

Management Framework for Quality Assurance to Strengthen Technology and TVET Pre-service Teacher Education

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Abstract

This study developed a management framework for quality assurance to enhance Technical-Vocational Education and Training (TVET) and technology pre-service teacher education programs in CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon). Using the three-round Delphi consensus-building technique, the research assessed quality assurance practices and challenges in managing Bachelor of Technology and Livelihood Education (BTLEd) and Bachelor of Technical Vocational Teacher Education (BTVTEd) programs. The study also examined key factors affecting student performance in licensure examinations, career decision influences, and strategies to improve program appeal. Thirteen Delphi experts, including College Deans and program chairs, and 117 BTLEd and BTVTEd graduates participated. Thematic and statistical analyses, including the Mann-Whitney U test, compared assessment differences between graduates concerning licensure exam performance, career decisions, and program appeal strategies. The findings highlight that Teacher Education Institutions (TEIs) in the region prioritize quality assurance through curriculum reviews, faculty engagement, accreditation, facility maintenance, and continuous improvement. However, they face challenges such as resource limitations, curriculum misalignment, faculty development issues, and lack of specific quality assurance standards for TVET programs. Graduates noted factors influencing their licensure exam performance and career decisions, emphasizing the importance of review preparation, teaching strategies, and professional development. To enhance program appeal, there is a need for sustained career guidance, institutional initiatives, and program awareness efforts. The study recommends strengthening collaboration with stakeholders and implementing the proposed management framework to align with national and international standards.

1. Introduction

The image of TVET is often quite low in many countries, including both advanced industrial economies and developing countries (UNESCO-UNEVOC, 2018). In fact, in 2019, out of 18,847 teacher education graduates, only 4.32% completed TVET-related teacher education programs. This reflects a low representation of TVL teachers to meet the demands in government schools. Additionally, not all BTVTEd graduates enter the teaching field, as they have career paths in industries. Paramount to the pursuit of excellence in education is shaping the future of

societies, and the significance of quality assurance in education cannot be overstated. The institutionalization of Technical, Vocational, and Livelihood Education (TVL) in 2012 was a highlight of the K-12 curriculum, preparing students not just for higher education but also for entrepreneurship, middle-level skills advancement, and the workforce. Teacher education institutions offering BTLEd and BTVTEd degrees confront considerable obstacles because of their antiquated curricula and poor alignment with the demands of the labour market today. Graduates with abilities that fall short of industry standards due to the mismatch have gaps in their employability (Alinea, 2022; Rao, 2024). Deficits in administrative support, such as poor facilities, antiquated equipment, and restricted funds, exacerbate this problem by impeding the creation of programs and the availability of resources (Gasmelseed, 2021; Rao, 2024). The success of these programs is further impacted by the paucity of qualified teachers, who frequently lack both pedagogical training and pertinent industrial experience (Tanaka et al., 2023).

Quality assurance in TVET programs relies on frameworks and standards that ensure consistency and alignment with industry benchmarks (Scull et al., 2011; Morley, 2024). Nevertheless, there are many obstacles to implementing good quality assurance procedures. These include deficient finance, infrastructure, and regulatory frameworks that impede the formation of strong industrial relationships and cause disparities in educational quality (Gasmelseed, 2021; Mutebi & Ferej, 2023). Professional development and feedback mechanisms contribute to continuous improvement by enabling instruction to be aligned with student needs and performance to be tracked (Morley, 2024; Scull et al., 2011). TVET programs must be relevant and effective in a labor market that is changing quickly, and addressing these issues is essential to responding to the pressures of globalization (Scull et al., 2011).

The study aims to develop a management framework for quality assurance to enhance pre-service technology and TVET teacher education in CALABARZON through the Delphi consensus technique. It seeks to identify the quality assurance practices in technology and TVET teacher training institutions, such as curriculum design, faculty engagement, accreditation, facilities, partnerships, and teaching quality, while also recognizing the challenges in these programs, including resource constraints, curriculum issues, faculty competence, industry collaboration, program appeal, and adherence to quality standards. Additionally, the study aims to identify factors that influence the performance of BTLEd and BTVTEd graduates in the Licensure Examination for Teachers (LET) and their career choices, as well as to compare graduates' assessments of these factors. Finally, the study seeks to identify strategies to enhance the appeal of technology and TVET teacher education and develop a comprehensive management framework for quality assurance that aligns with the needs of the TVET sector and society.

Despite the introduction of K to 12 in 2013, inadequate quality assurance provision in some schools led to an increased demand for TVET teachers. Low qualification standards of pre-service teachers, lack of industrial background, and issues in the migrated BTLEd and BTVTEd curricula indicate problems in TVET teacher training. The study explored the factors contributing to low licensure examination ratings, addressed quality assurance challenges, understood factors influencing career choices, and aimed to enhance the appeal of TVET and technology teacher education in CALABARZON. A management framework can facilitate curriculum reviews and align teacher education with evolving needs, leading to globally competitive and competent students.

2. Quality Assurance Practices and Challenges in TVET

A number of serious problems pertaining to faculty credentials and curriculum relevance are plaguing the BTLEd and BTVTEd programs in the Philippines. Research shows that these programs frequently have out-of-date curricula that do not reflect the demands of the labour market today, creating a skills gap between graduates' abilities and what employers are looking for (Alinea, 2022; Rao, 2024). Administrative factors that impede program development and resource availability, such as inadequate facilities, poor equipment, and limited budget, exacerbate the misalignment (Rao, 2024; Gasmelseed, 2021). Moreover, the success of these programs is compromised by the dearth of competent instructors possessing both pedagogical expertise and pertinent industry experience (Tanaka et al., 2023; Eze et al., 2022). More teachers with nationally certified technical abilities have had to be hired and trained as a result of TVL programs, underscoring the need for enhancements in teacher preparation and continuous professional development (Majumdar et al., 2021; UNESCO, 2012). The success of these initiatives is further complicated by obstacles to student involvement and retention, such as financial hardships and mental health problems (Watermark Insights, 2023).

Establishing frameworks and standards to guarantee consistency and conformity with industry benchmarks is one of the essential approaches for quality assurance in TVET programs (Scull et al., 2011; Morley, 2024). These frameworks are necessary to ensure consistency throughout institutions and to direct the creation and execution of educational initiatives. Feedback mechanisms that offer insights into student performance and assist in customizing instructional approaches to better match learner needs—like surveys and learning analytics systems—are the driving forces behind continuous improvement (Morley, 2024; Scull et al., 2011). By encouraging an environment of accountability and continual learning inside organizations, peer evaluations and professional development help to improve quality assurance even more (Morley, 2024). These procedures are essential for updating curricula to reflect changes in the sector and in technology, guaranteeing that TVET

programs stay current. Even though quality assurance procedures are crucial, there are a number of obstacles that prevent them from being used effectively in TVET programs. Program quality is frequently compromised at educational institutions by inadequate infrastructure and resources, which prohibit programs from fulfilling necessary standards. These problems are made worse by funding constraints, which result in a lack of funding for essential improvements to classrooms and other infrastructure (Gasmelseed, 2021). Furthermore, a lack of strong regulatory frameworks to monitor quality assurance procedures leads to uneven quality among organizations and a deviation from international best practices (Mutebi & Ferej, 2023). The ability of TVET programs to adapt and uphold high standards is further complicated by the demands of a fast-changing labour market and the pressures of globalization (Scull et al., 2011).

Addressing the noted issues and enhancing program efficacy need the creation of management frameworks for TVET programs. Research highlights that in order to promote improvements in TVET programs, there is a need for efficient administrative support, which includes improved facilities, modern equipment, and improved funding procedures (Rao, 2024). Furthermore, a major aspect in drawing and keeping students in BTLEd and BTVTEd programs is career selection. Graduates' employment decisions are significantly influenced by intrinsic motivations, such as a desire to teach and a sense of personal fulfilment (Li & Sun, 2011; Mangaoil et al., 2017). Career choices and satisfaction are also influenced by social and environmental factors, such as meaningful connections with students and support from the community (Li & Sun, 2011; Mangaoil et al., 2017). Enhancing the appeal of TVET programs involves addressing these intrinsic motivations and providing strong support systems to improve student engagement and retention (Hossain, 2021; Köpsén & Anderson, 2017). The Delphi method, which is applied in policy formation and educational research, is a vital tool for reaching agreement among specialists on difficult TVET-related topics. By obtaining professional viewpoints and implementing them into educational initiatives, this approach helps with well-informed decision-making and policy development (Irdayanti et al., 2015; Abdul Rahman et al., 2022; Mohd et al., 2023). The Delphi technique ensures that educational procedures are based on expert consensus and are adaptable to contemporary issues and trends through iterative rounds of feedback and analysis. This methodology facilitates the ongoing enhancement of TVET programs and aids in the creation of enhanced management structures and curricula.

2.1 Research Framework

The study developed a management framework for quality assurance in TVET and technology pre-service teacher education programs in CALABARZON. The Delphi consensus-building technique, involving multiple rounds of structured questions, feedback, and revision, was employed. The study progressed through three phases: Pre-Delphi, Delphi, and Framework Development. In the Pre-Delphi phase, experts were selected based on their diverse backgrounds and experiences in TVET program management. Preliminary questions were formulated, piloted, and refined for the upcoming Delphi phase. The Delphi phase consisted of rounds where experts shared opinions on key factors affecting the performance of Bachelor of Technology graduates in licensure exams, quality assurance practices and challenges in teacher education institutions, and strategies to enhance program appeal. Qualitative data were analyzed, and a consensus-building survey was designed for Round 2. In Round 2, survey results were presented, and the Delphi panel rated statements for consensus. Analysis using Coefficient of Variations and Interquartile Range (IQR) identified statements without consensus, leading to a Round 3 survey. The APMO (Average Percent of Majority Opinions) method was used to analyze opinions on unresolved items. The final phase involved developing a management framework for quality assurance. This process considered literature, consensus-building results, and the researcher's reflections on fieldwork outcomes.

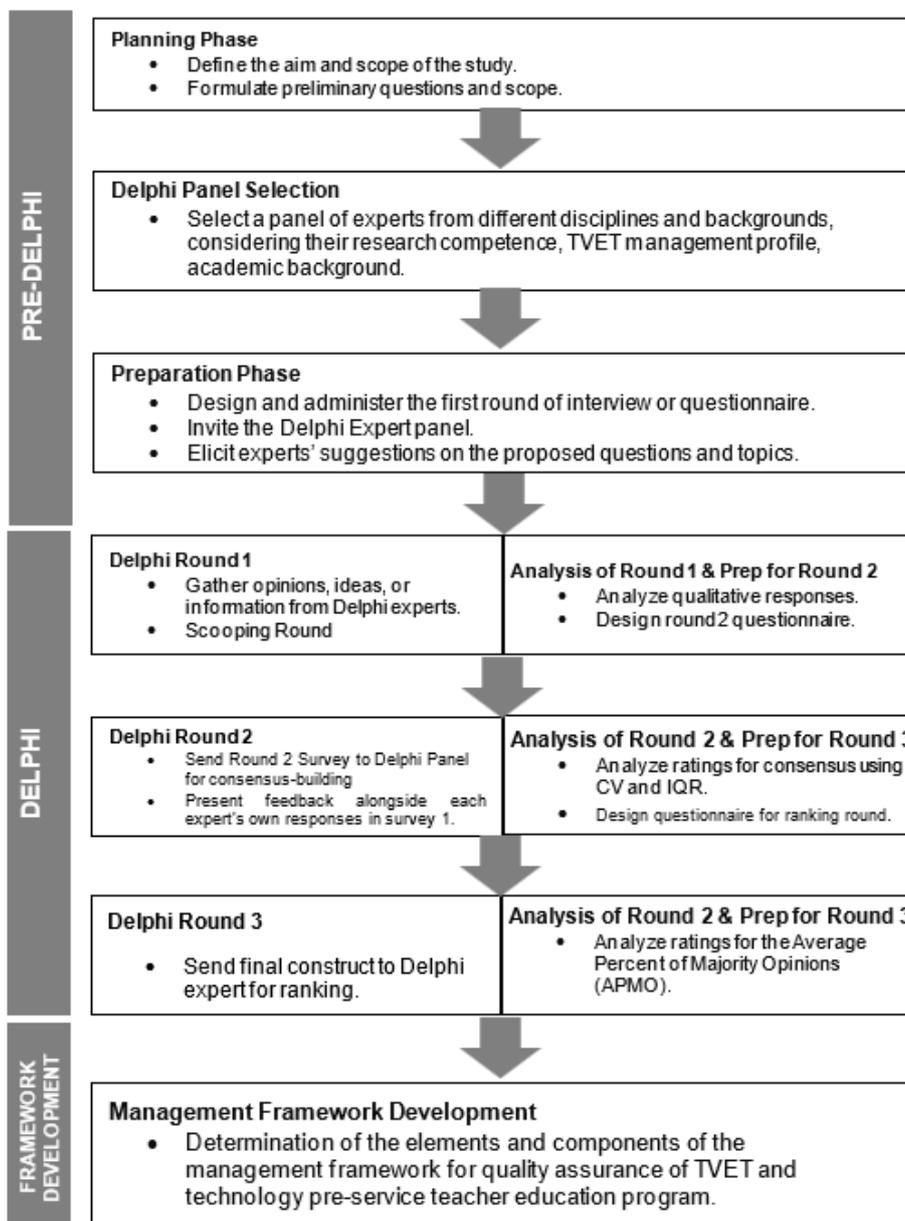


Fig. 1 Research framework

3. Methodology

3.1 Research Design

To accomplish the study's objectives, a Delphi study design, was implemented. This approach involved multiple iterative rounds of structured questionnaires to gather insights from a panel of experts, reflecting the Delphi technique's appropriateness across various research domains. The Delphi method, well-suited for situations with incomplete knowledge, was selected due to its effectiveness in improving understanding, addressing problems, and developing forecasts (Skulmoski et al, 2007). The research design encompassed three stages: the initial round distributed an initial interview to collect expert opinions on the practices and challenges in quality assurance of BTLEd and BTVTEd programs, the factors contributing to the performance of the graduates in the licensure examination, the factors influencing their teaching career decisions, and the strategies to make the programs more appealing. The second round, drawing inspiration from Subri et al (2020) involved reviewing, ranking, and thematically analyzing items based on responses from Round 1, seeking additional input, clarification, and consensus on identified research areas. Finally, in the third round, further consensus was achieved. This approach, inspired by the collaborative efforts of multiple experts, culminated in the development of a survey questionnaire, as evident in the studies conducted by Mohd et al (2023) and Nashir (2020), which was answered by BTLEd and

BTVTEd graduates. The study resulted to a management framework for quality assurance to strengthen the technology and TVET preservice teacher education in CALABARZON.

3.2 Population and Sample

The study involved 13 Delphi experts in teacher education and quality assurance in the CALABARZON region, employing a purposive sampling technique to select a diverse panel. There were five State Universities in the region, each with one College Dean of Teacher Education and one Program Chair for either the BTLEd or BTVTEd program. Depending on the number of students enrolled, some colleges had two separate program chairs, which determined the number of Delphi experts qualified to participate in the study. The selected experts possess qualifications such as practical experience in managing teacher education institutions and TVET quality assurance, appointment as College Dean or Program Chair in relevant programs, satisfactory competence in management, holding a master's degree or higher, related-TESDA qualifications, and having an interest in the study. These experts, affiliated with State Universities in CALABARZON (Cavite State University, Laguna State Polytechnic University, Batangas State University, University of Rizal System, and Southern Luzon State University), were chosen based on their association and recommendations from other experts. The focus is on quality rather than quantity, considering that the number of respondents does not strongly correlate with the quality of decisions. For the survey respondents, since the population couldn't be determined, quota sampling was employed. During the three-week fieldwork, a total of 107 individuals from CALABARZON participated, including 86 BTLEd graduates specializing in various areas and 21 BTVTEd graduates from diverse specializations.

3.3 Data Gathering Instrument

To achieve the study's objectives, the researcher utilized Key Informant Interviews (KII) and Likert-type Survey Questionnaires. KII involved in-depth qualitative interviews with 13 Delphi experts and professionals in management, curriculum development, TVET, and teacher education. These interviews aimed to identify quality assurance practices, challenges in teacher education programs, factors affecting graduates' performance and career decisions, and strategies to enhance program appeal. Additionally, a 5-point Likert scale questionnaire was used in the second Delphi round to gauge experts' agreement on various items. The survey questionnaire, developed post-Delphi rounds, was administered to BTLEd and BTVTEd graduates to assess factors influencing their licensure exam performance, career decisions, and strategies to attract SHS students to TVET and technology teacher education programs. The questionnaire was subjected to pilot testing, which yielded a Cronbach's Alpha score of 0.973, indicating that the items are excellent and suitable for proceeding to the actual data gathering.

3.4 Data Analysis and Interpretation

The study utilized both qualitative and quantitative approaches to gather and analyze data. Qualitatively, the Delphi technique was employed across three stages: initial content analysis involved face-to-face interviews with experts to collect insights, which were then synthesized into a survey. In the consensus-building stage, experts rated and reviewed the survey to establish agreement using statistical measures like Coefficient of Variations (CV) and Interquartile Range (IQR). Disagreements led to a third round, analyzed via the Average Percent of Majority Opinion (APMO) method. Both datasets were analyzed using a spreadsheet application (MS Excel). The responses from the quantitative survey were recorded in Excel before being imported and processed in SPSS to measure the statistical correlation. Thematic analysis identified patterns in qualitative data, following Caulfield's (2023) systematic approach. Quantitatively, data from BLTEd and BTVTEd graduates in CALABARZON were collected via surveys. Statistical methods including frequency analysis, weighted mean, and standard deviation were applied. Inferential statistics like the Mann-Whitney U Test compared program assessments, while descriptive statistics summarized insights. Integration of qualitative and quantitative findings informed a management framework addressing teacher education issues aligned with stakeholder perspectives and quality assurance standards, grounded in relevant literature.

4. Results and Discussion

4.1 Quality Assurance Practices of Technology and TVET Teacher Training Institutions

The quality assurance practices of technology and TVET teacher training institutions were identified during the Delphi first round of this study, thereafter, consensus was achieved on the thematically analyzed practices employed by the TEIs during the second and third Delphi rounds. Delphi technique enables group problem-solving using an iterative process of problem definition, discussion, feedback, and revisions (Irdayanti et al, 2015).

Delphi Survey Rounds. Over the course of three rounds, the survey examined quality assurance procedures in teacher preparation facilities. Faculty growth, curriculum compliance with international standards, and

continual improvement in line with industry needs were highlighted in 45 noteworthy statements from expert interviews in the first round. Facilities of the highest caliber, partnerships with associations of professionals, and ongoing evaluation via KPIs were given top priority by the institutions. Using thematic analysis and interquartile range (IQR) measurements, the second round improved upon these insights, yielding consensus on 29 items. However, one item, which dealt with engagement with external partners, did not satisfy the consensus threshold and was re-examined in the third round. The last round addressed outstanding issues, one of which was promoting international cooperation. In the end, the Average Percent of Majority Opinions helped to attain consensus.

4.1.1 Continuous Curriculum Design and Review

The first cluster of statements included TEIs which are conducting regular reviews and updates of BTLEd or BTVTED curricula to align with industry needs, changing CHED requirements, and board specifications. This got a strong agreement as shown on the mean of 4.80 (SD:0.63), CV value of 13.18 and an IQR of 0.00. This agrees with the findings of Lemaitre, (2009) that the curriculum should be aligned with the international standards. This is followed by involving students, industry experts, alumni, and representatives from professional organizations in the curriculum design and validation which was indicated by the similar mean of 4.80 (SD:0.42), CV of 8.78 and an IQR of 0.00. Meanwhile, the mean of 4.60 (SD: 0.43) with CV of 12.17 and an IQR of 0.00 was received by the quality assurance practice of aligning the curriculum with international standards and best practices to enhance global competitiveness of the graduates.

Table 1 Consensus of opinions on the quality assurance practices of the technology and TVET teacher training institutions as to continuous curriculum design and review

Continuous Curriculum Design and Review	Mean	SD	CV	IQR
1. Conducts regular reviews and updates of BTLEd or BTVTED curricula to align with industry needs, changing CHED requirements, and board specifications.	4.80	0.63	13.18	0.00
2. Involves students, industry experts, alumni, and representatives from professional organizations in the curriculum design and validation.	4.80	0.42	8.78	0.00
3. Collaborates with other department and colleges in the refinement of the curriculum (i.e. College of Industrial Technology)	4.70	0.67	14.36	0.00
4. Aligns the curriculum with international standards and best practices to enhance global competitiveness of the graduates.	4.60	0.43	12.17	0.00

4.1.2 Faculty Engagement

All items achieved an IQR ≤ 1.00, signaling strong consensus among experts to halt the iterative process. The highest mean of 4.70 (SD: 0.67) and CV value of 14.36 indicate strong agreement that TEIs support faculty attendance at conferences and workshops for networking and knowledge enhancement. Moreover, TEIs emphasize faculty engagement in research, publication, TESDA certification, and post-graduate studies, reflecting dedication to academic and professional growth, with a mean rating of 4.60 (SD: 0.70) and CV value of 15.20. As pointed by Tanaka et al (2023) inadequate training opportunities for TVET instructors can limit their effectiveness in teaching the necessary skills. Also, Morley (2024) emphasized that engaging in peer reviews through collaboration networks helps educators gain insights into teaching practices and assessment tasks from colleagues. Similarly, recognizing faculty contributions to technology and TVET education garnered a mean of 4.60 (SD: 0.70) and a CV value of 15.20. Faculty involvement in industry immersions, collaborative projects, and business enterprises received the lowest mean rating of 4.50 (SD: 0.71), indicating strong agreement among Delphi experts. While still indicating a strong agreement, this suggests that there might be areas for improvement or varying perspectives among experts regarding the implementation of these practices. Ensuring high input quality—such as qualified faculty and appropriate educational resources as mentioned by Gasmelseed (2021) is essential for effective TVET programs. Further exploration and discussion could provide valuable insights into optimizing these engagement strategies to ensure a well-rounded and effective faculty development approach within TEIs.

Table 2 Consensus of opinions on the quality assurance practices of the Technology and TVET teacher training institutions as to faculty engagement

Faculty Engagement	Mean	SD	CV	IQR
5. Supports continuous engagement of faculty members to professional development opportunities in terms of research, publication, TESDA certification, post-graduate studies.	4.60	0.70	15.20	0.75

6. Engages faculty members to industry immersions, community or industry collaborative projects, business enterprise.	4.50	0.71	15.71	1.00
7. Acknowledges and recognizes faculty members for their unique contributions for technology and TVET on the areas of instruction, research, community engagement.	4.60	0.70	15.20	0.75
8. Supports faculty attendance at relevant conferences and workshops to enhance their network and knowledge base.	4.70	0.67	14.36	0.00

4.1.3 Accreditation and Program Certification

The category of responses focuses on the quality assurance practices of technology and TVET teacher training institutions regarding accreditation and program certifications. As tertiary education evolves, quality assurance processes must also adapt (Lemaitre, 2009). All indicators had an IQR ≤ 1.00 , negating the need for a third Delphi consensus round. TEIs strongly endorse regular internal and external audits, seeking accreditation for programs, and encouraging industry-relevant certifications alongside TVET specializations. These practices received a consistent mean of 4.70 (SD: 0.48, CV: 10.28), reflecting a strong commitment to external validation and adherence to quality standards. There is also strong agreement (mean: 4.60, SD: 0.52, CV: 11.23) on using accreditation feedback to improve TVET and technology program management, emphasizing alignment with industry standards. Embedding industry-recognized certifications into the curriculum, which received a mean of 4.50 (SD: 0.71, IQR: 15.71), demonstrates TEIs' focus on enhancing students' practical skills and job prospects. Following standards to guarantee consistency and conformity with industry benchmarks is one of the essential approaches for quality assurance in TVET programs (Scull et al., 2011; Morley, 2024).

Table 3 Consensus of opinions on the quality assurance practices of the technology and TVET teacher training institutions as to accreditation and program certification

Accreditation and Program Certification	Mean	SD	CV	IQR
9. Conducts regular internal and external audits to ensure ongoing compliance with accreditation standards and immediately address the identified areas for improvement.	4.70	0.48	10.28	0.75
10. Seeks accreditation from relevant accrediting bodies for technology and TVET programs.	4.70	0.48	10.28	0.75
11. Encourages students to obtain industry-relevant certifications alongside their TVET specialization in TESDA.	4.70	0.48	10.28	0.75
12. Acknowledges and recognizes faculty members for their unique contributions for technology and TVET on the areas of instruction, research, community engagement.	4.60	0.70	15.20	0.75
13. Supports faculty attendance at relevant conferences and workshops to enhance their network and knowledge base.	4.70	0.67	14.36	0.00

4.1.4 Provision for Quality Facilities and Learning Resources

The experts strongly agree on the importance of providing complete and suitable tools, equipment, learning facilities, training areas, and well-equipped laboratories for programs like BTLED and BTVTED, with both aspects receiving the highest mean ratings of 4.80 (SD: 0.63). Facilities and materials do not meet the required standards, which hampers the effective delivery of programs (Gasmelseed, 2021). These items also had CV values of 13.18 and IQR values of 0.00, indicating no need for further Delphi consensus rounds. Other practices, such as regular maintenance, upgrades of facilities, and ensuring access to quality learning resources, scored a mean of 4.70 (SD: 0.67) with the same CV and IQR values, resulting in their deletion from further rounds. This consistent agreement highlights the experts' uniform perspective on the significance of these quality assurance practices.

Table 4 Consensus of opinions on the quality assurance practices of the technology and TVET teacher training institutions as to quality facilities and learning resources

Quality Facilities and Learning Resources	Mean	SD	CV	IQR
14. Equips teacher training institutions with state- of-the-art, complete and suitable tools and equipment, learning facilities, training areas, and laboratory of BTLED and BTVTED programs	4.80	0.63	13.18	0.00
15. Conducts regular maintenance and upgrade of facilities to meet changing industry standards and training facilities requirements	4.70	0.67	14.36	0.00

16. Ensures availability of contextualized, quality, and outcomes-based learning resources like textbooks	4.70	0.67	14.36	0.00
17. Manages favorable scheduling of lecture and laboratory classes.	4.80	0.63	13.18	0.00
18. Ensures equitable access to resources for all students, considering factors such as financial constraints and physical disabilities.	4.70	0.67	14.36	0.00

4.1.5 Collaboration with Partners and Organizations

The TEIs' efforts to maintain partnerships with TVET-related professional organizations and institutions. The highest mean value of 4.70 (SD: 0.67, CV: 14.36) indicates strong agreement among Delphi experts on involving faculty and students in research collaboration, community extension activities, and supporting innovation and entrepreneurship. This consensus emphasizes the belief that such collaborations enhance TVET programs. Sustaining strong relationships with alumni in industries and schools follows with a mean of 4.60 (SD: 0.70, CV: 15.20, IQR: 0.75). Additionally, participating in industry-sponsored competitions and conducting regular industry forums and networking events received mean ratings of 4.40 (SD: 0.84, CV: 19.17, IQR: 1.00) and 4.30 (SD: 0.82, CV: 19.15, IQR: 0.75), respectively. The consensus highlights the importance of alumni and international collaborations in enhancing TVET programs, with continued discussion needed on international perspectives. Without strong partnerships, TVET programs may not sufficiently prepare students for employment (Gasmelseed, 2021).

Table 5 Consensus of opinions on the quality assurance practices of the technology and TVET teacher training institutions as to collaboration with partners and organizations

Collaboration with Partners and Organizations	Mean	SD	CV	IQR
19. Involves faculty and students on research collaboration, community extension activities, and support innovation and entrepreneurship.	4.70	0.67	14.36	0.00
20. Participates in industry-sponsored competitions to showcase students' skills and foster connections with potential employers.	4.40	0.84	19.17	1.00
21. Conducts regular industry forums and networking events for students and faculty to interact with professionals.	4.30	0.82	19.15	1.00
22. Sustains strong relationships with alumni working in the industries and schools.	4.60	0.70	15.20	0.75
23. Encourages international collaborations, exchange programs, and exposure to diverse technological settings.	4.10	0.88	21.36	1.75

4.1.6 Continuous Improvement

The Delphi experts emphasized the need for expanded training beyond department heads to foster a shared culture of quality assurance. Training sessions and webinars were recommended to enhance commitment to excellent customer service and continuous improvement within academic institutions (Rodriguez, 2022). Experts stressed the importance of regular Key Performance Indicator (KPI) assessments to monitor program quality, with the highest mean score of 4.80 (SD: 0.42, CV: 8.78). Aligning program goals with national educational objectives was identified as crucial (Sanyal, 2013). They also supported regular evaluations from students, industry, and school partners, along with benchmarking best practices, which received a mean score of 4.70, indicating strong consensus on these quality assurance practices. Using feedback to identify areas for improvement received the lowest mean of 4.60 (SD: 0.70), demonstrating agreement among experts. All indicators had an IQR value of less than 1.00, indicating consensus without the need for a third Delphi round.

Table 6 Consensus of opinions on the quality assurance practices of the technology and TVET teacher training institutions as to continuous improvement

Continuous Improvement	Mean	SD	CV	IQR
24. Solicits feedback, through regular evaluation from students, and industry and school partners.	4.70	0.67	14.36	0.00
25. Communicates and uses feedback to identify areas for improvement.	4.60	0.70	15.20	0.75
26. Regularly assesses key performance indicators (KPI) of the college to monitor program quality.	4.80	0.42	8.78	0.00
27. Conducts regular industry forums and networking events for students and faculty to interact with professionals.	4.30	0.82	19.15	1.00

28. Benchmarks on the best practices of other technology and TVET teacher training institutions.	4.70	0.67	14.36	0.00
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4.2 Current Challenges Encountered in Quality Assurance of BTLEd and BTVTEd Programs

Delphi Survey Rounds. The survey revealed several significant challenges to ensuring the quality of BTLEd and BTVTEd programs, including a lack of resources, issues with content and teaching methods, faculty competency, and industry cooperation for teacher preparation. The lack of specialized faculty, antiquated teaching materials, resistance to cutting-edge teaching techniques, and poor industry partnership were all emphasized, in addition to inadequate professional development. Complicating matters were low enrolment rates and uneven application of quality standards. By classifying statements into six themes and examining expert consensus and divergence, the second phase of analysis improved these discoveries. Because of the earlier differences in opinion, the statement about the "fast pace of technological changes in industries" was re-examined in the third round. Experts agreed that it should be included, highlighting the flexibility of the Delphi process in identifying and validating important issues.

4.2.1 Resource Constraints

Delphi experts strongly agree on the limited financial resources for acquiring, maintaining, and upgrading training equipment, facilities, and spaces. According to Stander and Herman (2017), primary barriers to quality assurance in higher education management include physical and financial resource limitations, capacity development (including leadership and academic responsibilities), and program design challenges. Difficulty in recruiting and retaining qualified faculty members with practical industry experience exacerbates the problem, leading to a lack of industry-specific expertise among teaching staff. Outdated training tools, equipment, and facilities further compound these issues, with a mean score of 4.70 (SD: 0.48), indicating widespread consensus among experts. The coefficient of variation (CV) of 10.28 and interquartile range (IQR) of 0.75 underscore the uniformity of these concerns across respondents. Quality assurance is crucial in ensuring that educational programs consistently meet high standards in education, scholarship, and infrastructure. A robust quality assurance system not only enhances student confidence but also strengthens an institution's reputation as a provider of top-quality education services. It improves operational efficiency and enhances competitiveness among peer institutions (Ruiz and Sabio, 2012). Sharma and Sharma (2015) add to these challenges by highlighting issues such as inadequate infrastructure, faculty shortages, high student-faculty ratios, and mismatches in teacher supply and demand.

Table 7 Consensus of opinions for the current challenges in quality assurance of BTLEd and BTVTEd programs as to resource constraints

Resource Constraints	Mean	SD	CV	IQR
1. Limited financial resources in procuring, maintaining, and upgrading training equipment, facilities, and spaces.	4.70	0.48	10.28	0.75
2. Hiring and retaining qualified faculty members with practical and industrial experience.	4.70	0.48	10.28	0.75
3. Lack of industry-related experience among faculty.	4.70	0.48	10.28	0.75
4. Outdated training tools, equipment, and facilities.	4.70	0.48	10.28	0.75

4.2.2 Curriculum and Pedagogy Challenges

Issues in the implementation of BTLEd and BTVTEd curricula include challenges identified by Jaiswal (2016) in teacher education, such as innovation in pre-service teacher education, lack of current educational materials, development of national professional standards, and the need to strengthen university-school partnerships for teacher preparation and mentoring. Delphi experts highlight several challenges in these programs. They strongly agree that the diversity of specializations within BTLEd and BTVTEd is a major issue, with a mean score of 4.80 (SD: 0.42), CV of 8.78, and IQR of 0.00. The recent introduction of these programs follows closely, scoring 4.70 (SD: 0.48), CV of 10.28, and IQR of 0.75. Borrowing tools and equipment from other programs or colleges also poses significant challenges, scoring 4.50 (SD: 0.85), CV of 18.89, and IQR of 0.75. Additionally, there is strong agreement among experts regarding resistance to innovative teaching methods, emphasis on traditional teaching, and issues with outdated instructional materials, all scoring 4.40 (CV: 19.17, IQR: 1.00). Reluctance to embrace new technologies or lack of training in utilizing them can stifle innovation in teaching methods, ultimately affecting student learning outcomes (Bar, 2024). The rapid pace of technological advancements in industries, though

acknowledged as a challenge, received a lower mean score of 4.00 (SD: 1.05), CV of 26.35, and higher IQR of 1.75, necessitating further exploration in subsequent Delphi rounds.

Table 8 *Consensus of opinions for the current challenges in quality assurance of BTLEd and BTVTEd programs as to curriculum and pedagogy*

Curriculum and Pedagogy	Mean	SD	CV	IQR
5. Recency of BTLEd and BTVTEd programs	4.70	0.48	10.28	0.75
6. Diversity of specializations in BTLEd and BTVTEd programs	4.80	0.42	8.78	0.00
7. Borrowing of tools and equipment and training facilities from other program/college	4.50	0.85	18.89	0.75
8. Emphasis on traditional teaching and resistance to innovative teaching methods and hands-on learning approaches.	4.40	0.84	19.17	1.00
9. Fast pace of technological changes in industries.	4.00	1.05	26.35	1.75
10. Unavailability or outdated instructional materials and learning resources (books, modules, etc.)	4.40	0.84	19.17	1.00

4.2.3 Faculty Competence and Development

Delphi experts identify strongly agree (mean 4.50, SD: 0.71) that faculty participation in professional development programs is crucial, with a CV of 15.71 and IQR of 1.00. This is emphasized by the Ministry of Education and Sports of Lao PDR and the German Ministry of Cooperation and Development (2015), advocating for regional standards to enhance TVET teacher qualifications. Additionally, there are concerns about the lack of professional development opportunities for BTLEd and BTVTEd professors, and the scarcity of faculty with expertise in multiple TLE/TVET areas, both scoring 4.30 and showing strong agreement. These issues have CV values of 22.06 and 29.11 respectively, with an IQR of 1.00, indicating consensus among experts. Technical teachers play a crucial role in developing effective technicians and TVET practitioners (Alinea & Alinea, 2022). Jaiswal (2016) underscores the importance of ongoing professional development for teachers, linking it directly to enhancing educational quality through improved teaching practices and curriculum implementation.

Table 9 *Consensus of opinions for the current challenges in quality assurance of BTLEd and BTVTEd programs as to faculty competence and development*

Faculty Competence and Development	Mean	SD	CV	IQR
11. Lack of related professional development opportunities for BTLEd and BTVTEd professors.	4.30	0.95	22.06	1.00
12. Unavailability of faculty members with specialization in more than one area of TLE/TVET.	4.30	1.25	29.11	1.00
13. Participation of faculty to professional development programs and initiatives.	4.50	0.71	15.71	1.00

4.2.4 Industry Collaboration

The findings highlight a strong consensus among Delphi experts regarding two significant challenges faced by (TEIs) in the context of sustaining quality-assured (BTLEd) and (BTVTEd) programs. Both lack of strong collaboration between TVET teacher training institutions and industries for practical training experiences and absence of reputable organizations for TVET and technology teacher education got the similar mean scores of 4.80 (SD: 0.63, and 0.42, respectively) with a CV value of 13.18 and 8.78 for both indicators. Both items got an IQR of 0.00 which is less than the acceptable interquartile range. The absence of a supportive administrative environment can exacerbate industry-practice gaps (Rao, 2024). Lack of strong collaboration between TVET teacher training institutions and industries for practical training experiences underscores a crucial gap in the alignment between academic preparation and industry needs. Practical training is a cornerstone of TVET, and the absence of collaboration may hinder students' exposure to real-world applications, potentially affecting the quality and relevance of their education.

Table 10 *Consensus of opinions for the current challenges in quality Assurance of BTLEd and BTVTEd programs as to industry collaboration*

Industry Collaboration	Mean	SD	CV	IQR
14. Lack of strong collaboration between TVET teacher training institutions and industries for practical training experiences.	4.80	0.63	13.18	0.00

15. Absence of reputable organizations for TVET and technology teacher education.	4.80	0.42	8.78	0.00
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4.2.5 Program Appeal

Results disclosed that low enrollment in BTLEd and BTVTED program received a mean of 4.60 (SD: 0.52) with a CV value of 11.23 and an IQR of 1.00 indicating a strong agreement that this is one of the challenges that TEIs encounter. Same is also true with limited public awareness of technology and TVET education as indicated by the mean value of 4.80 (SD: 0.42) with a CV value of 8.78 and an IQR value of 0.00.

Table 11 Consensus of opinions for the current challenges in quality assurance of BTLEd and BTVTED programs as to program appeal

Program Appeal	Mean	SD	CV	IQR
16. Low enrollment in BTLEd and BTVTED program	4.60	0.52	11.23	1.00
17. Limited public awareness of technology and TVET education.	4.80	0.42	8.78	0.00

4.2.6 Quality Assurance Standards

Quality assurance operates at institutional, programmatic, and course levels, addressing stakeholder concerns and implementing various mechanisms (Sanyal & Martin, 2007). Ancho (2019) highlights the need for future education leaders to bridge theoretical knowledge with practical quality assurance practices to enhance student academic achievement. The data revealed a lack of a national quality assurance framework for technology and TVET teacher training institutions, with a mean score of 4.30 (SD: 0.95) and a CV of 22.06. A Quality Assurance Framework (QAF) sets domains and parameters for evaluating educational quality, guiding self and external evaluations effectively (SES, 2023). Similarly, inconsistencies in implementing quality assurance mechanisms and standards were identified as problematic, scoring 4.20 (SD: 0.92) with a CV of 21.88. Both items had an IQR of 1.00, indicating agreement among experts without the need for further consensus in subsequent Delphi rounds. Almadani et al. (2011) conclude that many quality assurance procedures lack research-based foundations, affecting their effectiveness in educational settings.

Table 12 Consensus of opinions for the current challenges in quality assurance of BTLEd and BTVTED programs as to quality assurance standards

Quality Assurance Standards	Mean	SD	CV	IQR
18. Lack of consistency in implementing quality assurance mechanisms and standards.	4.20	0.92	21.88	1.00
19. Lack of national quality assurance framework for technology and TVET teacher training institutions.	4.30	0.95	22.06	1.00

4.2.7 Transparency and Representation of Items in LET

The Delphi survey highlighted that maintaining transparent communication about the purpose and structure of the Test of Skills (TOS) with students received a high mean score of 4.90 (SD: 0.32), indicating strong consensus among experts (CV: 6.45, IQR: 0.00). Overall, CV values below 50% for all statements suggest general agreement among experts on identified challenges. However, there was one outlier related to the rapid pace of technological changes in industries, with an IQR value of 1.75, which exceeds the accepted threshold of 1. This divergence indicates differing expert opinions on the significance of this challenge. To address this, further exploration will be conducted in the third round of the Delphi survey to achieve consensus on this specific issue, ensuring thoroughness in the process.

Table 13 Consensus of opinions for the current challenges in quality assurance of BTLEd and BTVTED programs as to transparency and representation of items in LET

Transparency and Representation of Items in LET	Mean	SD	CV	IQR
20. Maintaining a transparent communication about the purpose and structure of the TOS with students.	4.90	0.32	6.45	0.00

4.3 Factors Influencing the Career Choices of BTLEd and BTVTED Graduates

Delphi Survey Rounds. The first round of the Delphi survey identified 27 key factors influencing students' decisions to pursue teaching careers, categorized into intrinsic motivations, external influences, and professional

development opportunities. Students were inwardly motivated by a love of teaching, a sense of fulfilment from their own development, and a conviction in the value of education. The community’s regard for teachers, employment stability, excellent teaching experiences, and support from colleagues and family were examples of external variables. Opportunities for professional growth, like job promotion and involvement in workshops and research, were also very important. Experts evaluated these factors in a second round, and the results demonstrated strong consensus. All items achieved coefficients of variation below 50% and interquartile ranges at or below 1, indicating that expert opinions have converged and that the Delphi method was effective in improving the survey instrument.

Respondents Assessment of the Factors Influencing their Teaching Career Decisions. BTLEd and BTVTEd graduates across CALABARZON assessed factors influencing their teaching career decisions. For BTLEd graduates, intrinsic motivations received strong agreement (composite mean 3.78). They highly value passion for their subject (highest mean 3.87) and teaching (mean 3.78), emphasizing personal fulfillment and love for their field. In contrast, external factors like recognition and rewards received less emphasis (lowest mean 3.59), highlighting their focus on intrinsic satisfaction (Mahon et al., 2011). Similarly, BTVTEd graduates prioritize intrinsic motivations such as imparting knowledge (mean 3.76) and contributing to society (mean 3.76) (Li & Sun, 2011). They also place less emphasis on external recognition and rewards (lowest mean 3.38), showing a preference for intrinsic motivations and societal impact in their career decisions.

Table 14 Respondents assessment of the factors influencing their teaching career decisions

Statements	BTLEd Graduates			BTVTEd Graduates		
	WM	SD	VI	WM	SD	VI
Intrinsic and Extrinsic Motivators						
1. Passion of teachers for teaching and learning.	3.86	0.35	SA	3.71	0.46	SA
2. Perceived sense of fulfillment from seeing students learn and grow.	3.85	0.36	SA	3.71	0.46	SA
3. Belief that teaching is a fulfilling and purposeful profession	3.84	0.37	SA	3.71	0.46	SA
4. Emulation from role models in the form of past teachers	3.70	0.46	SA	3.62	0.50	SA
5. Love and enthusiasm for a particular subject or field of study	3.87	0.34	SA	3.67	0.48	SA
6. Opportunity to impart knowledge and skills with other people.	3.85	0.36	SA	3.76	0.44	SA
7. Recognition and rewards for teacher’s commitment to teaching.	3.59	0.56	SA	3.38	0.67	SA
8. Perceived job stability and security associated with teaching.	3.79	0.41	SA	3.62	0.50	SA
9. Competitive salary and benefits that teaching offers.	3.65	0.55	SA	3.57	0.68	SA
10. Desire to contribute to the greater good of society.	3.83	0.38	SA	3.76	0.44	SA
Composite Mean	3.78		SA	3.65		SA
Social and Environmental Factors						
1. Encouragement from peers and family to pursue teaching profession.	3.71	0.55	SA	3.62	0.50	SA
2. Positive encounters observed during the pre-service teaching experiences.	3.77	0.43	SA	3.71	0.46	SA
3. Respect, regard, and outlook of the community for teachers.	3.78	0.47	SA	3.76	0.44	SA
4. Cultivation of sense of social responsibility.	3.81	0.39	SA	3.76	0.44	SA
5. Perception of teaching as a profession that offers a reasonable work-life balance	3.74	0.49	SA	3.76	0.44	SA
6. Opportunity to be part of a community and to form meaningful connections with them.	3.84	0.37	SA	3.76	0.44	SA
Composite Mean	3.78		SA	3.73		SA
Prospect for Professional Development Opportunities						
1. Potential professional advancement in the teaching profession.	3.84	0.37	SA	3.71	0.44	SA
2. Availability of professional development opportunities and the potential for career growth	3.78	0.42	SA	3.71	0.46	SA
3. Prospect of continuous learning through conferences and workshops in btled or btvted.	3.83	0.42	SA	3.71	0.46	SA
4. Chance to engage in educational research and contribute to publications	3.78	0.45	SA	3.67	0.48	SA
Composite Mean	3.81		SA	3.70		SA

Regarding social and environmental factors, BTLEd graduates strongly agree (mean 3.78), particularly valuing community and meaningful connections (highest mean 3.84) (Li & Sun, 2011). Encouragement from peers and family, while still influential (lowest mean 3.71), is less pivotal compared to community involvement.

Similarly, BTVTEd graduates strongly agree on social and environmental factors (mean 3.73), emphasizing societal perceptions, social responsibility, and community connections (highest mean 3.76). Peer and family encouragement (lowest mean 3.62) also influences their decision but to a lesser extent. In terms of professional development opportunities, BTLEd graduates strongly agree (composite mean 3.84), particularly valuing career advancement (highest mean 3.84) over opportunities and continuous learning (lowest mean 3.78) (Li & Sun, 2011). Likewise, BTVTEd graduates strongly agree on the influence of professional development (composite mean 3.71), emphasizing career advancement, opportunities, and continuous learning (highest mean 3.71). However, engagement in educational research and publications is slightly less influential (lowest mean 3.67).

4.4 Strategies of Teacher Education Training Institutions to Make Technology and TVET Teacher Education More Appealing

Delphi Survey Rounds. During the first round of the Delphi process, experts suggested methods to make BTLEd and BTVTEd programs more appealing. They placed particular emphasis on career counselling, institution-based projects, and raising program awareness. Investing in innovative facilities, including entrepreneurship into the curriculum, providing financial aid and scholarships, advertising the high demand for TVET and technology teacher education through career fairs and individual counselling, and granting scholarships were some of the main recommendations. Experts recommended obtaining input from graduates, sharing alumni success stories, and working with high schools on outreach initiatives to increase program awareness. In order to further refine and validate the techniques targeted at boosting the attractiveness of these initiatives, the Delphi process was used in the second round to gain expert comments on the efficacy of these 15 recommended solutions.

Respondents Assessment of the Strategies to make Technology and TVET Teacher Education Programs More Appealing. According to the assessment of BTLEd graduates, there was strong agreement across all indicators related to career guidance and counseling aimed at boosting program appeal. They strongly agreed (mean of 3.67) that career guidance emphasizing the high demand for TVET and technology teacher education is crucial. This reflects their recognition of the practical relevance and significance of these programs in today's educational landscape. Similarly, BTVTEd graduates also showed strong agreement (grand mean of 3.49) across all indicators, with the highest mean (3.62) indicating strong endorsement for career guidance highlighting program demand.

Table 15 Respondents assessment of the strategies to make technology and TVET teacher education more appealing

Statements	BTLEd Graduates			BTVTEd Graduates		
	WM	SD	VI	WM	SD	VI
Career Guidance and Counseling						
1. Career guidance programs that show high demand of TVET teachers.	3.67	0.47	SA	3.62	0.50	SA
2. Career fairs, workshops, and seminars conducted that showcased the diverse career pathways available in technology and TVET teaching.	3.56	0.52	SA	3.52	0.60	SA
3. Personalized counseling sessions to understand the relevance of TVET programs.	3.55	0.55	SA	3.33	0.73	SA
Composite Mean	3.59		SA	3.49		SA
Institution-led Efforts						
1. Scholarships, or financial aid available to reduce the financial burden on students.	3.45	0.66	SA	3.43	0.67	SA
2. Presented established profile of quality and relevance of TVET education programs	3.73	0.50	SA	3.67	0.48	SA
3. Investment of the school in state- of-the-art laboratory, facilities and equipment.	3.69	0.52	SA	3.62	0.50	SA
4. Integration of entrepreneurship and innovation into the curriculum.	3.48	0.57	SA	3.43	0.60	SA
Composite Mean	3.59		SA	3.54		SA
Developing Program Awareness						
1. Feedback of the students who graduated from the program.	3.72	0.50	SA	3.67	0.48	SA
2. Inspiration or shared success stories of individuals who have excelled after completing technology and TVET teacher education.	3.80	0.40	SA	3.81	0.40	SA

3. Collaborate with high schools to organize outreach programs, workshops, and interactive sessions to build awareness about TVET teacher education programs.	3.62	0.54	SA	3.38	0.59	SA
Composite Mean	3.71		SA	3.63		SA

Regarding institution-led efforts, BTLEd graduates strongly agreed (general mean of 3.59), especially emphasizing the importance (mean of 3.73) of colleges presenting a quality and relevant profile of their TVET and technology teacher education programs. BTVTEd graduates also strongly agreed (general mean of 3.54) with similar statements, emphasizing the role of institutions in enhancing program appeal. This shared sentiment underscores their alignment on the importance of institutional efforts. In terms of raising program awareness, BTLEd graduates strongly agreed (grand mean of 3.71) with strategies aimed at increasing public awareness. They particularly valued (highest mean of 3.80) the impact of sharing success stories of program graduates who excelled, highlighting the effectiveness of personal narratives in enhancing program appeal. Similarly, BTVTEd graduates expressed strong agreement (grand mean of 3.63) that the listed strategies would improve the appeal of both programs. They also emphasized (highest mean of 3.81) the importance of sharing success stories as a key factor in boosting program attractiveness. These findings underscore the effectiveness of career guidance, institutional initiatives, and awareness-raising strategies, supported by strong consensus among both groups of graduates.

4.5 Difference in the Assessments of the BTLEd and BTVTEd Graduates

Given the non-normal distribution of the data, the Mann-Whitney U test was chosen as a non-parametric method to compare the assessments of BTLEd and BTVTEd graduates regarding factors influencing LET performance, teaching career decisions, and strategies to enhance program appeal. The results revealed a significant difference ($U = 501, p = .002$) in how BTLEd and BTVTEd graduates perceive factors contributing to LET performance.

Table 16 Comparison of the BTLEd and BTVTEd graduates assessments

	Statistic	P	Interpretation	Decision
Factors Contributing to LET Performance vs. Program	501.000	.002	Reject	Significant Difference
Factors Affecting Teaching Career Decisions vs. Program	721.000	.139	Failed to Reject	No Significant Difference
Strategies to Make BTLEd and BTVTEd more Appealing	816.000	.489	Failed to Reject	No Significant Difference

BTLEd graduates emphasized curriculum and teaching strategies at their institutions, while BTVTEd graduates focused more on school-related factors. This indicates a divergence in their perspectives on key influences despite both groups acknowledging personal factors. Conversely, no significant difference was found in the assessment of factors affecting teaching career decisions ($U = 721, p = .139$), suggesting similar perceptions between BTLEd and BTVTEd graduates in this regard. Similarly, there was no significant difference in their assessments of strategies to enhance program appeal ($U = 816, p = .489$). This indicates a shared perspective across both groups on how to make BTLEd and BTVTEd programs more attractive.

4.6 Comprehensive and Coherent Management Framework for Quality Assurance of Pre-Service Technology and TVET Teacher Education

A management framework for quality assurance of technology and TVET teacher education program is a set of principles and methods that help to plan, implement, and evaluate the quality of the education program that prepares teachers for technology and TVET. An effective management structure plays a role in ensuring that the organization continues to perform according to the standards (Estalaki, 2017). Quality assurance is the process of ensuring that the education program meets the standards and expectations of the stakeholders, such as the students, the employers, the regulators, and the society. This management framework is designed considering the following components such as quality policy, quality standards, quality monitoring, quality improvement, and quality evaluation, leading to a quality assured technology and TVET pre- service teacher education programs.

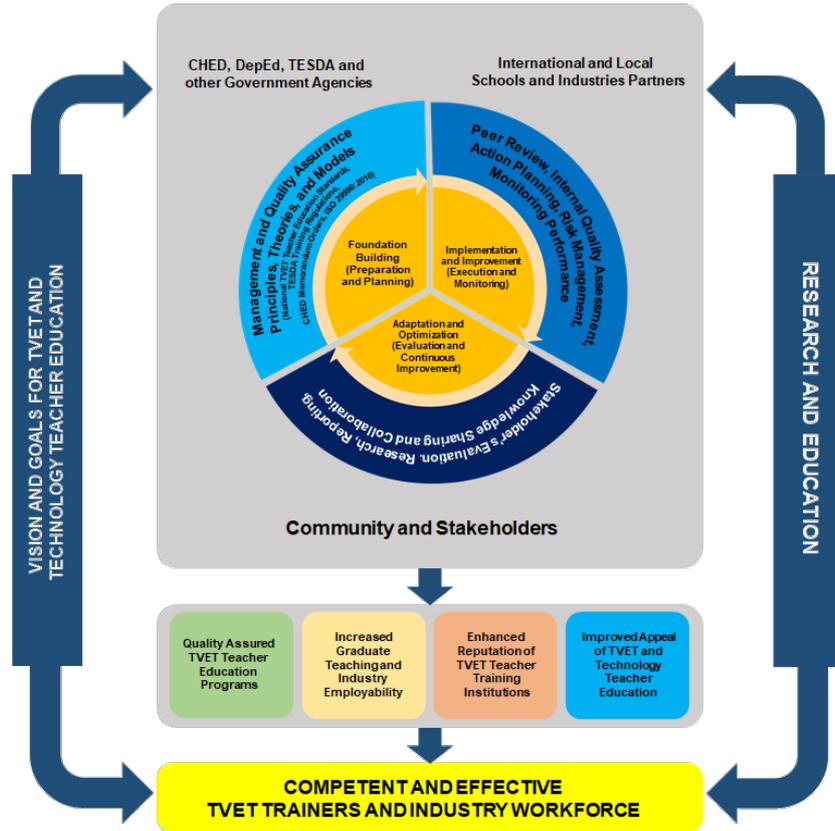


Fig. 2 Management framework for quality assurance

A management framework for quality assurance of technology and TVET teacher education program is a set of principles, methods, and tools that help to plan, implement, and evaluate the quality of the education program that prepares teachers for technology and TVET fields. The management framework as shown on Figure 1 below, outlines the important elements that should be considered by Teacher Education Institutions (TEIs) to effectively manage the BTLED and BTVTEd programs. The framework for TVET teacher education emphasizes producing competent and effective trainers by focusing on quality assurance through a structured three-phase approach: Foundation Building, Implementation and Improvement, and Adaptation and Optimization. The objectives include efficient resource management, adherence to standards, fostering a culture of quality, and aligning TVET programs with workforce needs and the National Qualification Framework. Key activities involve forming expert teams, conducting self-assessments, engaging in peer reviews, and promoting continuous improvement through data-driven decisions and stakeholder collaboration. This phased approach ensures that TVET programs remain relevant, effective, and responsive to industry and societal demands.

5. Conclusions and Recommendations

Based on the findings, several conclusions can be drawn. Firstly, technology and TVET teacher training institutions in CALABARZON employ various quality assurance practices, including curriculum review, faculty engagement, accreditation, facility provision, and collaboration with stakeholders. However, they face challenges such as resource limitations, curriculum issues, faculty development needs, and industry collaboration gaps. Respondents strongly agree on factors contributing to their licensure exam performance and teaching career decisions, including review preparation, motivation, and professional development prospects. Efforts to make teacher training programs more appealing should include career guidance, institutional initiatives, and awareness programs targeting Senior High Schools. While there's a significant difference in the assessments of licensure exam factors between BTLED and BTVTEd graduates, no such difference was observed in factors influencing career decisions or program appeal strategies. The proposed management framework underscores the importance of clear quality policies, standards, performance monitoring, improvement initiatives, and regular evaluations in ensuring quality assurance in technology and TVET teacher education programs.

Authors recommend the distribution and consideration of the developed management framework for quality assurance by TVET and technology teacher training institutions, the Commission on Higher Education, and the Professionals Regulation Commission. Additionally, teacher education institutions should initiate programs to

enhance collaboration with communities and Senior High Schools to raise awareness of BTLED and BTVTEd programs. Furthermore, improving the quality of TVET teacher education necessitates nurturing partnerships with TESDA, DepEd, businesses, industries, and communities, focusing on various aspects including curriculum review, facility management, technology transfer, and teacher training. Lastly, conducting further in-depth studies such as graduate tracer studies and program evaluation surveys is recommended to assess the implementation and quality of BTLED and BTVTEd offerings.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: Dr. Bryan S. Cabreros, as the lead author, contributed significantly to the **conceptualization and execution** of the fieldwork in CALABARZON, while Dr. Cherrypyn Barbacena provided expert guidance in **refining the research topics, determining the scope of inquiry, and validating the methods and instrumentation** used in the study.*

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