Transformative Education Studies
Vol. 1 No. 2, April (2025), pp. 31-37

ISSN 3090-7268 (online)
Published by Yayasan Cinta Negara Indonesia

The Effect of Blended Learning on Teacher Candidates' Learning Outcomes in the Teacher Professional Education Programme (PPG)

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A R T I C L E I N F O

Article history:

Received: Marc 26, 2025
Revised: Aprl 13, 2025
Accepted: Aprl 30, 2025

Keywords:

Blended learning;
Learning outcomes;
PPG;
Student teacher candidates;
Teacher education.

ABSTRACT

This study investigates the effect of the blended learning model on the learning outcomes of student teacher candidates enrolled in the Teacher Professional Education (PPG) program. Blended learning, which combines face-to-face and online learning components, is increasingly adopted in teacher education to enhance flexibility, engagement, and effectiveness. Using a quasi-experimental design, this research compares the academic performance of student teachers exposed to the blended learning model with those undergoing traditional instruction. Data were collected through pre-tests and post-tests and analyzed using statistical techniques to determine significant differences in learning outcomes. The findings indicate that the blended learning model significantly improves student teacher candidates' understanding of pedagogical concepts and their application in teaching practice. The study concludes that integrating blended learning in the PPG program positively impacts the quality of teacher preparation, supporting more adaptive and student-centered instruction.

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1. INTRODUCTION

In the era of rapid technological advancement and globalization, education systems worldwide are undergoing significant transformations to better prepare future professionals. Teacher education programs, such as the Teacher Professional Education (PPG) in Indonesia, play a crucial role in equipping student teacher candidates with the necessary knowledge, skills, and attitudes to become effective educators. Traditionally, PPG programs have relied heavily on conventional face-to-face learning methods, which, while effective in some respects, face challenges related to student engagement, flexibility, and accessibility. The integration of technology in education has led to the emergence of innovative teaching models, with blended learning becoming increasingly prominent. Blended learning combines face-to-face classroom instruction with online learning activities, providing a flexible, interactive, and student-centered approach that leverages the strengths of both modes. This learning model is especially relevant in teacher education because it allows future teachers to experience diverse teaching strategies and digital tools, which they can later apply in their classrooms.

The COVID-19 pandemic accelerated the adoption of blended and online learning models worldwide, revealing both opportunities and challenges in educational delivery. For PPG programs, the shift has highlighted the need to understand how blended learning influences student teacher candidates' academic performance and readiness to teach in a technology-rich environment. Thus, examining the effect of blended learning on learning outcomes within the PPG context is both timely and necessary. Despite the growing use of blended learning in higher education, including teacher preparation programs, there is still limited empirical evidence regarding its effectiveness in improving

the learning outcomes of student teacher candidates in the PPG program. Existing studies offer mixed results, with some reporting enhanced student engagement and achievement, while others indicate challenges such as technological barriers and reduced interaction.

Moreover, the unique characteristics of the PPG program, which combines theoretical knowledge with practical teaching skills, require an instructional approach that supports both cognitive and practical competencies. It remains unclear whether blended learning can adequately meet these dual demands or if it merely supplements traditional methods without significant improvement. Therefore, this study aims to fill this gap by systematically investigating the impact of the blended learning model on the learning outcomes of student teacher candidates in the PPG program, focusing on both knowledge acquisition and pedagogical skill development.

This study has the following objectives; To examine the difference in learning outcomes between student teacher candidates exposed to the blended learning model and those taught using traditional face-to-face methods in the PPG program. To assess the extent to which blended learning enhances cognitive understanding and practical teaching skills among student teacher candidates. To identify the challenges and benefits experienced by student teacher candidates when participating in blended learning within the PPG context. This research contributes to the field of teacher education by providing empirical evidence on the effectiveness of blended learning in the PPG program. The findings will inform policymakers, curriculum developers, and educators in designing and implementing more effective teacher training models that incorporate technology without compromising the quality of learning.

For student teacher candidates, the study highlights how blended learning can influence their academic achievement and preparedness for real-world teaching. Understanding these effects can guide institutions in providing adequate support and resources to maximize the benefits of blended learning. Furthermore, this study adds to the growing body of literature on educational technology integration in teacher education, particularly in developing countries like Indonesia, where access to digital resources and pedagogical innovations is rapidly evolving but still unevenly distributed. The theoretical foundation of this study draws from several educational theories that support blended learning as an effective instructional approach.

Constructivist Learning Theory posits that learners actively construct knowledge through interaction with content, peers, and instructors. Blended learning fosters this constructivist environment by combining asynchronous online activities, where students can reflect and engage with materials at their own pace, with synchronous face-to-face sessions that enable direct interaction and collaborative learning. Cognitive Load Theory emphasizes the importance of managing cognitive resources during learning. Blended learning allows instructional designers to balance information delivery across multiple formats, reducing overload by enabling students to process information in segments and revisit materials as needed. Technology Acceptance Model (TAM) explains how users come to accept and use technology. In the context of PPG, the perceived ease of use and usefulness of blended learning platforms influence student teacher candidates' motivation and engagement, which in turn affect their learning outcomes. These theories collectively provide a framework for understanding how the blended learning model impacts student engagement, motivation, and academic performance in teacher education.

Blended Learning Model: An instructional approach combining traditional face-to-face classroom methods with online learning activities and digital resources. PPG (Teacher Professional Education): A formal teacher training program designed to prepare student teacher candidates for professional teaching certification. Student Teacher Candidates: Individuals enrolled in the PPG program undergoing preparation to become certified teachers. Learning Outcomes: The measurable knowledge, skills, and attitudes that students acquire as a result of their learning experiences. This study focuses specifically on student teacher candidates in the PPG program at a selected university, which may limit the generalizability of the findings to other contexts or educational levels. The research examines learning outcomes primarily through academic performance measured by standardized tests and practical assessments, without extensive exploration of long-term teaching effectiveness. The study also acknowledges potential limitations related to technology access, learner motivation, and instructor readiness to implement blended learning effectively, which may influence results.

2. RESEARCH METHOD

This study employed a quasi-experimental design to investigate the effect of the blended learning model on the learning outcomes of student teacher candidates in the Teacher Professional Education (PPG) program. The research was conducted at a university offering the PPG program, involving two groups: an experimental group receiving blended learning and a control group receiving traditional face-to-face instruction. This study employed a quasi-experimental design to investigate the effect of the blended learning model on the learning outcomes of student teacher candidates in the Teacher Professional Education (PPG) program. The research was conducted at a university offering the PPG program, involving two groups: an experimental group receiving blended learning and a control group receiving traditional face-to-face instruction. The experimental group underwent a blended learning model that integrated online learning activities—such as video lectures, discussion forums, and digital assessments—with conventional classroom sessions. Meanwhile, the control group received only traditional classroom-based instruction without any online components. Learning outcomes were measured using a standardized test designed to assess knowledge and pedagogical skills relevant to the PPG curriculum. The test consisted of multiple-choice questions and practical teaching scenario analyses. Validity and reliability tests were conducted prior to the main study to ensure the instrument's accuracy and consistency. Data were collected through pre-tests administered before the intervention to assess baseline knowledge, and post-tests given after the completion of the instructional period to measure learning gains. Additionally, observational notes and student feedback were collected to provide qualitative insights into the learning process. Quantitative data from pre- and post-tests were analyzed using descriptive statistics and inferential statistics, specifically paired sample t-tests and independent sample t-tests, to determine whether there were statistically significant differences in learning outcomes between the two groups. Qualitative data were analyzed thematically to complement the quantitative findings.

3. RESULTS AND DISCUSSIONS

Results

This study aimed to examine the effect of the blended learning model on the learning outcomes of student teacher candidates enrolled in the Teacher Professional Education (PPG) program. The research compared the academic performance of an experimental group exposed to blended learning with a control group receiving traditional face-to-face instruction. Data were collected through pre-tests and post-tests designed to assess cognitive knowledge and pedagogical skills relevant to the PPG curriculum.

Descriptive Statistics

The initial analysis involved descriptive statistics to summarize the test scores for both groups before and after the intervention. The pre-test scores indicated that both groups had comparable baseline knowledge and skills.

Experimental Group (Blended Learning):

- Pre-test Mean Score: 62.5 (SD = 7.8)
- Post-test Mean Score: 83.2 (SD = 6.4)
- Control Group (Traditional Learning):
- Pre-test Mean Score: 63.1 (SD = 8.1)
- Post-test Mean Score: 75.4 (SD = 7.2)

Inferential Statistics

To determine if the observed differences in learning outcomes were statistically significant, inferential analyses were conducted using paired sample t-tests and independent sample t-tests. The paired sample t-test revealed a significant increase in post-test scores compared to pre-test scores ($t(29) = 14.56$, $p < 0.001$), indicating substantial learning progress following the blended learning intervention. Similarly, the control group showed improvement, but to a lesser extent ($t(29) = 8.43$, $p < 0.001$).

Between-Group Comparison

An independent sample t-test comparing the post-test scores of the two groups confirmed that the experimental group outperformed the control group significantly ($t(58) = 4.97$, $p < 0.001$). This result supports the hypothesis that the blended learning model enhances student teacher candidates' learning outcomes more effectively than traditional face-to-face methods.

Learning Outcomes by Competency Domain

The assessment was divided into two competency domains: cognitive understanding (theoretical knowledge) and practical pedagogical skills. The experimental group's mean score in the cognitive domain increased by 25%, from 60.8 to 76.1, compared to a 15% increase in the control group, from 61.2 to 70.3. The difference was statistically significant ($p < 0.01$). In the practical domain, which included scenario-based problem solving and teaching simulations, the experimental group demonstrated a 30% improvement, whereas the control group improved by only 18%. Statistical analysis confirmed a significant difference favoring the experimental group ($p < 0.01$). These findings suggest that blended learning not only improves theoretical knowledge but also enhances the practical competencies essential for effective teaching.

Student Engagement and Perceptions

In addition to quantitative test scores, qualitative data were collected through questionnaires and focus group discussions to understand student teacher candidates' engagement and perceptions of the blended learning model. Approximately 85% of students in the experimental group reported increased motivation and active participation in learning activities due to the interactive online components such as discussion forums, video tutorials, and quizzes. Many participants highlighted the flexibility of accessing learning materials anytime and anywhere as a major advantage, which allowed them to balance their studies with other commitments effectively

Despite the benefits, 30% of respondents mentioned difficulties related to internet connectivity and occasional technical issues with the learning platform. Some also expressed initial challenges adapting to self-directed online learning but noted improvements over time. Over 80% of student teacher candidates in the blended learning group believed that this model better prepared them for real classroom teaching by providing diverse learning experiences and opportunities to practice pedagogical skills digitally before face-to-face sessions. The results suggest that integrating blended learning into the PPG curriculum can lead to more effective teacher preparation by combining the strengths of online and face-to-face learning. It supports a more student-centered learning environment where candidates can engage deeply with content and develop practical skills in a supportive, flexible setting.

Discussions

This study investigated the effect of the blended learning model on the learning outcomes of prospective teacher students enrolled in the Teacher Professional Education (PPG) program. The findings reveal that the blended learning approach significantly enhances both cognitive understanding and practical teaching competencies compared to traditional face-to-face instruction. This section discusses these results in detail, interpreting their meaning in the context of existing research and the unique demands of teacher education. The quantitative results demonstrated a significant increase in post-test scores for the experimental group exposed to blended learning compared to the control group. The experimental group's mean score rose from 62.5 to 83.2, whereas the control group improved from 63.1 to 75.4. Statistical analysis confirmed that this difference was significant, indicating that the blended learning model more effectively supports knowledge acquisition and skill development.

This finding aligns with numerous studies highlighting the benefits of blended learning in higher education. For example, research by Means et al. (2013) and Graham (2019) shows that blended learning environments can improve student performance by combining the advantages of online and face-to-face modalities. The flexibility and variety of instructional materials allow students to engage with content more deeply and at their own pace, leading to better retention and understanding. Moreover, the improvement in learning outcomes was not limited to theoretical knowledge but extended to practical pedagogical skills. The PPG program requires prospective teachers to master both cognitive concepts and teaching competencies. The experimental group demonstrated a 30% increase in practical skills assessment scores compared to an 18% increase in the control group, underscoring the blended learning model's effectiveness in fostering applied skills.

The dual focus on cognitive and practical competencies reflects the comprehensive nature of teacher education. The constructivist learning theory supports this approach by emphasizing that learners build knowledge through active engagement and meaningful experiences (Piaget, 1972; Vygotsky, 1978). The blended learning model promotes constructivist principles by offering diverse learning activitiessuch as video lectures, discussion forums, and teaching simulations that encourage reflection, collaboration, and application. Online components allow prospective teachers to review complex pedagogical theories repeatedly and engage with multimedia resources that cater to different learning styles. Face-to-face sessions then provide opportunities for hands-on practice, feedback, and peer interaction, which are essential for mastering teaching skills.

The results confirm that the blended learning model effectively integrates these elements, producing more holistic learning outcomes than traditional instruction. This is consistent with the findings of Yilmaz (2017), who noted that blended learning enhances both knowledge and skills acquisition, particularly in professional education contexts where practice is vital. Qualitative data from questionnaires and focus group discussions provide further insight into why blended learning improves learning outcomes. Most students in the experimental group reported higher engagement and motivation compared to their peers in the control group. The interactive nature of online learning activities—such as quizzes, forums, and digital assignments—made the learning process more enjoyable and less monotonous.

This finding is supported by Self-Determination Theory (Deci & Ryan, 1985), which suggests that autonomy, competence, and relatedness are key drivers of motivation. Blended learning affords students greater autonomy over their learning pace and choice of activities, fostering intrinsic motivation. The ability to interact with peers and instructors online also satisfies social relatedness needs, further enhancing engagement. The flexibility offered by blended learning was repeatedly praised by students, who valued being able to access materials anytime and balance studies with other responsibilities. This flexibility reduces stress and promotes self-regulated learning, which is crucial for adult learners like PPG candidates.

Despite the positive outcomes, the study also identified several challenges associated with implementing the blended learning model. About 30% of students reported difficulties with internet connectivity and technical glitches on the learning platform. These issues sometimes hindered their ability to participate fully in online activities, reflecting infrastructural barriers commonly reported in developing country contexts (Mtebe & Raisamo, 2014). Additionally, some students initially struggled with adapting to the self-directed nature of blended learning. Unlike traditional settings where instructors guide every step, blended learning requires greater learner autonomy and time management skills. However, most participants indicated that their ability to navigate these challenges improved over time with support from instructors and peers.

From the instructors' perspective, while they recognized the benefits of blended learning in promoting higher-order thinking and collaboration, they also expressed the need for ongoing professional development. Effective blended instruction demands proficiency not only in pedagogical strategies but also in technology use and online facilitation skills. The findings have significant implications for the design and delivery of PPG programs and similar teacher education initiatives. First, integrating blended learning can enhance the quality of teacher preparation by improving both conceptual understanding and practical teaching skills. This is crucial in producing competent teachers capable of meeting contemporary classroom demands.

Second, to maximize blended learning's potential, institutions must address technological and pedagogical challenges. Investments in reliable internet infrastructure, user-friendly learning management systems, and continuous instructor training are essential. Moreover, providing orientation and scaffolding for students to develop self-regulated learning skills will facilitate smoother transitions to blended learning environments. Third, the study supports a shift towards more learner-centered, flexible teacher education models. By leveraging digital tools and online resources, PPG programs can cater to diverse learning needs and contexts, making teacher education more inclusive and accessible.

This study's results are consistent with prior research emphasizing the effectiveness of blended learning in teacher education. For instance, studies by Bernard et al. (2014) and Hrastinski (2019) found that blended learning fosters deeper engagement and improves learning outcomes by combining the best aspects of online and face-to-face instruction. However, this study extends the literature by focusing specifically on the PPG context in Indonesia, a setting where research on blended learning remains limited. The positive outcomes observed here contribute to understanding how blended learning can be tailored to professional education programs in developing countries, where infrastructure and cultural factors differ from Western contexts. While the current study offers valuable insights, further research is recommended to explore blended learning's long-term effects on teaching practice after graduation. Longitudinal studies tracking graduates' classroom performance and student outcomes would provide a more comprehensive picture of blended learning's impact.

Additionally, qualitative research focusing on instructor experiences and pedagogical strategies in blended learning environments could identify best practices and inform professional development programs. Finally, research examining the cost-effectiveness and scalability of blended learning models in teacher education across different regions would support policymakers in making informed decisions about educational investments. In summary, the blended learning model positively affects the learning

outcomes of prospective teacher students in the PPG program by enhancing cognitive knowledge, practical skills, engagement, and motivation. Despite challenges related to technology and learner adaptation, the model represents a promising approach to modernizing teacher education. Its successful implementation requires institutional support, infrastructure improvement, and capacity building for both students and instructors. This study contributes to the growing evidence base advocating for blended learning as an effective and flexible strategy for preparing competent educators in the digital age.

4. CONCLUSION

This study has demonstrated that the blended learning model significantly improves the learning outcomes of student teacher candidates in the Teacher Professional Education (PPG) program. The integration of online and face-to-face learning modalities provided a more flexible, engaging, and effective instructional approach compared to traditional classroom methods. Quantitative data showed that students exposed to blended learning achieved higher scores in both cognitive knowledge and practical teaching skills, highlighting the model's ability to enhance comprehensive teacher competencies. The blended learning approach fosters active student engagement by allowing learner autonomy and providing diverse, interactive learning materials that accommodate different learning styles. This increased engagement translated into better motivation and deeper understanding, essential factors in preparing future teachers for the complexities of real classroom environments. Moreover, the model supports self-regulated learning, enabling students to manage their own pace and learning processes effectively. Despite these advantages, challenges such as technological limitations and initial adjustment difficulties were noted. Reliable internet access and adequate technical support are critical to ensuring equitable and smooth implementation of blended learning in PPG programs. Additionally, instructors require continuous professional development to effectively facilitate blended instruction and utilize digital tools. Overall, the findings suggest that adopting blended learning in teacher education can significantly improve the quality of teacher preparation by combining the strengths of traditional and digital learning environments. To maximize its benefits, educational institutions should invest in infrastructure, training, and student support systems. This approach aligns with the evolving demands of 21st-century education and prepares prospective teachers to integrate technology confidently and creatively into their future classrooms. In conclusion, blended learning represents a promising strategy for enhancing student teacher candidates' learning outcomes, equipping them with the knowledge and skills necessary to succeed as professional educators in a rapidly changing educational landscape.

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