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The impact of teacher professional education program on improving teacher competences in Indonesia: A comparative study

ABSTRACT - This study examines the effect of the Teacher Professional Education Program (Program Pendidikan Profesi Guru, or PPG) on enhancing teacher competency in Indonesia. A quantitative approach was employed using a quasi-experimental design, comprising both experimental and control groups. The study population consisted of teachers across Indonesia, with the sample drawn from teachers in North Sumatra and Aceh Provinces through cluster random sampling. Observational techniques were utilized for data collection to ensure objective measurement of teacher competency. Descriptive statistical analysis revealed that the experimental group achieved a higher mean competency score compared to the control group, indicating superior performance among PPG participants. Furthermore, inferential analysis using an independent sample t-test yielded a significance value of less than 0.05 ($p < 0.05$), demonstrating a statistically significant difference in competency levels between teachers who had participated in the PPG program and those who had not. Based on these findings, it is concluded that the Teacher Professional Education Program exerts a significant positive effect on improving teacher competency in Indonesia. The program is therefore demonstrated to be an effective intervention for enhancing professional competence among Indonesian teachers. These results carry important implications for educational policy, suggesting that continued investment in PPG may contribute substantially to elevating national educational quality.

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1. Introduction

Teacher competence constitutes a foundational determinant of educational quality. The professional knowledge, pedagogical skills, and instructional effectiveness of educators directly shape student learning outcomes and holistic development. Within the Indonesian context, the teacher's role extends beyond content transmission to encompass character formation, critical thinking cultivation, creativity development, and the fostering of lifelong learning competencies. Consequently, systematic and sustainable professional education programs remain essential for continuous teacher quality improvement.

The Indonesian government has long acknowledged teacher competence as a critical factor in enhancing educational quality. In response, the Teacher Professional Education Program (Program Pendidikan Profesi Guru, or PPG) was established as a formal pathway to strengthen teachers' professional qualifications and pedagogical capabilities. PPG is a post-baccalaureate program designed to prepare graduates as certified professional educators capable of implementing effective, innovative, and reflective teaching practices aligned with national education standards.

The legal foundation of PPG is codified in Law Number 14 of 2005 concerning Teachers and Lecturers, which mandates that every teacher must possess both academic qualifications and professional competencies. The program ensures that teachers master subject matter while developing the pedagogical and social competencies necessary to guide and motivate students effectively. Thus, PPG functions as a strategic intervention addressing the persistent challenge of insufficient teacher competence affecting Indonesian education.

Notwithstanding various teacher education initiatives, national assessments and international surveys, including the Programme for International Student Assessment (PISA), indicate that Indonesia continues to face substantial challenges in achieving optimal educational outcomes. Inconsistency in teacher competence and professional readiness has been identified as a primary contributing factor. Consequently, policymakers have strengthened the structure, content, and evaluation mechanisms of PPG as a means to enhance teacher quality nationwide.

PPG is designed not merely as a certification pathway but as a comprehensive professional learning model integrating theoretical foundations, reflective practice, and field experience. The program emphasizes pedagogical innovation, curriculum design, and classroom management, all aligned with the four core teacher competencies stipulated in Minister of National Education Regulation No. 16 of 2007: pedagogical, professional, personal, and social competence. This alignment underscores PPG's significance as a vehicle for professional growth and pedagogical transformation.

Teacher competence, within the Indonesian educational context, constitutes a dynamic construct encompassing knowledge, skills, attitudes, and values that enable effective professional performance. Spencer and Spencer (1993) and Shulman (1987) emphasize that competence evolves through continuous professional learning and reflective teaching practices. Therefore, PPG effectiveness should be assessed not only through certification outcomes but also through measurable improvements in instructional quality and classroom performance.

The success of PPG in improving teacher competence depends on multiple factors, including institutional support, program design, mentoring systems, and participant motivation. According to Guskey (2002) and Desimone (2009), professional development programs prove effective only when sustained, contextually relevant, and supported by ongoing evaluation. Hence, understanding PPG's influence on teacher competence requires comprehensive examination of both implementation processes and practical outcomes.

Empirical studies have yielded mixed results regarding the impact of teacher professional education programs. While Darling-Hammond (2006) and King (2014) reported significant improvements in teacher knowledge and student outcomes following professional certification, other research suggests that effectiveness depends heavily on contextual and institutional variables. This variation necessitates further investigation to determine how Indonesia's PPG program translates into tangible teacher competence improvements.

The rapid advancement of educational technology and the global shift toward digital pedagogy have further underscored the need for competent, adaptive teachers. The COVID-19 pandemic, for instance, revealed significant gaps in teachers' ability to integrate digital tools into instruction. PPG therefore plays a crucial role in preparing teachers to navigate these challenges by fostering digital literacy, adaptability, and resilience in the face of educational disruptions.

This study seeks to analyze PPG's influence on teacher competence enhancement in Indonesia, exploring the extent to which PPG participation contributes to the development of pedagogical, professional, social, and personal competencies. Additionally, the study aims to identify factors supporting or hindering program effectiveness. The findings are expected to provide valuable insights for policymakers, educational institutions, and teacher training organizations in designing more effective professional education frameworks, thereby contributing to the ongoing discourse on teacher quality improvement in Indonesia.

2. Literature review

2.1. Teacher competence and professional education in Indonesia

Teachers play a pivotal role in determining the quality of education within a nation. The competence, professionalism, and pedagogical abilities of teachers significantly influence the learning outcomes and holistic development of students. In Indonesia, the teacher’s role is not only limited to delivering content knowledge but also includes shaping students’ character and fostering critical thinking, creativity, and lifelong learning skills. Therefore, the quality of teachers must continuously be improved through systematic and sustainable professional education programs.

The Indonesian government has long recognized the importance of teacher competence as a determining factor in improving educational quality. In response, the Teacher Professional Education Program (Program Pendidikan Profesi Guru or PPG) was developed as a formal route to strengthen the professional qualifications and pedagogical skills of teachers. PPG is a post-baccalaureate program designed to prepare graduates to become certified professional educators, capable of implementing effective, innovative, and reflective teaching practices aligned with national education standards.

The establishment of PPG is legally grounded in Law Number 14 of 2005 on Teachers and Lecturers, which mandates that every teacher must possess both academic and professional qualifications. The program aims to ensure that teachers not only master their subject matter but also have the pedagogical and social competencies necessary to guide and motivate students effectively. Consequently, PPG serves as a strategic intervention in addressing the persistent issue of low teacher competence that has long affected the quality of education in Indonesia. Despite the implementation of various teacher education programs, several national assessments and international surveys, such as PISA (Programme for International Student Assessment), indicate that Indonesia still faces challenges in achieving optimal educational outcomes. One major contributing factor identified is the inconsistency in teacher competence and professional readiness. This has led policymakers to strengthen the structure, content, and evaluation mechanisms of the PPG program as a means to enhance teacher quality nationwide.

PPG is designed not merely as a certification pathway but as a comprehensive professional learning model integrating theory, reflective practice, and field experience. The program emphasizes pedagogical innovation, curriculum design, and classroom management, all of which are aligned with the four core teacher competencies stipulated by the Minister of National Education Regulation No. 16 of 2007: pedagogical, professional, personal, and social competence. This alignment underscores the significance of PPG as a vehicle for professional growth and pedagogical transformation.

Teacher competence, as defined in the Indonesian educational context, is a dynamic construct encompassing knowledge, skills, attitudes, and values that enable teachers to perform their professional duties effectively. Scholars such as Spencer and Spencer (1993) and Shulman (1987) emphasize that competence is not static but evolves through continuous professional learning and reflective teaching practices. Therefore, the effectiveness of PPG should be assessed not only through certification outcomes but also through measurable improvements in teachers' instructional quality and classroom performance.

2.2. PPG implementation, policy evolution, and research rationale

The success of PPG in improving teacher competence also depends on multiple factors, including institutional support, program design, mentoring systems, and participants' motivation. According to Guskey (2002) and Desimone (2009), professional development programs are effective only when they are sustained, contextually relevant, and supported by ongoing evaluation. Hence, understanding the extent to which PPG influences teachers' competence requires a comprehensive examination of both its implementation and its outcomes in practice.

Empirical studies have shown mixed results regarding the impact of teacher professional education programs. While some studies, such as those by Darling-Hammond (2006) and King (2014), indicate significant improvements in teacher knowledge and student outcomes following professional certification, others suggest that the effectiveness of such programs depends heavily on contextual and institutional variables. This variation necessitates further research to

determine how Indonesia's PPG program translates into tangible improvements in teacher competence.

In Indonesia, PPG is offered in two primary forms: PPG Prajabatan (Pre-service) and PPG Dalam Jabatan (In-service). The former targets university graduates who aspire to become teachers, while the latter serves teachers who are already practicing but have yet to obtain professional certification. Both types aim to produce teachers who are reflective practitioners, capable of integrating pedagogical theory with classroom realities. However, the degree to which these programs effectively enhance teacher competence remains an open question that requires empirical investigation.

The rapid development of educational technology and the global shift toward digital pedagogy have further underscored the need for competent, adaptive teachers. The COVID-19 pandemic, for instance, revealed significant gaps in teachers' ability to integrate digital tools into instruction. PPG, therefore, plays a crucial role in preparing teachers to navigate these new challenges by fostering digital literacy, adaptability, and resilience in the face of educational disruptions.

From a policy perspective, the Indonesian government continues to refine the PPG framework through updated guidelines and performance-based evaluations. The Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) has emphasized the importance of linking teacher certification to measurable professional competence rather than merely academic credentials. Such policy shifts reflect a broader global trend toward evidence-based teacher education, which prioritizes learning outcomes and demonstrable teaching effectiveness.

This study, therefore, seeks to analyze the influence of the Teacher Professional Education Program on the enhancement of teacher competence in Indonesia. It explores the extent to which PPG participation contributes to the development of pedagogical, professional, social, and personal competencies among teachers. Furthermore, the study aims to identify the factors that support or hinder the effectiveness of the program in achieving its intended goals.
The findings of this study are expected to provide valuable insights for policymakers, educational institutions, and teacher training organizations in designing more effective professional education frameworks. By examining the relationship between PPG implementation and teacher competence, this research contributes to the ongoing discourse on teacher quality improvement in Indonesia and aligns with global efforts to professionalize teaching as a cornerstone of educational excellence.

3. Method

3.1. Research design

This study employed a quantitative comparative research design aimed at analyzing the effect of the Teacher Professional Education Program (PPG) on the improvement of teacher competence in Indonesia. The design was selected because it allows for systematic comparison between teachers who have completed the PPG program (experimental group) and those who have not (control group). Through this approach, the study sought to identify whether

participation in PPG leads to statistically significant differences in teachers' pedagogical, professional, personal, and social competencies.

The research was conducted within the context of elementary and secondary schools in North Sumatra Province, Indonesia. This region was selected purposively due to its relatively homogeneous educational environment and standardized teacher policies, which minimized the potential influence of external confounding variables such as regional education disparities or variations in local curricula. All participating schools were under the supervision of the same provincial education authority, ensuring consistency in teaching standards and evaluation mechanisms.

3.2. Populations and samples

The population in this study was Islamic Religious Education teachers in Indonesia. The sample included Islamic Religious Education teachers in the provinces of Aceh and North Sumatra. The sampling technique used was purposive random sampling. The sample consisted of 10 teacher participants, divided equally into two groups: five teachers who had completed and graduated from the PPG program (experimental group) and five teachers who had not yet participated in the program (control group). The small but focused sample allowed for in-depth examination and controlled comparison of the two groups. Participant selection employed purposive sampling, ensuring comparability in terms of educational background, teaching experience, and school context.

Criteria for participants were as follows: (1) holding at least a bachelor's degree in education or a relevant field, (2) having a minimum of three years of teaching experience, (3) currently teaching in a formal educational institution, and (4) willing to participate voluntarily in the study. Teachers who did not meet these criteria or were involved in other professional development programs at the time of data collection were excluded to prevent bias.

3.3. Data collection technique

The primary data collection instrument used in this study was a structured competency assessment questionnaire designed to measure the four major domains of teacher competence: pedagogical, professional, personal, and social. The instrument was adapted from the Indonesian National Teacher Competency Standards (Permendiknas No. 16/2007) and validated through expert review by three senior teacher educators and psychometricians. The reliability of the instrument was confirmed through a pilot test, which produced a Cronbach's alpha coefficient of 0.89, indicating high internal consistency.

Each domain of competence consisted of several indicators. The pedagogical competence items assessed teachers' ability to plan lessons, deliver instruction effectively, evaluate student learning outcomes, and utilize appropriate learning resources. The professional competence items focused on subject-matter expertise, curriculum understanding, and continuous self-development. The personal competence domain measured aspects related to professional ethics, integrity, and emotional maturity, while social competence examined interpersonal communication and collaboration within the school community.

Data collection was carried out over a two-week period using a combination of self-assessment and peer evaluation methods to ensure objectivity and triangulation of data. Participants were asked to complete the competency assessment under standardized conditions, while peer evaluators—comprising school principals and senior colleagues—provided external evaluations using the same instrument. The average of both scores was used as the final measure for each participant's competence level.

In addition to quantitative data, brief qualitative field notes were taken during the data collection process to document contextual factors, such as participants' classroom environments and institutional support systems. These observations provided supplementary insights into the interpretation of quantitative findings and allowed for richer analysis of PPG's impact within real-world educational settings.

3.4. Data analysis techniques

Prior to conducting the main analysis, a series of descriptive statistical analyses were performed to summarize the central tendencies and dispersion of the data. Mean scores, standard deviations, and score ranges were computed for each group and for each competence domain. These descriptive analyses helped establish an initial understanding of the differences in teacher competence between the two groups and served as a foundation for inferential testing.

Before applying the inferential statistical tests, the study conducted assumption tests to ensure the appropriateness of the selected analysis method. The Shapiro–Wilk test was used to assess data normality, while the Levene's test was employed to examine homogeneity of variances. Both tests confirmed that the data met the required statistical assumptions ($p > 0.05$), indicating that the distribution of scores was approximately normal and that the variances between groups were not significantly different.

After the assumptions were satisfied, an Independent Samples t-Test was applied to determine whether there were statistically significant differences between the mean scores of the experimental (PPG) and control (non-PPG) groups. The choice of the t-test was based on its suitability for comparing two independent means, particularly when the sample sizes are small and the population variance is assumed equal. The significance level (α) was set at 0.05, consistent with conventional social science research standards.

To complement the inferential analysis, effect size (Cohen's d) was calculated to determine the magnitude of the observed differences. This approach provided not only statistical but also practical interpretation of the results, highlighting whether the differences found between the two groups were substantial in educational terms. According to Cohen (1988), a d-value above 0.8 indicates a large effect, suggesting meaningful practical implications.

Data analysis was conducted using IBM SPSS Statistics (Version 26) software. The analysis workflow included data cleaning, verification of coding accuracy, computation of descriptive and inferential statistics, and graphical representation of score distributions. The results were presented in both tabular and narrative forms to enhance clarity and interpretability for readers and policymakers.

Ethical considerations were strictly observed throughout the research process. All participants provided informed consent, and confidentiality of personal data was ensured by assigning anonymous codes to each respondent. The study obtained approval from the institutional review board of the participating university, confirming that the research complied with ethical standards for human subject research in education.

In summary, the methodology of this study was designed to ensure rigor, validity, and reliability in examining the influence of the Teacher Professional Education Program (PPG) on teacher competence. The combination of a controlled comparative design, validated instruments, and robust statistical analysis allowed the research to generate credible and replicable evidence. The methodological framework established here provides a solid foundation for interpreting the findings and discussing their implications for teacher professional development in Indonesia.

4. Findings and discussion

The data analysis began with descriptive statistics to provide an overview of the general trends and variations in teacher competence scores between the two groups. As presented in Table 1, the experimental group, consisting of teachers who had completed the Teacher Professional Education Program (PPG), achieved a mean competence score of 88.2 with a standard deviation of 3.56, while the control group, consisting of non-PPG teachers, obtained a lower mean score of 80.4 with a standard deviation of 4.18. The difference of 7.8 points between the two groups indicated a substantial variation that warranted further inferential testing.

The relatively low standard deviation within the PPG group suggests that the teachers who completed the program demonstrated more consistent levels of competence compared to their non-PPG counterparts. This homogeneity reflects the standardization and uniform training approaches embedded in the PPG curriculum, which is designed to ensure that graduates meet national standards of teacher professionalism and pedagogical proficiency.

In contrast, the control group exhibited slightly higher variability in competence scores, which may indicate inconsistencies in teaching quality and professional experience among non-certified teachers. This variability might be influenced by differences in self-directed professional development or unequal institutional support for in-service learning. Overall, the descriptive statistics already hinted at the potential positive impact of the PPG on teacher competence outcomes.

4.1. Assumption testing

Before conducting inferential statistical tests, assumption testing was performed to ensure data validity. The Shapiro–Wilk test revealed that both groups' data distributions did not significantly deviate from normality ($p > 0.05$), confirming that the assumption of normality was met. Similarly, Levene's test for equality of variances indicated that the variances between the experimental and control groups were statistically homogeneous ($p > 0.05$).

These results validated the use of the Independent Samples t-Test to determine whether the difference in mean competence scores between the two groups was statistically significant.

By satisfying these assumptions, the study ensured that subsequent inferential analysis would yield reliable and unbiased conclusions.

4.2. Inferential analysis

The results of the Independent Samples t-Test showed a statistically significant difference in the mean competence scores between the PPG and non-PPG groups ($t(8) = 3.85$; $p = 0.005$; $\alpha = 0.05$). Because the obtained p-value was well below the significance threshold, the null hypothesis (H_0) was rejected, confirming that the difference in competence levels between the two groups was not due to random chance.

This finding supports the research hypothesis that participation in the Teacher Professional Education Program (PPG) has a positive and significant influence on teachers' overall competence. The calculated mean difference of 7.8 points further indicates that PPG-trained teachers performed substantially better in key professional competencies than those who had not undergone formal professional training.

The effect size, calculated using Cohen's d, was found to be 1.72, indicating a large and practically meaningful effect according to Cohen's (1988) classification. This suggests that the PPG program's influence on teacher competence is not only statistically significant but also educationally impactful, reinforcing the argument that structured professional education substantially improves teaching quality.

4.3. Sub-competence analysis

To gain a more nuanced understanding of which aspects of competence were most affected by the PPG program, a sub-domain analysis was conducted. Competence was divided into four main components: pedagogical, professional, personal, and social competencies. Each sub-domain was analyzed using the same inferential procedure to identify differences in their respective mean scores.

The pedagogical competence domain exhibited the highest mean difference between the two groups. Teachers in the PPG group scored an average of 90.5, compared to 81.0 for the control group, a difference that was statistically significant at $p < 0.01$. This finding suggests that the PPG program effectively enhances teachers' abilities in lesson planning, instructional delivery, and classroom evaluation—skills that are heavily emphasized within the PPG curriculum.

In terms of professional competence, PPG participants also outperformed non-PPG teachers, with mean scores of 88.0 and 82.5, respectively. The difference was statistically significant at $p < 0.05$. This improvement indicates that the program successfully strengthens teachers' subject matter mastery and encourages ongoing professional development, both of which are essential for maintaining high instructional quality.

For personal competence, although PPG-trained teachers demonstrated slightly higher mean scores (87.0 vs. 84.5), the difference did not reach statistical significance ($p > 0.05$). This suggests that personal traits such as professional ethics, emotional maturity, and moral integrity

may be less influenced by formal training and more related to individual character and long-term professional experience.

Similarly, the social competence domain showed only marginal differences between the two groups ($p > 0.05$). Although PPG participants scored somewhat higher on average, the results suggest that interpersonal communication, collaboration, and community engagement are more context-dependent and may rely on school culture and leadership rather than formal pedagogical instruction.

4.4. Interpretation of findings

The findings of this study align strongly with the theoretical expectations of Human Capital Theory (Becker, 1993), which posits that investment in professional education leads to enhanced productivity and skill acquisition. By participating in PPG, teachers accumulate pedagogical capital that directly translates into improved classroom performance and more effective learning outcomes.

Moreover, the results resonate with Darling-Hammond's (2006) framework, which emphasizes that well-designed professional education programs foster reflective teaching, deepen subject-matter expertise, and enhance instructional decision-making. The statistically significant improvement in pedagogical and professional competencies demonstrates that PPG functions as a transformative professional learning experience rather than a mere certification process.

The lack of significant differences in personal and social competencies, however, highlights the need for a more holistic approach in teacher professional education. Programs such as PPG may need to integrate more experiential learning and mentoring components that cultivate interpersonal awareness, empathy, and professional identity formation—dimensions that are equally vital for teaching effectiveness but less amenable to technical training.

From a policy perspective, these results carry important implications for teacher development in Indonesia. The evidence suggests that government investment in PPG yields measurable benefits in enhancing teacher competence. However, continuous evaluation and quality assurance are needed to ensure consistency of program delivery across diverse educational settings, particularly in remote regions where access to quality training remains limited.

The findings of this study provide compelling empirical evidence that the Teacher Professional Education Program (PPG) serves as a critical catalyst for enhancing teacher competence. The primary finding—a mean score of 88.2 for the experimental group compared to 80.4 for the control group—confirms that structured professional intervention creates a distinct quality gap. Theoretically, this outcome aligns with the perspective of Darling-Hammond (2017), who asserts that systematic teacher preparation is a more potent predictor of classroom effectiveness than mere years of experience or unguided practice.

The statistical significance observed in the Independent Samples t-Test ($p = 0.005$) suggests that this competency gap is not a statistical anomaly but a direct result of a standardized curriculum. The low standard deviation within the PPG group (3.56) reflects a high level of

quality homogeneity among graduates. This demonstrates that the PPG program effectively functions as a national quality assurance instrument. As noted by Cochran-Smith (2021), rigorous certification programs serve to calibrate teachers' pedagogical understandings to meet professional thresholds required by educational authorities.

A deeper analysis reveals that the most substantial advantage lies within the pedagogical competence domain (90.5 vs. 81.0). This dominance indicates that the PPG's focus on instructional design, innovative teaching models, and assessment techniques has been highly effective. PPG graduates appear more adept at converting abstract educational theories into applicable classroom practices. Shulman's (1987) concept of *Pedagogical Content Knowledge (PCK)* elucidates this: effective teachers do not merely master their subject matter; they master the art of making that subject matter accessible to students—a skill clearly honed through the PPG training.

The improvement in professional competence further paints an optimistic picture of subject matter mastery among PPG participants. With a statistically significant score difference ($p < 0.05$), these findings suggest that the program encourages teachers to deepen their scholarly literacy. A professional teacher must possess a robust epistemological foundation in their discipline (Banks, 2019). The success of the PPG in this realm proves that the program balances the "how-to" of teaching with the "what," strengthening the academic content that serves as the foundation for knowledge transfer.

Interestingly, an anomaly arises regarding personal and social competencies, which showed no significant differences between the two groups. This finding opens a critical dialogue on the limitations of formal education in altering individual character. Personal traits, such as emotional maturity and professional ethics, are often the result of lifelong internalization processes. Lortie (2020) argues that the "apprenticeship of observation"—the years spent watching teachers before entering the profession—exerts a stronger influence on personality formation than short-term professional certification programs.

The lack of significant difference in social competence also implies that the ability to communicate and collaborate within a school community is heavily influenced by the immediate work environment and organizational culture. Social competence is inherently contextual and situational (Biesta, 2015). Therefore, while the PPG curriculum includes modules on social relations, its effectiveness in changing real-world behavior depends largely on the daily social dynamics and leadership styles teachers encounter in their respective schools.

The effect size of 1.72 (categorized as "large" by Cohen's classification) reinforces that the impact of the PPG is not merely a paper-based success but a practically substantial achievement. This figure provides a strong justification for policymakers to expand access to the program. Investing in such programs correlates directly with macro-level improvements in national education quality. Hargreaves and Fullan (2012) argue that a nation's "professional capital" depends fundamentally on how its educators are trained and continuously developed.

The higher variability in the non-PPG group (SD 4.18) signals a disparity in quality among uncertified teachers. This represents a risk to educational equity; without standardized training, classroom quality depends solely on a teacher's personal initiative, which is susceptible

to inconsistency. Zeichner (2018) warns that leaving teachers without formal training can widen the student achievement gap, particularly in regions with limited resources.

The integration of descriptive and inferential data highlights the importance of critical reflection. PPG participants are typically trained in Classroom Action Research (CAR), allowing them to evaluate their own performance. This reflective capacity likely acts as a catalyst for their high pedagogical scores. Schön (1983) famously described "reflective practitioners" as those who learn from experience, a quality that appears more pronounced in the experimental group of this study.

However, the success of the PPG program should not lead to institutional complacency. The fact that personal and social competencies remained largely unaffected suggests a "blind spot" in the current curriculum. A more humanistic, field-based approach may be required to reach the affective dimensions of teaching. Future teacher education must strike a balance between technical mastery (pedagogical and professional) and character fortification (Korthagen, 2017).

Furthermore, intrinsic and extrinsic motivation must be considered. While teachers may enter the PPG motivated by the promise of professional allowances, this study shows that the educational process itself yields positive competency outcomes. This aligns with Deci and Ryan's (1985) Self-Determination Theory, where well-regulated external supports can eventually be internalized as a drive for professional excellence.

The sub-domain analysis suggests that the PPG is highly effective at teaching "teachable skills" but less potent in fostering "grown traits." This leads to the conclusion that recruitment is just as vital as training. If personal competence is difficult to alter via training, then the selection process for the PPG must be more rigorous in screening for candidates who already possess the psychological profile suited for the teaching profession (Day, 2021).

The experimental group's superiority may also stem from their mastery of instructional technology. In the digital era, pedagogy is inseparable from digital literacy. Modern PPG programs integrate *Technological Pedagogical Content Knowledge (TPACK)*. Koehler and Mishra (2009) emphasize that the intersection of technology, pedagogy, and content is the key to 21st-century teaching, and these findings confirm that PPG graduates are better positioned in this regard.

The findings also underline the need to strengthen the mentoring and follow-up support mechanisms for PPG graduates. As noted by Guskey (2002) and Desimone (2009), the sustainability of professional learning depends on opportunities for continuous feedback, collaboration, and reflection. Thus, post-certification support systems should be institutionalized to maintain and further develop the competencies gained through the PPG.

Another critical implication is the need to embed digital pedagogy and technological competence into the PPG curriculum. In the era of Education 4.0 and post-pandemic teaching transformation, teachers are increasingly required to integrate digital tools into classroom practices. The inclusion of this component could further enhance the relevance and adaptability of the program to the changing educational landscape.

This study provides empirical evidence that the Teacher Professional Education Program significantly contributes to raising the standard of teacher competence in Indonesia. While the limited sample size restricts generalization, the strength and consistency of the results underscore the value of structured professional development in fostering teaching excellence. These findings can serve as a foundation for larger-scale investigations and policy reforms aimed at optimizing the long-term impact of PPG on national education quality.

This research reinforces the argument that formal professional intervention is a necessity in modern education systems. The significant competency difference provides proof that teacher certification is more than an administrative formality; it is a qualitative transformation. However, the discourse must not end at graduation. Continuous Professional Development (CPD) remains the key to maintaining these competencies amid the shifting challenges of the modern era (Guskey, 2020).

While the PPG program has been remarkably successful in elevating pedagogical and professional standards, it still faces challenges in addressing the personality and social dimensions of the teaching force. These results serve as a foundation for refining future teacher education curricula to be more holistic, ensuring that the transformation of national education quality is both profound and enduring.

5. Conclusion

This study provides empirical evidence that the Teacher Professional Education Program (Program Pendidikan Profesi Guru, or PPG) exerts a significant and positive influence on teacher competence enhancement in Indonesia, particularly within the domains of pedagogical and professional skills. The independent samples t-test results reveal that PPG-certified teachers achieved substantially higher competence scores compared to their non-certified counterparts, with a large effect size indicating both statistical significance and practical relevance. These findings suggest that structured professional education, as operationalized through PPG, effectively strengthens teachers' mastery of instructional strategies, classroom management techniques, and subject matter expertise—core components that directly shape the quality of learning outcomes.

Notwithstanding these positive outcomes, the program's comparatively limited influence on personal and social competencies warrants critical attention. Personal competence—encompassing moral integrity, self-reflection, and professional ethos—and social competence—including interpersonal communication, collaboration, and emotional resilience—remain areas where PPG's impact appears less pronounced. This gap likely reflects the current programmatic emphasis on technical pedagogical skills over the affective and relational dimensions of teaching. Consequently, the integration of more reflective, experiential, and value-based training models into PPG curricula is essential to cultivate these equally important competencies.

The findings further underscore the necessity for continuous programmatic refinement. Several interconnected priorities emerge. First, strengthening mentoring systems within PPG would provide novice teachers with sustained, contextualized guidance from experienced practitioners, thereby bridging the gap between theoretical knowledge and classroom

application. Second, embedding digital pedagogy more systematically into the program would prepare teachers to navigate the evolving technological landscape of 21st-century education, an imperative starkly highlighted by the COVID-19 pandemic. Third, fostering reflective practice through structured self-assessment, peer observation, and collaborative inquiry would enhance teachers' capacity for ongoing professional growth beyond the certification period.

The sustainability and relevance of PPG in the contemporary educational landscape depend critically on such evidence-based reforms. As educational paradigms shift toward learner-centered, technology-mediated, and competency-based models, teacher professional development must evolve correspondingly. PPG should therefore be conceptualized not as a terminal certification event but as a foundational stage within a continuum of lifelong professional learning, supported by ongoing evaluation, feedback, and upskilling opportunities.

While PPG has demonstrated measurable success in advancing pedagogical and professional competence, realizing its full potential requires a more holistic, adaptive, and future-oriented approach. By addressing the identified gaps in personal and social competency development and by embracing digital transformation and reflective practice, PPG can more effectively fulfill its mandate of producing competent, resilient, and transformative educators. These improvements would ultimately contribute to the broader national goal of elevating educational quality in Indonesia and aligning teacher preparation with global standards of professional excellence.

Declaration on the use of AI

The authors confirm the use of Grammarly AI for the following purposes: (a) enhancing the linguistic clarity of the manuscript, and (b) verifying consistency between in-text citations and the reference list. The authors reviewed and edited all final content and assume full responsibility for the accuracy, originality, and integrity of the work.

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