"BRIDGING SKILLS TO CERTIFICATION: A COMPARATIVE ASSESSMENT OF TECHNOLOGY STUDENTS' COMPETENCE AND READINESS FOR CERTIFIED PLANT MECHANIC PRACTICE ACROSS ACADEMIC PROGRAMS"

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Abstract: *The study determined the level of competency and preparedness of technology students in the technology programs in Zamboanga City for Certified Plant Mechanic (CPM) practice. The descriptive-comparative research design was used to collect data from 145 graduating students through a validated questionnaire that corresponds to the CPM competency requirements. Weighted mean, Shapiro–Wilk test and Kruskal–Wallis H test were used to analyze data. The results indicated that students were generally competent and highly ready for CPM practice but there were significant differences among programs in the selected competence and readiness areas prior to elements of CPM practice. These variations suggest that curriculum focus and exposure to practical training and learning experiences impact the students' preparation for certification. The study finds that technology programs are critical in preparing students for CPM practice, but further curriculum improvement, more laboratory training, and closer industry collaboration are needed to ensure consistent competency development and certification readiness.*

Keywords: Certified Plant Mechanic, competence, readiness, technology students, competency-based education, technical education

INTRODUCTION

Technical and vocational education and training (TVET) is a key mechanism for the production of skilled workers to satisfy the workforce needs of industrial sectors. The increasing demand for qualified personnel in the mechanical, manufacturing, power and other industrial services in Zamboanga City accentuates the importance of producing graduates with the appropriate technical skills and readiness in the workplace. The aim of competency-based education is the development of knowledge, skills, and attitudes that are aligned with the occupational standards and expectations of industry [12;8]. The students of the technology course in Industrial Technology, Mechanical Technology, Automotive Technology and Refrigeration and Air-Conditioning Technology will have competencies in terms of machinery operation, maintenance, troubleshooting and industrial practices. Upon successful completion of these programs, students are eligible to take the Certified Plant Mechanic (CPM) licensure exam. The CPM exam covers skills in the following areas: power plant machinery, industrial plant machinery and shop machinery and practices. These areas are important indicators of technical competence and professional preparedness for the practice of plant mechanic.

Technical competence and readiness are necessary for successful transition from academic training to professional practice. Students are mandated to demonstrate their competence in the use of knowledge and skills in troubleshooting, machine operations and safety and maintenance procedures through authentic learning experiences [2]. However, the low level of participation and performance of graduates in certification examinations indicate the need to investigate their level of competency and readiness for professional practice. Prior research has shown the importance of aligning educational outcomes with industry needs [6;4], but there is little research on differences in competency and readiness among technology programs that prepare students for Certified Plant Mechanic practice. This research aims to evaluate the competence and readiness of the technology students in the academic programs in Zamboanga City for insights for curriculum improvement, skills enhancement, and better certification preparation.

Research Problem

The study aimed at determining the competence and readiness of the technology program students on Certified Plant Mechanic (CPM) practices. Specifically, it aimed to measure the competence and readiness of the students of technology programs in the different elements of CPM practices and to find out if there are significant differences in the levels of competence and readiness of the students of technology programs when grouped according to the elements of CPM practices.

METHODS

Design and Setting

The study used the quantitative, non-experimental descriptive-comparative research design to determine the competence and readiness of the technology students for Certified Plant Mechanic practice and whether there are differences among academic programs. The descriptive component was used to determine the current level of competence and readiness of students, and the comparative component was used to study differences between programs. This design was considered appropriate because the study was designed to measure existing conditions and to determine differences among groups without manipulating variables. The study was conducted at a public higher education institution in Zamboanga City, Philippines. The institution was founded in 1905 and was declared as a polytechnic university under Republic Act No. 11187. It offers various technology and engineering courses that develop relevant skills and professional competencies in the industry. The school provides academic programs in Automotive Technology, Mechanical Technology, Refrigeration and Air-Conditioning Technology, and Industrial Technology with specializations in power plant engineering and other technical fields. The study was carried out in the College of Technology, where the selected programs for training students to the practice of Certified Plant Mechanic are implemented. The choice of the research site was based on the fact that it offers a full range of technology programs and produces graduates with the technical skills required to operate and maintain the industry and for professional certification.

Respondents and Sampling

The study was conducted with 145 graduating technology students from four programs that qualify them to pursue Certified Plant Mechanic (CPM) certification. Accuracy and verification of respondent distribution was obtained from the official population records from the university registrar. The respondents were composed of Bachelor of Science in Mechanical Technology (51 or 35%), Bachelor of Science in Automotive Technology (51 or 35%), Bachelor of Science in Industrial Technology major in Power Plant Engineering (26 or 18%), and Bachelor of Science in Refrigeration and Air-Conditioning Technology (17 or 12%). The programs were selected for their relevance in the development of competencies in the operation, maintenance, troubleshooting and industrial practices required for Certified Plant Mechanic practice. The respondents were all qualified graduating students from the identified technology programs using total enumeration sampling techniques. The reason for employing this sampling method was that the target population was available and had the particular features required for assessing competence and readiness for professional certification. The participation of all qualified respondents provided an opportunity for an overall comparison of competency and readiness levels of students across academic programs and provided evidence of the extent to which technology education outcomes are aligned to the requirements for Certified Plant Mechanic certification.

Research Instruments

Data was collected using a structured questionnaire developed by the researcher. The instrument was developed based on the competency requirements for the Certified Plant Mechanic (CPM) examination as prescribed under Republic Act No. 8495 (The Philippine Mechanical Engineering Act of 1998), specifically the competency areas covered in the Certified Plant Mechanic assessment. The questionnaire was designed to assess the competence and readiness of technology students for Certified Plant Mechanic practice. The instrument had three parts. Part I collected the respondents' demographic information, including their academic program. Part II measured the respondents' competency in the competency domains of power plant machinery, industrial plant machinery, and shop machinery and practices by using a four-point rating scale ranging from 1 (Low Competent) to 4 (Highly Competent). Part III assessed the respondents' preparedness for Certified Plant Mechanic on a four-point Likert scale of 1 to 4, where 1 is Low Ready and 4 is Highly Ready. The instrument was submitted to experts in mechanical technology and technical education for content validation prior to data collection.

Validity and Reliability of the Instrument

The researcher-developed questionnaire was content validated by a panel of experts consisting of Certified Plant Mechanics, Registered Mechanical Engineers, Professional Mechanical Engineers and technical education faculty members to determine its relevance, clarity and alignment with the competency requirements for Certified Plant Mechanic practice. Before its use, the instrument was re-edited based on the comments of the validators. The instrument was then pilot-tested on 20 graduating technology students with similar characteristics as the target respondents but not included in the actual study. The reliability analysis showed an overall Cronbach's alpha coefficient of 0.860, indicating good internal consistency. These procedures validated and confirmed the instrument's reliability and validity to assess students' competence and readiness for Certified Plant Mechanic practice.

Data Collections and Ethics

Prior to data collection, approval for conducting the study was obtained from concerned institutional authorities. Once permission was obtained, the validated questionnaire was administered to the selected identified graduating technology students from the academic programs. Researcher explained the purpose of the study and instructions for completing the questionnaire. Participation was voluntary and all respondents were requested and provided their informed consent prior to data collection. Anonymity and strict confidentiality of responses were assured by the respondents that the information collected would be used only for academic and research purposes. They were also informed that they could decline or withdraw from the study at any time without penalty. The completed questionnaires were collected, checked for completeness and prepared for data coding and statistical analysis.

Statistical Analyses

Descriptive and inferential statistics were used in the analysis of data. Frequency and percentage were used to describe the distribution of the respondents according to academic programs, while weighted mean was used to determine the level of students' competence and readiness for Certified Plant Mechanic practice. Reliability of the instrument was established using Cronbach's alpha. The normality of the data was tested by Shapiro–Wilk test, which showed that the competence scores ($W = 0.964$, $p = 0.002$) and readiness scores ($W = 0.958$, $p = 0.001$) were not normally distributed. Because the assumption of normality was violated ($p < .05$) the Kruskal–Wallis H test was used to determine the significant differences in competence and readiness among the academic programs. The significant results were further examined using pairwise comparison tests to detect specific group differences.

Technology Programs	Grand Mean	Interpretations
BSIT-PPE	2.54	Competent
BSRACT	2.45	Low Competent
BSAT	2.69	Competent
BSMT	2.51	Competent

RESULT

Table 1. Level of Student Competence in CPM Practices across Technology Programs

Table 1. The competence level of technology students in the

Certified Plant Mechanic (CPM) practice by academic program. The result reveals that most of the students were generally Competent with BSAT having the highest grand mean (M=2.69) followed by BSIT-PPE (M=2.54) and BSMT (M=2.51). Meanwhile, BSRACT was given the lowest rating (M = 2.45), interpreted as Low Competent. The results show that students have the skills needed for CPM practices. However, there are differences between programs, which indicate differences in the exposure and development of the skills.

Table 2. Level of Student Readiness in CPM Practices across Technology Programs

TECHNOLOGY PROGRAMS	GRAND MEAN	INTERPRETATIONS
BSIT-PPE	2.61	Highly Ready
BSRACT	1.54	Low Ready
BSAT	2.87	Highly Ready
BSMT	3.00	Highly Ready

Table 2 shows the level of readiness of technology students for Certified Plant Mechanic (CPM) practices across academic programs. Results showed that BSMT got the highest readiness level with a grand mean of 3.00, followed by BSAT (M = 2.87) and BSIT-PPE (M = 2.61), all interpreted as Highly Ready. In contrast, BSRACT recorded the lowest level of readiness with a grand mean of 1.54, described as Low Ready. The findings indicate that most technology programs are adequately prepared for CPM practice, but differences in program exposure and competency-related experiences may affect students' preparedness for certification requirements.

Table 3. Significant Difference on the Level of Student Competence when Grouped into Elements of CPM Practice

Competence	X^2	df	p-value	Decision	Interpretation
Elements of Power Plant Machinery (Troubleshooting and repair)	*12.473*	*3*	*0.006*	*Reject the H_o*	*Significant*
Shop Machinery and Practices (Bench work and Machine Operation)	*51.031*	*3*	*0.000*	*Reject H_o*	*Significant*
Element of Industrial Plant Machinery (Safety and Maintenance)	*3.106*	*3*	*0.376*	*Retain H_o*	*Not Significant*

The significant difference of students' competence on Certified Plant Mechanic (CPM) practices when classified according to academic programs is shown in Table 3. The Kruskal–Wallis H test indicated significant differences in competence in Elements of Power Plant Machinery (Troubleshooting and Repair), H(3) = 12.473, p =.006, and Shop Machinery and Practices (Benchwork and Machine Operation), H(3) = 51.031, p < .001. These results indicate that student competence in these areas varies widely between technology programs. There was, however, no significant difference in Elements of Industrial Plant Machinery (Safety and Maintenance), H(3) = 3.106, p = .376, suggesting that the students across programs are similarly competent in safety and maintenance practices. The results show that academic programs have different effects on some of the technical competencies, especially those which involve practical experience and application.

Table 4. Significant Difference on the Level of Student Readiness when Grouped into Elements of CPM Practice

Level of Readiness	X^2	df	p-value	Decision	Interpretation
Troubleshooting and Repair	*15.855*	*3*	*0.001*	*Reject H_o*	*Significant*
Bench work and Machine Operation	*9.468*	*3*	*0.024*	*Reject H_o*	*Significant*
Safety and Maintenance	*13.422*	*3*	*0.004*	*Reject H_o*	*Significant*

Table 4 shows the significant difference in the students' readiness for the Certified Plant Mechanic (CPM) practices based on their academic programs. The Kruskal–Wallis H test showed significant differences in all readiness components: Troubleshooting and Repair, H(3) = 15.855, p = .001; Benchwork and Machine Operation, H(3) = 9.468, p = .024; and Safety and Maintenance, H(3) = 13.422, p = .004. These findings suggest that students' levels of preparedness differ significantly by technology program. The results indicate that differences in curriculum emphasis, practical training exposure, and program-specific learning experiences may help to explain differences in students' preparedness for Certified Plant Mechanic practice. Hence, academic programs may need to continuously improve competency-based training and practical learning opportunities to ensure similar readiness among technology students.

DISCUSSION

The results show that the technology students have the competencies and readiness for the practice of Certified Plant Mechanic (CPM) in general, although there are differences between academic programs. The competence differences can be explained by differences in curriculum focus, amount of practical training and opportunities to apply it in practice. This is in line with the principles of Competency-Based Education that focus on the development of measurable skills that are aligned with occupational standards and workplace needs [8]. The difference in technical competencies, especially troubleshooting, repair and machine operation, emphasizes the importance of experiential learning in technology education. Practical engagement with industry related tasks allows students to integrate theoretical knowledge with technical performance and thus to strengthen occupational competence [7;1]. Similarly, differences in readiness point to the role of learning opportunities within programs in shaping students' readiness for professional certification. Results pointed to the importance of ongoing curriculum enhancement, equal access to hands-on training, and more robust industry-academia collaborations to ensure that graduates from various technology programs are comparable in skills and readiness for CPM practice. Matching educational instruction to industry competency standards is key to closing the skills gap and improving workforce readiness [5;9]. The findings also show that in order for technology students to achieve uniform levels of competencies, the assessment of instructional strategies, training facilities and learning resources should be a continuous process among academic programmed. Variations between programs suggest that institutions need to identify areas of competence that require improvement and design specific measures to address these gaps. Laboratory activities, simulation-based learning and exposure to the workplace improve students' opportunities to practice and develop critical CPM skills in real-life situations [5;4]. Faculty also play a vital role in keeping training methods relevant to technological developments and industry needs. The results also suggest that CPM practice readiness is not just a technical skill, but that students must also develop problem solving skills, adaptability and confidence to be able to use their skills in real work settings. "The preparation of students for certification and the demands of the dynamic mechanical and industrial sectors require balanced programmed that integrate classroom learning with hands-on application and industry involvement" [6;2]. Thus, there is a need for continuous collaboration among educational institutions, industry partners and professional organizations to develop a highly skilled and competitive workforce that could meet the standards of Certified Plant Mechanic practice [4;6].

CONCLUSIONS

The study concluded that technology students possess the critical competence and preparedness needed for Certified Plant Mechanic (CPM) practice, although there are differences in academic programs. Variations in competence and readiness imply that students' preparedness for professional certification is influenced by program-specific curriculum structures, practical training exposure, and learning experiences. The findings support the importance of competency-based education and experiential learning in developing technical capabilities that meet occupational standards [8;2]. Technology programs should regularly compare their curriculum to industry competency requirements to strengthen students' preparation for CPM certification, especially in areas that require significant hands-on application such as troubleshooting, repair, and machine operation. Institutions should also scale up laboratory-based activities, workplace immersion and industry collaboration to offer learners authentic learning experiences that bridge academic preparation and professional practice [7;5]. Universities and colleges need to develop mechanisms for monitoring the development of competencies and identifying precisely where students need additional help and instruction. Partnerships with industry, professional organizations and certification bodies can provide opportunities to update training practices, expose students to current technologies and address the changing needs of the workplace. The study further shows that competence as a CPM practitioner is not only about technical knowledge and skills, but also about confidence, adaptability and the ability to apply the learnt competencies in real industrial settings. Therefore, there is always a need for curriculum and faculty development, improvement of resources and opportunities for practical training to ensure that the graduates of technology are adequately prepared to meet the expectations of the CPM profession and contribute meaningfully to the technical workforce.

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