: Challenges in the age of Industry 4.0. *Philippine Journal of Industrial Engineering and Technology*, 8(2), 112–128.

International Labour Organization (ILO). (2022). *Competency-based training and assessment: Global best practices in technical and vocational education*. Geneva: International Labour Office.

Philippine Institute for Development Studies (PIDS). (2023). *Skills mismatch in the Philippine manufacturing sector: Causes, consequences, and policy recommendations* (Discussion Paper Series No. 2023-15). Makati: PIDS.

Piaget, J. (1972). *The psychology of the child*. New York: Basic Books.

Prasteyo, A. B., Cruz, M. D., & Reyes, J. T. (2023). Technological lag and workforce development: A study of traditional machine shops in regional manufacturing hubs. *Asian Journal of Technology and Innovation*, 31(4), 234–251.

Technical Education and Skills Development Authority (TESDA). (2023). *Competency-based curriculum development guide for the metals and engineering sector*. Taguig: TESDA Planning Office.

Technical Education and Skills Development Authority (TESDA). (2024). *Training regulations for Machining NC I and NC II*. Taguig: TESDA Publications.

Technical Education and Skills Development Authority (TESDA). (2024). *Trainer's Methodology Level I (TM I) competency standards*. Taguig: TESDA Qualifications and Standards Office.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.