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Bridging Equity and Excellence: A Mixed-Methods Quality Assurance Evaluation of Indonesia's Pre-Service Professional Teacher Program

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Abstract. This study examined the effectiveness and quality assurance of Indonesia's pre-service professional teacher (PPG) program through an equity-oriented lens using a convergent mixed-methods design. Quantitative and qualitative data were collected from teacher candidates across diverse regions and institutional contexts, integrating data from survey results, interviews, focus group discussions, and document analysis to provide a comprehensive evaluation. The findings indicate that the program contributes positively to the development of professional competence and overall participant satisfaction. However, the analysis revealed persistent inequities in program experiences and outcomes, particularly across geographical regions and institutional capacities. Teacher candidates from more developed regions and higher-accredited institutions tended to report more favorable experiences compared to those in underserved and remote areas. These disparities highlight structural challenges related to uneven access to digital infrastructure, variations in mentoring quality, and differing levels of institutional support. Further analysis identified digital access, mentoring practices, and student agency as critical factors shaping participants' experiences and perceived program quality. The qualitative findings reinforce the need for more inclusive and adaptive program implementation, emphasizing equitable access to learning resources and context-sensitive evaluation mechanisms. This study positions equity as a central dimension of quality assurance and argues that effectiveness cannot be fully understood without addressing systemic disparities. recommendnds strengthening digital infrastructure, enhancing mentor

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capacity, and embedding continuous, equity-focused evaluation within the program. These strategies are essential to ensure that teacher education reforms not only improve overall quality but also promote more equitable outcomes across diverse educational contexts.

Keywords: digital infrastructure; equity in teacher education; mentoring quality; mixed-methods evaluation; pre-service teacher (PPG) program)

1. Introduction

Ensuring the quality of pre-service teacher education is a central concern for countries seeking to deliver meaningful and future-ready education. In Indonesia, pre-service teacher education (locally known as *pendidikan guru pra-jabatan* or PPG) plays a strategic role in preparing a new generation of professional teachers capable of responding to the growing complexities of 21st-century education (Firmansyah et al., 2022). The prospective teachers of today are expected not only to master academic and pedagogical competencies but also to adapt to change, integrate educational technologies, and design innovative learning experiences aligned with global and digital demands.

Since its national implementation in 2017, the Indonesian government has strengthened PPG through policies aimed at improving teacher professionalism standards. The program is designed to ensure that all teacher candidates meet national benchmarks in subject mastery, pedagogical competence, and technology integration (Loeneto et al., 2022). This direction aligns with the demands of 21st-century education, where digital literacy, critical thinking, communication, collaboration, and creativity are essential competencies for both teachers and students (Chang et al., 2025; Lambert & Gong, 2010).

The design of PPG combines theoretical coursework with practical teaching experience (Saptono et al., 2021). Through structured practicum activities, candidates engage in authentic classroom settings (Myles et al., 2006; Theelen et al., 2020). The program adopts the technological, pedagogical, and content knowledge (TPACK) framework to support the integration of content, pedagogy, and technology. Empirical studies indicate that PPG graduates demonstrate stronger capabilities in integrating technology into teaching compared to non-PPG peers (Chang et al., 2025), suggesting that the program contributes positively to the development of essential teaching competencies.

Despite these strengths, translating knowledge into effective classroom practice remains challenging. Many graduates report low self-efficacy in applying TPACK, particularly in diverse and resource-constrained school environments (Meletiou-Mavrotheris & Paparistodemou, 2024). Limited access to teaching resources, insufficient practical exposure, and a lack of sustained professional support often hinder the effective application of acquired competencies. These issues highlight the need for a more comprehensive approach that not only develops technical skills but also strengthens teacher agency, confidence, and professional resilience (Day, 2018).

Structural challenges further complicate the implementation of PPG. Unequal resource distribution, variations in mentor quality, and gaps in digital infrastructure, especially in rural and remote areas, contribute to disparities in program experiences and outcomes (Aguliera & Nightengale-Lee, 2020; Li, 2025; Muttaqin, 2018). These inequities pose a significant barrier to achieving equitable teacher preparation and, ultimately, equitable student learning outcomes across Indonesia.

To address these challenges, rigorous and context-sensitive evaluation is essential. In this study, *effectiveness* is defined as the extent to which PPG enhances teacher competence, particularly in integrating content, pedagogy, and technology for classroom practice. Meanwhile, *quality* refers to the consistency, relevance, and equity of program implementation across different institutional and regional contexts. International literature suggests that mixed methods approaches, combining quantitative and qualitative data, provide a comprehensive basis for evaluating complex educational programs (Davis, 2017).

Drawing on global best practices is also important for strengthening program relevance. Studies on teacher education in STEM contexts highlight the value of interdisciplinary learning and authentic practice in improving teacher self-efficacy and instructional quality (Rehman et al., 2025; Wu et al., 2024). These insights offer valuable implications for enhancing PPG, particularly in fostering innovation and adaptability among future teachers.

Against this background, this study aimed to evaluate the effectiveness and quality of PPG in Indonesia, with particular attention to issues of equity across diverse contexts. The study addressed the following research questions:

RQ1. How effective is the implementation of Indonesia's PPG in strengthening the professional competencies of prospective teachers?
RQ2. What key factors shape the quality of PPG implementation, particularly regarding TPACK integration?
RQ3. How do teacher candidates perceive the effectiveness of PPG in supporting their TPACK development and readiness for classroom practice?
RQ4. To what extent do regional disparities in PPG implementation affect the professional competence outcomes of graduates?
RQ5. What strategies are most effective for improving the evaluation and monitoring of PPG quality in Indonesia?

By addressing these questions, this study provides empirical insights and practical recommendations to strengthen PPG in Indonesia. The findings are expected to support policymakers and educational stakeholders in improving both the quality and equity of teacher preparation, contributing to more inclusive and sustainable educational development.

2. Literature Review

2.1 Pre-Service Professional Teacher Program

Click or tap here to enter text.Law of the Republic of Indonesia Number 14 Year 2005 Concerning Teachers and Lecturers (Republic of Indonesia, 2005) mandates

that teachers meet academic qualifications, demonstrate core competencies, obtain certification, and maintain physical and mental fitness. In Indonesia, these competencies encompass pedagogical, personal, social, and professional domains (Arifudin & Raza Ali, 2022). To meet these requirements, the government established pre-service teacher education (PPG) as the primary pathway for preparing certified teachers. Empirical studies indicate that PPG contributes to strengthening teaching competence, classroom readiness, and the integration of educational technology (Arifudin & Raza Ali, 2022; Purwasih et al., 2025; Sahroni & Subroto, 2022). Thus, PPG functions not only as a certification mechanism but also as a key instrument for systemic teacher education reform.

Despite long-standing implementation, challenges remain in ensuring equitable access to certified teachers. A substantial number of teachers, particularly in disadvantaged, frontier, and remote (3T) regions, remain uncertified. This gap reflects structural constraints in teacher distribution and access to professional preparation. In response, the government has expanded and accelerated PPG for both in-service and prospective teachers. Existing studies suggest that this expansion improves teacher preparedness and learning quality, although disparities across regions persist.

The structure of PPG includes several stages: selection, academic coursework, teaching practicum, competency assessment, and certification. This sequence is designed to ensure that candidates develop integrated competencies for classroom practice. The selection process is conducted nationally and involves administrative screening, academic testing, and interviews (Gutierrez & Nailer, 2021). It aims to maintain merit-based entry while widening access. Systems such as SIMPKB (a national teacher management system) and PDDikti (Indonesia's higher education database) support this process by ensuring data integration, transparency, and accountability. These systems are central to quality assurance, as they enable standardized monitoring of candidate progression across institutions.

International research on PPG highlights the importance of structured preparation, mentoring, and reflective practice in developing teaching competence (Kennedy-Clark et al., 2018; Mena et al., 2017; Qadrianty et al., 2024). In the Indonesian context, these principles are embedded within PPG, although their implementation varies across regions. This variation underscores ongoing challenges in achieving equitable program quality.

The learning process within PPG integrates academic preparation with field experience. It includes matriculation for non-education graduates, orientation, coursework, practicum, and technology-supported learning environments (Saptono et al., 2021). The final stage is the UKPPPG, a national competency assessment that evaluates candidates' readiness for professional practice. Beyond its certification function, the UKPPPG plays a critical role in quality assurance by ensuring that all graduates meet standardized competency benchmarks. At the same time, differences in pass rates across regions highlight the need to address equity gaps in preparation and support.

Admission to PPG requires academic qualifications, health clearance, and ethical standards. The centralized selection system, supported by SIMPKB, is designed to ensure fairness, transparency, and merit-based access. However, ensuring equitable participation across diverse geographic and institutional contexts remains an ongoing policy challenge.

2.2 Pre-Service Professional Teacher Learning

The learning design of PPG is structured around a graduate profile that defines the expected competencies and professional identity of participants (Abbas et al., 2023). This profile guides curriculum development, learning outcomes, and study load allocation, ensuring alignment between program objectives and implementation. It emphasizes not only instructional competence but also professional integrity, adaptability, and social responsibility.

Graduates are expected to demonstrate the ability to implement student-centered learning, integrate technology, and respond to diverse classroom contexts. They are also encouraged to embody national values, including those derived from Pancasila, while maintaining a commitment to continuous professional development. This holistic approach reflects the broader goal of preparing teachers who can navigate both pedagogical and social complexities in education systems.

The PPG curriculum is organized into three categories: core, selective, and elective courses (Nurwataniah et al., 2022). Core courses establish foundational competencies aligned with national standards. Selective courses provide opportunities to deepen expertise in areas such as literacy, educational technology, and curriculum innovation. Elective courses, developed by teacher training institutions (LPTKs), allow contextual adaptation based on local needs and institutional strengths. This structure balances standardization with flexibility, which is essential for addressing diverse educational contexts.

The program requires a total of 38 credits completed over 2 semesters. Learning activities are designed to integrate theory, practice, and reflection. The MERDEKA learning approach emphasizes active participation through stages such as self-reflection, concept exploration, collaboration, contextual application, and action. This approach aligns with learner-centered principles and supports the development of adaptive teaching practices, particularly in diverse and resource-variable environments.

2.3 Pre-Service Professional Teacher Program Assessment

Assessment in PPG is designed to evaluate both learning processes and outcomes comprehensively (Qadrianty et al., 2024). It combines formative assessment, which supports ongoing development, and summative assessment, which determines the achievement of learning outcomes. This dual approach ensures that evaluation captures not only final performance but also learning progression.

The program applies to a benchmark-referenced assessment approach, where candidates are evaluated against established competency standards rather than compared to peers. This model supports fairness and consistency across

institutions, which is essential for maintaining national quality standards. Assessment methods include written tests, performance tasks, reflective activities, and classroom-based evaluations, covering cognitive, affective, and practical dimensions of teaching competence.

Assessment responsibilities are shared between lecturers, field supervisors, and mentor teachers. Academic components are evaluated through coursework, participation, and examinations, while practicum performance is assessed through teaching demonstrations, lesson planning, and professional behavior. This multi-source evaluation approach aligns with international standards in teacher education, which emphasize the importance of authentic and practice-based assessment.

The UKPPPG serves as the final evaluation stage, consisting of written and performance-based components. It functions not only as a certification requirement but also as a national quality assurance mechanism that standardizes graduate competence. However, variations in assessment outcomes across regions suggest that access to preparation resources, mentoring quality, and institutional support influence candidate performance. These differences highlight the importance of embedding equity considerations within assessment systems to ensure that evaluation reflects not only standards but also contextual realities.

3. Methodology

This study employed a convergent mixed-methods evaluation design, integrating quantitative and qualitative approaches, to assess the implementation and effectiveness of Indonesia's 2024 pre-service teacher education (PPG) program. A convergent design was selected because it enables simultaneous examination of program outcomes and participant experiences within the same phase of analysis. Quantitative data were used to measure key outcomes, such as teacher competence development and program effectiveness, while qualitative data explored the experiences, perceptions, and contextual challenges faced by teacher candidates and facilitators. The integration of these data sources allowed for comprehensive triangulation, thereby strengthening the validity and depth of the evaluation.

The evaluation framework was guided by established quality assurance principles in higher education, particularly continuous improvement, stakeholder engagement, and evidence-based decision-making. These principles were operationalized by drawing on international quality assurance models, including the European Higher Education Area (ESG) standards, total quality management approaches, and ISO 21001 for educational organizations. In addition, the study aligned with global recommendations on educational quality monitoring from organizations such as the OECD (2019) and UNESCO (2021). Together, these frameworks provided a robust foundation for evaluating both the effectiveness and equity of program implementation across diverse contexts.

3.1 Data Collection and Analysis

Quantitative data were collected through structured online surveys distributed to all participant groups involved in the study, including 324 pre-service teacher candidates, 42 lecturers and mentors, and 12 administrators and policymakers across participating institutions. The survey assessed satisfaction, perceived quality, resource adequacy, digital access, and learning outcomes. The instrument was adapted from established quality assurance measures in teacher education (Schmidt et al., 2009).

Qualitative data were obtained through multiple sources to ensure depth and triangulation. First, semi-structured interviews were conducted with a purposive sub-sample of participants representing each group, including 30 teacher candidates, 8 lecturers, and 4 program administrators. Each interview lasted approximately 45 to 60 minutes and was conducted online or in person, depending on participant availability. Interviews were guided by a flexible protocol and facilitated by trained researchers to ensure consistency while allowing participants to elaborate on their experiences.

Second, focus group discussions (FGDs) were conducted at each participating teacher training institution (LPTK), involving six to eight participants per group drawn from the three stakeholder categories (teacher candidates, lecturers/mentors, and administrators). Each FGD session lasted approximately 90 to 120 minutes and was facilitated by a moderator and a note-taker. The discussions focused on identifying best practices, implementation challenges, and opportunities for improving program quality and equity.

Third, document analysis included institutional accreditation reports, curriculum documents, quality assurance manuals, and relevant government policies. These documents were systematically reviewed to provide contextual understanding and to corroborate findings from surveys and interviews.

Fourth, field observations were carried out during practicum implementation in selected schools involving teacher candidates and their mentors. Each observation session lasted approximately two to three hours and focused on classroom interaction, mentoring practices, and the use of instructional resources. Observations were guided by a structured checklist to ensure consistency across sites.

3.2 Participants

The study was conducted across five representative LPTKs located in Java, Sumatra, and Eastern Indonesia. These sites were purposively selected to capture variation in institutional accreditation levels, regional characteristics, and resource availability. A stratified purposive sampling strategy was employed to ensure representation across key strata, including geographic regions (Java, non-Java, and 3T areas), institutional quality (accreditation levels), and participant roles within the program.

Within each stratum, participants were selected based on their direct involvement in the PPG program (Figure 1). The sampling hierarchy began at the institutional level (LPTK), followed by participant categories, including teacher candidates, lecturers/mentors, and administrators/policymakers. This approach ensured that multiple stakeholder perspectives were systematically included in the evaluation.

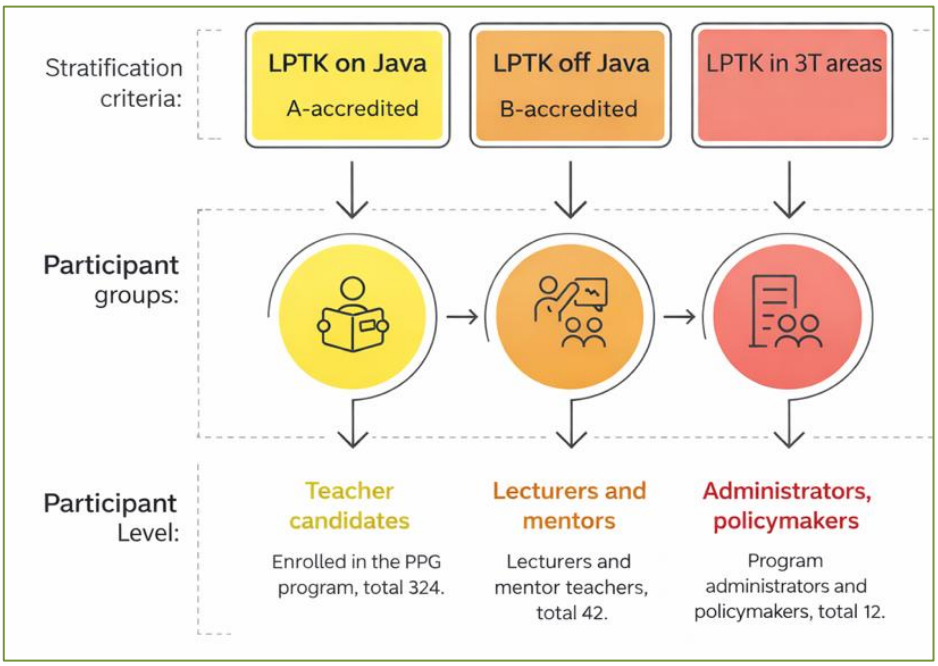

Figure 1: Participants in the PPG program

3.3 Instrument and Data Analysis

The survey instrument employed a five-point Likert scale and open-ended questions, covering key domains of educational quality, as illustrated in Figure 2, including institutional quality, program relevance, digital access, practicum quality, and assessment processes. These domains were explicitly mapped to the research questions to ensure alignment between measurement and analytical focus. Specifically, institutional quality and program relevance addressed RQ1 (program effectiveness), digital access and mentorship-related aspects informed RQ2 (factors influencing quality, particularly TPACK integration), participant perceptions were linked to RQ3, regional and institutional differences informed RQ4 (equity and disparities), and assessment-related domains supported RQ5 (quality assurance and monitoring strategies).

Interview and FGD protocols were developed based on established literature on teacher education quality assurance (Braun & Clarke, 2021; Darling-Hammond et al., 2017) and adapted to the Indonesian context. These instruments were designed to explore participants' experiences, contextual challenges, and perceptions of program quality, thereby complementing the survey domains. Figure 2 presents the educational quality framework used in this study and serves as a conceptual map linking survey domains, qualitative themes, and research

questions. This framework guided both data collection and analysis to ensure coherence across methods.

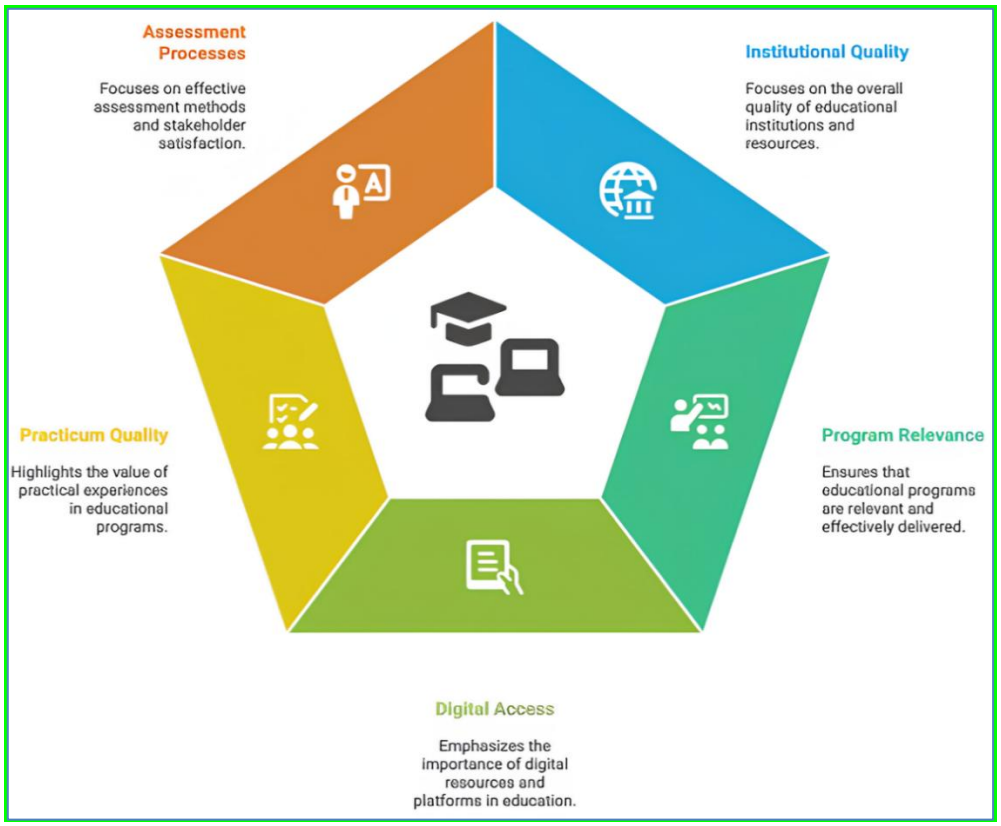

Figure 2: Educational quality framework

Quantitative data were analyzed using descriptive statistics (means, percentages, and standard deviations) to address RQ1 and RQ3 by summarizing overall program effectiveness and participant perceptions. Inferential analyses, including ANOVA and multiple regression, were applied to examine differences across regions and institutional types (RQ4) and to identify key predictors of program quality and satisfaction (RQ2). This approach enabled the identification of both general trends and statistically significant relationships among variables.

Qualitative data were analyzed using thematic analysis following the six-phase procedure proposed by Braun and Clarke (2021). The analysis focused on identifying themes related to program effectiveness (RQ1), influencing factors such as mentoring and digital access (RQ2), participant experiences (RQ3), and contextual disparities (RQ4), as well as recommendations for quality improvement (RQ5). Data was managed using NVivo 14 to ensure systematic coding and organization. The coding process combined deductive themes derived from the evaluation framework with inductive themes emerging from the data, such as student agency, adaptability, and stakeholder expectations.

In line with the convergent mixed-methods design, quantitative and qualitative findings were integrated during the interpretation phase through side-by-side comparison and joint interpretation. Quantitative results provided generalizable

patterns, while qualitative findings offered contextual explanations and deeper insights into these patterns. Convergence, complementarity, and divergence between the two data sources were examined to strengthen the validity and comprehensiveness of the conclusion. To ensure analytical rigor, several quality assurance procedures were implemented. Quantitative instruments were validated through pilot testing and reliability analysis, yielding Cronbach alpha values above .85. Qualitative analysis included inter-coder reliability checks to ensure consistency in coding, as well as member-checking sessions with selected participants to validate interpretations. Data triangulation across surveys, interviews, documents, and observations further enhanced the credibility and trustworthiness of the findings.

4. Results and Findings

4.1 Effectiveness of PPG Implementation in Improving Professional Competence

Both quantitative and qualitative findings strongly support the effectiveness of the pre-service professional teacher (PPG) program in enhancing professional competence (Table 1).

Table 1: Descriptive statistics by key variables

Variable	Mean (M)	Std. Dev. (SD)	Min–Max
Overall satisfaction	4.13	0.46	2.87–5
Digital infrastructure	3.78	0.71	2.00–5
Mentoring quality	4.08	0.51	2.50–5
Student agency/adaptability	4.05	0.57	2.67–5

The high mean satisfaction score (M = 4.13, SD = 0.46) indicates that most participants perceived the program as meeting or exceeding their expectations for teacher preparation. Notably, 82.7% of respondents reported increased pedagogical confidence, and 79.4% experienced significant improvements in lesson planning—two core indicators of professional readiness and effective classroom practice. Strong pass rates on national professional competency assessments further bolster this quantitative evidence: 87.2% of candidates passed the written exam, and 81.3% succeeded in the performance-based evaluation. These results suggest that PPG is effectively equipping prospective teachers with the necessary skills, knowledge, and self-efficacy to enter the teaching profession with confidence.

The ANOVA results (Table 2) indicate that satisfaction differed significantly by region and institutional accreditation. However, a more nuanced analysis revealed that program effectiveness is not uniform across all regions and institutions. The ANOVA results show that satisfaction levels are significantly higher among participants in Java (M = 4.21, SD = 0.41) compared to their counterparts in Eastern Indonesia (M = 3.54, SD = 0.75), with $F(2,321) = 16.82$, $p < 0.001$. Additionally, graduates from "A"-accredited teacher training institutions (LPTKs) reported greater satisfaction (M = 4.22) than those from "B"-accredited institutions (M = 3.91), with $F(1,322) = 7.56$, $p = 0.006$. These findings highlight the influence of regional and institutional factors—such as resource availability, institutional culture, and access to professional support—on

the overall perceived quality of teacher preparation. This pattern aligns with prior research, which emphasizes the critical roles of institutional quality and contextual equity in shaping program outcomes.

Table 2: ANOVA results: satisfaction by accreditation and region

Source	Sum of squares	*df*	Mean square	*F*
Accreditation	1.69	1	1.69	7.56
Region	5.88	2	2.94	16.82
Error	56.17	320	0.18	

Satisfaction in Java (M = 4.21, SD = 0.41) is significantly higher than in Eastern Indonesia (M = 3.54, SD = 0.75), with F (2,321) = 16.82, p < 0.001
"A"-accredited LPTKs scored higher (M = 4.22) than "B" (M = 3.91), with F (1,322) = 7.56, p = 0.006

In addition to statistical significance, the effect sizes indicate meaningful practical differences. The regional effect ($\eta^2 \approx 0.09$) suggests a moderate impact of geographic context on satisfaction, while institutional accreditation ($\eta^2 \approx 0.03$) reflects a smaller but still relevant effect. These findings indicate that while PPG is broadly effective, contextual factors substantially shape participant experiences.

Qualitative thematic analysis (NVivo $\kappa = 0.91$) further illuminated these results, revealing consistent student narratives of enhanced readiness and professional identity development. Participants frequently described the PPG experience as transformative, citing the program's combination of coursework, practicum, and mentoring as pivotal to their growth. One participant reflected:

> *"After PPG, I feel much more prepared to handle real classrooms and can design more interactive lessons."*

This sentiment was echoed by many, who reported feeling empowered to innovate, adapt, and respond to the diverse needs of their students.

4.2 Factors Influencing PPG Quality: Technology, Pedagogy, Content (TPACK)
The quality of PPG implementation is shaped by a complex interplay of technological, pedagogical, and personal factors, as confirmed by both statistical and qualitative analyses. Multiple regression analysis (Table 3) underscored the critical influence of digital infrastructure ($\beta = 0.32$, $t = 4.67$, $p < 0.01$), mentoring frequency ($\beta = 0.27$, $t = 3.53$, $p < 0.05$), and student agency ($\beta = 0.19$, $t = 2.41$, $p < 0.05$) on overall program satisfaction, with these variables collectively explaining 21% of the variance in satisfaction scores ($R^2 = 0.21$, $F(4,319) = 21.61$, $p < 0.001$). These findings empirically validate the conceptual foundation of the TPACK model, which posits that the effective integration of technology, strong pedagogical support, and learner autonomy is essential for high-quality teacher education (Schmidt et al., 2009; Voogt et al., 2015).

Table 3: Regression results: predictors of satisfaction

Predictor	β	Standard error	t	p
Digital infrastructure	0.32	0.07	4.67	<0.01
Mentoring frequency	0.27	0.08	3.53	<0.05
Student agency	0.19	0.09	2.41	<0.05

The regression model explains a moderate proportion of variance in satisfaction (R^2 = 0.21), indicating that while digital infrastructure, mentoring, and student agency are significant predictors, additional contextual and institutional factors may also contribute to program quality. The standardized coefficients suggest that digital infrastructure has the strongest relative influence, reinforcing its central role in contemporary teacher education systems.

Qualitative evidence from interviews and focus groups provides nuance to these statistics. Many participants described digital access as a "gateway" to deeper learning and innovation. Where digital infrastructure was robust, students could more readily engage with interactive materials, experiment with digital teaching tools, and collaborate beyond the physical classroom. Conversely, limited access to reliable Internet or digital resources was frequently cited as a barrier, particularly in remote regions, constraining both creativity and confidence in applying technology in teaching. One participant summarized this notion:

> *"Frequent mentor feedback and easy access to teaching resources really supported my growth as a teacher."*

This observation shows that although technology plays an important role, its benefits are most tremendous when supported by strong mentoring. Moreover, the frequency and quality of mentoring sessions were repeatedly associated with improvements in both pedagogical skill and technology integration. Students who benefited from regular, constructive feedback not only demonstrated higher levels of TPACK competence but also developed greater agency, demonstrating confidence, adaptability, and a willingness to innovate. These results echo international research emphasizing that teacher education quality is most robust when it combines digital access, strong mentoring frameworks, and the cultivation of reflective, proactive learners.

In sum, the findings illustrate that effective PPG delivery requires more than technological provision; it also depends on the frequency of high-quality mentoring and on empowering student teachers to take initiative in their professional growth. Addressing disparities in digital access and strengthening mentoring systems should therefore be prioritized in ongoing quality assurance and program development efforts.

4.3 Teacher Candidates' Perceptions of PPG in Developing TPACK

The survey data and qualitative evidence strongly support the role of the PPG program in strengthening teacher candidates' TPACK. Quantitative data reveal a high average TPACK development score (M = 4.18, SD = 0.52), with 86.1% of respondents reporting greater ability to integrate technology, pedagogy, and

subject content after completing the program. This level of agreement not only indicates widespread perceived growth but also suggests that the curriculum and instructional design of the program are effectively aligned with the demands of 21st-century teaching.

Qualitative thematic analysis adds depth to these results. Many participants described a transformative shift in their confidence and competence in using technology as an integral part of their teaching practice. As one candidate reflected:

> *"I can now confidently use digital tools for teaching and connect them with my subject matter, something I couldn't do before."*

Students echoed these statements across FGDs, linking their increased engagement and willingness to innovate directly to the explicit focus of the PPG on TPACK. Furthermore, candidates noted that hands-on, contextually relevant training in digital lesson design and implementation enabled them to create more interactive, student-centered learning experiences. This approach not only strengthened their professional confidence but also, as several candidates reported, increased student participation and improved learning outcomes during their teaching practicums. These findings are consistent with international research, which emphasizes that teacher preparation programs that embed TPACK as a core competency foster more adaptive, innovative, and effective educators.

In summary, both the high level of quantitative endorsement and the rich qualitative testimonies suggest that the commitment of the PPG to TPACK has had a tangible, positive impact on the digital and pedagogical capacities of its graduates, an essential foundation for effective teaching in the rapidly changing educational landscape of today.

4.4 Regional Gaps in PPG Implementation and Impact on Graduate Competence

The results revealed substantial regional disparities in both the implementation of PPG and the professional competence of its graduates, most notably between urban/Java areas and Indonesia's remote 3T regions. ANOVA and cross-tabulation analyses demonstrated that both satisfaction levels and competency assessment pass rates were significantly lower in 3T regions (pass rate: 76.3%) compared to urban or Java-based participants (90.5%). This gap arises from limited access to digital resources and fewer mentoring opportunities in remote areas, and statistical results confirm these factors as key predictors of overall satisfaction and competence.

Qualitative data provides vivid context for these disparities. Many participants from 3T regions highlighted persistent struggles with unreliable Internet, lack of digital equipment, and limited institutional support. One participant commented:

> *"Internet issues and lack of facilities in my region made it hard to complete assignments and practice new methods."*

Such challenges often lead to delayed coursework, restricted engagement with technology-based pedagogies, and a lack of confidence when applying innovative teaching approaches. Furthermore, the frequency and quality of mentoring were uneven, as urban-based candidates described receiving regular, supportive supervision. At the same time, their counterparts in disadvantaged regions often had to rely on sporadic or remote mentoring. These findings reinforce long-standing concerns in the literature regarding educational inequities and the critical need for differentiated support strategies.

Overall, the evidence shows that without addressing the digital and institutional divides between regions, national teacher education reforms risk perpetuating, rather than closing, existing gaps in teacher quality and educational opportunity. Ensuring equitable access to digital tools, infrastructure, and sustained mentorship must therefore be central to future policy and quality assurance efforts within Indonesia's PPG and similar teacher preparation programs worldwide.

To provide an integrated overview of the main findings, Table 4 summarizes the key quantitative and qualitative results of the study, including overall participant satisfaction, differences by accreditation and region, the predictive influence of digital infrastructure and mentoring frequency, and indicators of instrument reliability.

Table 4: Key results summary table

Finding/variable	Statistic/theme
Overall satisfaction (PPG)	$M = 4.13$, $SD = 0.46$
Satisfaction by accreditation (A/B)	$F(1,322) = 7.56$, $p = 0.006$
Satisfaction by region (Java/East)	$F(2,321) = 16.82$, $p < 0.001$
Digital infrastructure (predictor)	$\beta = 0.32$, $p < 0.01$ (regression), major qualitative theme
Mentoring frequency (predictor)	$\beta = 0.27$, $p < 0.05$ (regression), strong qualitative support
Reliability (quantitative scale)	Cronbach alpha = .89
Reliability (qualitative coding)	$\kappa = 0.91$

These disparities have important long-term implications. Unequal teacher preparation may translate into differences in instructional quality, student engagement, and learning outcomes, particularly in underserved regions. Over time, this may reinforce existing educational inequalities, as students in resource-constrained areas are less likely to benefit from high-quality teaching practices. Addressing these gaps is therefore a matter not only of program quality but also of educational justice and national development.

4.5 Most Effective Strategies for Improving the Evaluation and Monitoring of PPG in Indonesia

Analysis of program documents and stakeholder interviews identified three interrelated strategies as the most effective for strengthening the evaluation and ongoing quality assurance of the PPG. First, digital infrastructure investment

emerged as a foundational priority. Stakeholders consistently recommended allocating resources to expand high-speed Internet connectivity and digital learning platforms, especially in under-resourced LPTKs and remote regions. Such investments not only address access gaps but also enable richer learning and monitoring processes, in line with international recommendations on digital inclusion as a core element of teacher education reform.

Second, mentor training and networking emerged as a critical lever for improvement. Respondents highlighted the value of regular mentor workshops, capacity-building, and the development of peer-learning communities that cut across institutions. These collaborative networks enable mentors to share best practices, troubleshoot challenges, and ensure consistent supervision quality, a finding well supported by the literature on effective teacher professional development and distributed leadership.

Third, a continuous mixed-methods evaluation, combining routine quantitative assessment (e.g., surveys and test results) with rich qualitative feedback (e.g., interviews and classroom observations) was considered essential for adaptive program management. This approach facilitates real-time identification of issues and enables evidence-based adjustments to program design, supporting a cycle of continuous improvement. The emphasis on triangulation aligns with best practice in quality assurance, ensuring that multiple stakeholder perspectives inform policy and practice.

Participants repeatedly emphasized the practical importance of regular feedback and transparent monitoring throughout the program lifecycle, not only at its conclusion. As one candidate shared: "*We benefit most when there is clear communication and timely feedback on our progress; not just at the end but throughout the program.*" This sentiment emphasizes that formative, ongoing evaluation helps sustain motivation and supports timely remediation, a perspective that resonates with contemporary quality assurance models in higher education.

Statistical reliability analyses provided further confidence in the evaluation tools of the program, with satisfaction and monitoring scales demonstrating strong internal consistency (α = .89). Furthermore, the frequency and quality of mentoring were uneven, as urban-based candidates described receiving regular, supportive supervision.

Comparative evidence from other countries further supports these strategies. For example, Finland's teacher education system emphasizes strong mentoring and research-based training, contributing to consistently high teaching quality. Similarly, Singapore integrates continuous professional feedback and centralized quality monitoring systems, ensuring alignment between teacher preparation and national education goals. These models highlight the importance of combining strong infrastructure, mentoring systems, and continuous evaluation, which align closely with the findings of this study.

In summary, the evidence points to an evolving quality assurance paradigm for PPG: one that is digital, collaborative, and participatory, grounded in continuous data use and stakeholder engagement. Embedding these strategies will be vital for sustaining and scaling improvements in pre-service teacher education across Indonesia's diverse contexts.

5. Limitations of the Study

This study had several limitations that should be considered when interpreting the findings. First, the reliance on self-reported survey data may have introduced response bias, as participants might have overestimated their competence or satisfaction due to social desirability or program affiliation. Second, although the study included participants from diverse regions, representation from 3T (disadvantaged, frontier, and remote) areas remained proportionally limited, which may affect the generalizability of findings related to equity. Third, the cross-sectional design captured perceptions and outcomes at a single point in time, limiting the ability to assess long-term impacts of the PPG program on teaching effectiveness and student learning outcomes. Future research should adopt longitudinal designs to track graduates' performance in real classroom settings over time.

6. Discussion

This study demonstrated that Indonesia's professional teacher education program (PPG) has achieved notable progress in building a robust foundation for pre-service teacher education, yet it also uncovered enduring challenges that mirror trends in global teacher preparation systems. The consistently high satisfaction ratings from both quantitative and qualitative findings confirm that most teacher training institutions (LPTKs) have met national accreditation standards and provide professional learning environments, in line with policy aims and earlier research on institutional development in teacher education.

However, persistent gaps in digital infrastructure limit this institutional progress, especially in remote 3T regions, where 15% of LPTKs still face difficulties in providing adequate digital and laboratory resources. This situation reflects international concerns about unequal access to educational technology and its influence on teacher quality. As digital literacy becomes increasingly central to teacher competence, national strategies must prioritize equitable access to technology.

The selection process for PPG participants stands out for its procedural fairness and high transparency, evidenced by strong satisfaction scores and alignment with OECD (2019) benchmarks for initial teacher preparation. Yet, the lower ratings for outreach and information dissemination, especially in peripheral regions, reveal an ongoing need for targeted communication strategies, as effective access to program information directly influences candidate diversity and participation.

Central to the curricular model of the PPG is the integration of coursework, digital platforms, and field-based practicum, guided by the TPACK framework. Most

participants valued the relevance, active learning strategies, and practical teaching opportunities of the program, corroborating global findings on the importance of experiential and technology-enhanced learning in teacher preparation. However, limited digital access and variable mentorship quality, particularly in rural settings, constrained the full realization of TPACK competencies. This finding aligns with studies that call for infrastructure investment and stronger mentor preparation to close the urban–rural gap in teacher education quality.

In terms of assessment and professional competence, the high pass rates on national teacher exams and the rapid rate of graduate employability demonstrate that PPG has largely fulfilled its primary mandate. These findings echo successful outcomes reported in other large-scale teacher education reforms. Nevertheless, technical issues during assessment, such as Internet instability and device limitations, underscore the urgent need for resilient, adaptable evaluation systems in the digital era. Continuous program monitoring, remediation opportunities, and stakeholder feedback mechanisms are therefore essential for maintaining assessment validity and reducing anxiety among teacher candidates.

Qualitative insights from school principals, mentor teachers, and graduates further illustrated the strengths and growth areas of PPG. Principals described graduates as reflective, motivated, and innovative, and many highlighted their openness to new teaching methods as evidence of the positive impact of structured professional training. Nonetheless, soft skills, such as teamwork, communication, and classroom management, remain less developed among some graduates, confirming the argument that 21st-century teacher education must move beyond content knowledge and pedagogy to foster adaptive expertise.

The interplay between these findings suggests several policy implications. First, targeted investment in digital infrastructure and professional learning communities is vital to bridge regional disparities and support equitable teacher preparation (UNESCO, 2021). Second, more effective information dissemination and outreach, especially in underrepresented areas, will help broaden candidate diversity and participation (Friesner et al., 2021; Wilson et al., 2013). Third, expanding blended learning models and strengthening mentor teacher development could enhance the depth and reach of TPACK and soft skills development (Kavitha & Anitha, 2025; Nisa et al., 2025; Papanikolaou et al., 2017).

Finally, Indonesia's experience with PPG offers valuable lessons for other countries navigating similar educational reforms. Blending international best practices, such as STEM-based interdisciplinary training and responsive, context-sensitive evaluation (Bou Saad et al., 2025; Svabo et al., 2025), can further raise the standard of pre-service teacher education. The study recommends conducting longitudinal research to track the long-term impact of PPG on teacher effectiveness and student learning outcomes.

7. Conclusion

This study provides comprehensive evidence that Indonesia's PPG has made significant strides in improving the professional competence of future educators, as reflected in high satisfaction levels, strong competency outcomes, and the effective development of TPACK among teacher candidates. However, the findings also reveal persistent regional disparities, with participants in remote and under-resourced areas experiencing lower levels of satisfaction, limited access to digital infrastructure, and reduced mentoring support. Both quantitative and qualitative analyses confirmed that digital equity, mentoring quality, and student agency are critical factors shaping the overall effectiveness of pre-service teacher education.

In addition, the study highlights the need to further strengthen the development of essential soft skills, including teamwork, communication, and classroom management, which remain uneven among some graduates despite strong technical and pedagogical preparation. These competences are increasingly important for navigating complex classroom environments and fostering effective student engagement.

Taken together, these findings underscore the importance of targeted quality assurance strategies, including investment in digital infrastructure, systematic mentor development, and the institutionalization of continuous mixed-methods evaluation. At the same time, integrating structured opportunities for soft skills development within the curriculum and practicum is necessary to ensure more holistic preparation of future teachers.

Addressing these priorities is essential to ensuring that all teacher candidates, regardless of geographic or institutional context, benefit equitably from the strengths of the PPG program. Embedding these strategies within national teacher education policy will not only enhance program effectiveness and equity but also contribute to a more sustainable and comprehensive model of quality assurance that can inform teacher education reforms in similarly diverse educational contexts worldwide.

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