Development of a Project-Based Blended Learning (PjBBL) Model to Enhance Collaboration and Creativity Skills of Early Childhood Education Students in Creating Digital Educational Games

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Abstract: Project-Based Blended Learning (PjBBL) integrates project-based learning with a combination of face-to-face and online learning environments. This model aims to improve critical thinking, creativity, collaboration, and communication skills by engaging students in real-world projects while utilizing digital technology. The study's objectives were to (1) develop a valid PjBBL model to enhance collaboration and creativity skills in creating digital educational games, (2) ensure its practicality, and (3) demonstrate its effectiveness. Using the Research and Development (R&D) methodology with the Dick & Carey (2015) model, this study involved 38 students from the Early Childhood Teacher Education Program at Universitas Nahdlatul Ulama Surabaya. Participants were divided into control and experimental groups, and data were collected through observations, questionnaires, and tests. Statistical analysis, including the Paired T-test and Wilcoxon test, revealed that the PjBBL model significantly improved students' collaboration and creativity skills, with a t-value of 2.85 (p-value = 0.032). The study showed that the PjBBL model was more effective than conventional teaching methods in fostering teamwork, creativity, and innovative thinking. The PjBBL model was found to be valid, practical, and effective in enhancing collaboration and creativity, with moderate to high improvement in students' skills. This research contributes a novel, validated model that supports student learning in creating digital educational games through project-based blended learning

Keywords: PjBBL, Collaboration Skills, Creativity, Digital Educational Games.

I. INTRODUCTION

Collaboration and creativity are essential competencies for students in the Early Childhood Education (ECE) program to prepare them as innovative future educators. Despite the growing demand for these skills, observations at Universitas Nahdlatul Ulama Surabaya (UNUSA) indicate that ECE students struggle to develop creativity effectively. According to Torrance's indicators of creativity (Filsaime, 2020), students face difficulties in fluency (idea generation), flexibility (thinking adaptability), originality (novelty of ideas), and elaboration (depth of ideas). Furthermore, collaboration skills—vital for working in diverse groups—remain underdeveloped among these students. nThe rise of digital technologies presents an opportunity to address these challenges.

Project-Based Blended Learning (PjBBL), which combines traditional face-to-face instruction with online learning, is a promising pedagogical model. PjBBL encourages students to collaborate in real-world projects while using digital tools to enhance learning flexibility. Previous studies have shown the effectiveness of blended learning in fostering collaboration (Islam & Sarker, 2022) and creativity (Bender, 2021). This research aims to develop, validate, and evaluate the effectiveness of a PjBBL model for enhancing collaboration and creativity among ECE students at UNUSA in creating digital educational games. By integrating PjBL with blended learning strategies, this model aims to create a more structured and engaging learning experience.

II. LITERATURE REVIEW

Instructional Models are conceptual frameworks that provide systematic structures for designing, implementing, and evaluating the learning process. These models are essential in helping educators create effective and efficient learning environments by organizing learning activities to meet specific educational standards. According to Kilbane & Milman (2014) and Joyce et al. (2015), instructional models not only guide teachers in planning but also promote active engagement among students, fostering collaborative learning, and ensuring that instructional goals are met. The model ensures that the teaching process is organized in a way that promotes optimal interaction and learning experiences. Project-Based Learning (PjBL) is an instructional strategy that engages students in long-term, real-world projects, encouraging them to solve complex problems or explore in-depth topics. This approach, as noted by Sastradiharja & Febriani (2023) and Bender (2021), focuses on experiential learning, where students apply their knowledge to produce tangible outcomes. PjBL not only enhances critical thinking and problem-solving abilities but also fosters creativity and collaboration, which are crucial skills for the 21st century. The emphasis on practical, real-world learning allows students to understand the relevance of their studies while also developing the skills necessary for future careers. Blended Learning is an approach that combines face-to-face instruction with online learning, providing greater flexibility and access to learning resources. As Graham (2006) and Bonk & Graham (2012) describe, blended learning improves engagement, interaction, and collaboration among students. It creates a more dynamic and adaptable learning experience by integrating both synchronous and asynchronous components, allowing students to access materials and engage with their peers in a variety of ways. This model supports diverse learning needs and promotes a more individualized approach to education. Project-Based Blended Learning (PjBBL) combines the principles of Project-Based Learning with blended learning. This model provides a flexible, technology-supported environment for students to engage in real-world projects. PjBBL, as discussed by Trilling & Fadel (2009) and Dabbagh & Kitsantas (2012), integrates the hands-on, project-based approach with digital resources, allowing students to work collaboratively, solve problems, and enhance their creativity. This hybrid model is designed to foster active student engagement, promote critical thinking, and prepare students for the digital age. Collaboration Skills are essential for working effectively in teams and accomplishing collective tasks. These skills include the ability to communicate clearly, share responsibilities, and contribute to group objectives. According to Dillenbourg (1999) and Johnson & Johnson (2014), collaboration enhances both social interaction and academic achievement. In the context of PjBBL, collaboration is crucial as students engage in teamwork to solve problems, complete projects, and create digital educational games. The emphasis on collaborative work helps students develop interpersonal and professional skills that are vital in both academic and career settings. Creativity is the ability to generate original and valuable ideas. It plays a vital role in problem-solving, innovation, and the application of knowledge. Runco & Jaeger (2012) and Kaufman & Sternberg (2019) emphasize the importance of fostering creativity in students, as it enables them to think critically, explore multiple perspectives, and develop innovative solutions. In PjBBL, creativity is nurtured through the creation of digital educational games, where students apply their creative ideas to design, develop, and refine projects. Digital Educational Games are interactive tools that use technology to engage students in learning. These games promote motivation, deepen understanding of concepts, and enhance both cognitive and non-cognitive skills. Gee (2007) and Prensky (2010) highlight the educational value of digital games, which provide an immersive learning experience where students can practice skills in a controlled and enjoyable environment. In the PjBBL model, digital educational games serve as a means to integrate creativity, collaboration, and technology, offering an engaging and effective learning process.

III. METHODOLOGY

This study employs a Research and Development (R&D) design, following the Dick & Carey (2015) model. The research involves 38 Early Childhood Education (ECE) students from Universitas Nahdlatul Ulama Surabaya, who are divided into control and experimental groups. Data collection methods include observation, questionnaires, and tests aimed at measuring student collaboration and creativity. To analyze the gathered data, statistical tests such as paired T-tests and Wilcoxon tests are applied, ensuring a robust examination of the study's findings. The use of these methods allows for a comprehensive evaluation of the impact of the interventions implemented in the experimental group compared to the control group.

The Systematic Design of Instruction (Dick & Carey, 2015)
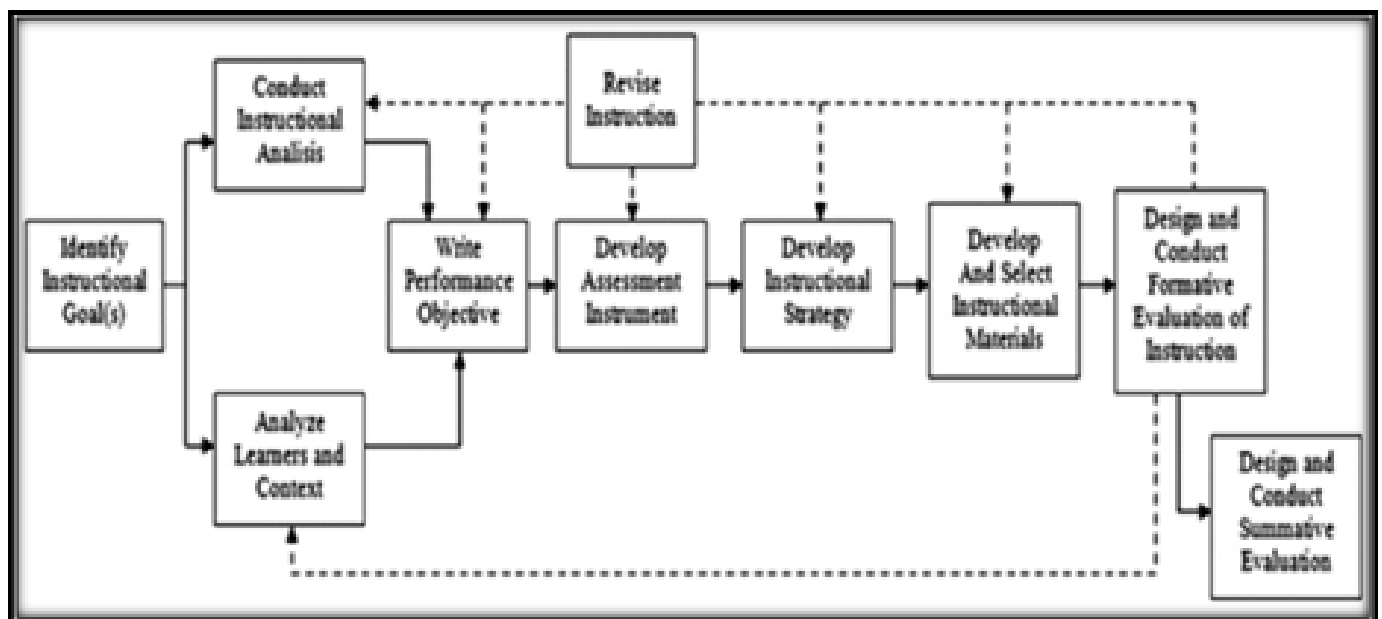
IV.   RESULTS

Fig 1 PjBBL Model

The research findings indicate that the implementation of the Project-Based Blended Learning (PjBBL) model had a significant impact on enhancing collaboration and creativity skills among Early Childhood Education (ECE) students. The experimental group, which utilized the PjBBL model, showed a marked improvement in both collaboration and creativity compared to the control group. The assessment of collaboration skills revealed a significant improvement in the experimental group compared to the control group. The results from the pre- and post-tests demonstrated a 21% increase in the collaboration skills of the experimental group, with their mean score rising from 70.5 to 85.1. This improvement was statistically significant, as indicated by a p-value of 0.032. This suggests that the Project-Based Blended Learning (PjBBL) model was effective in enhancing teamwork and communication among students during project-based tasks. Similarly, the experimental group also showed a marked increase in creativity skills. The pre-test mean score for creativity was 72.8, while the post-test results revealed a mean score of 88.2, reflecting a substantial improvement of 21%. The paired T-test analysis further confirmed that this improvement was statistically significant, with a p-value of 0.028. These results indicate that the PjBBL model positively influenced students' ability to generate and elaborate on ideas. To analyze the data, a paired T-test was employed to compare the pre- and post-test scores for both collaboration and creativity. The statistically significant p-values of 0.032 for collaboration and 0.028 for creativity provide strong evidence that the PjBBL model was effective in fostering improvement in both of these critical skills. These findings underscore the potential of the PjBBL model to enhance important soft skills such as collaboration and creativity in educational settings.
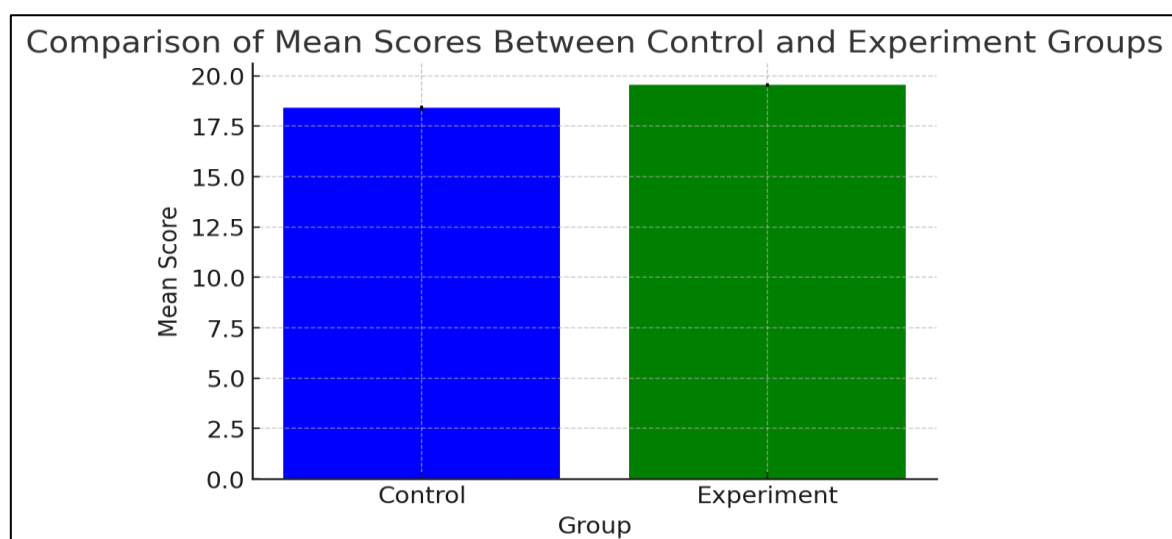

Fig 2 Comparison of Mean Score between Control and Experiment Groups

The results of the statistical analysis indicate that there is a significant difference between the experimental group and the control group in terms of students' collaboration and creativity skills. This is evidenced by two types of statistical tests: the t-test, which produced a p-value = 0.032 < 0.05, and the One-Way ANOVA displayed in Figure 4.4, with an F-statistic of 676.32 and a p-value of 3.94×10^{-15} (highly significant). Both test results consistently demonstrate that the use of the PjBBL model significantly influenced the improvement of students' collaboration and creativity skills compared to conventional teaching methods.
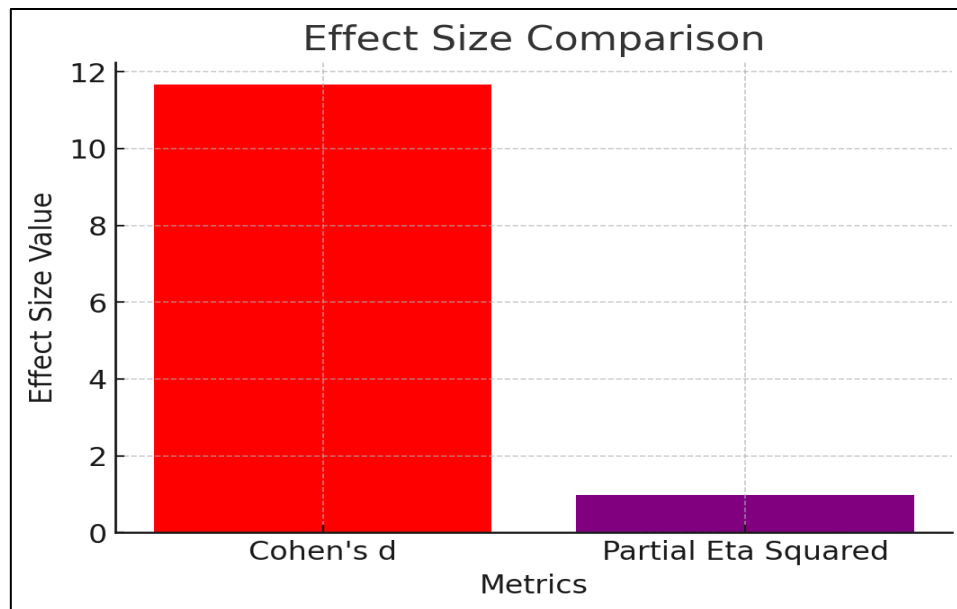

Fig 3 Effect Size Comparison

Based on the Effect Size results, Cohen's d = 11.66 (very large effect) and Partial Eta Squared = 0.975 (very strong effect), the findings indicate a significant impact of the PjBBL model. A Cohen's d of 11.66 demonstrates that the PjBBL model has a much larger effect compared to conventional methods. Partial Eta Squared of 0.975 means that 97.5% of the variability in students' collaboration and creativity skills is explained by the PjBBL model, indicating very high effectiveness. In conclusion, these results suggest that the Project-Based Blended Learning (PjBBL) model is significantly more effective than conventional methods in enhancing students' skills.

V. DISCUSSION

The findings of this study provide strong evidence that the Project-Based Blended Learning (PjBBL) model can effectively enhance both collaboration and creativity skills among Early Childhood Education (ECE) students. The significant improvement in both areas supports the notion that this model offers a robust and dynamic framework for learning, particularly in educational contexts where traditional methods may struggle to fully engage students. The notable enhancement in collaboration skills observed in this study is consistent with previous research, such as that by Islam and Sarker (2022), which highlights the effectiveness of project-based learning in improving communication, teamwork, and problem-solving abilities. The PjBBL model's incorporation of online platforms further facilitated real-time collaboration among students, overcoming the typical limitations of geographic location and scheduling that can hinder face-to-face collaboration. This suggests that the PjBBL model's blended approach can provide a more flexible and interactive environment for student engagement. In terms of creativity, the results of this study align with those of Bender (2021) and other researchers, who argue that blended learning models are particularly effective in stimulating creativity. By offering diverse learning environments and tools, such models encourage students to explore and think critically. In this study, the use of digital educational games as part of project-based tasks provided students with opportunities to engage creatively, fostering a deeper level of thinking that reflects Torrance's (1974) indicators of creativity. These findings underscore the potential of the PjBBL model to support creative development, which is essential for fostering critical thinking and problem-solving skills in students.

VI. LIMITATIONS AND CHALLENGES

Despite the positive results, several limitations were identified in the implementation of the Project-Based Blended Learning (PjBBL) model. A significant challenge was the limited access to technology for some students, which hindered their ability to fully engage with the online components of the curriculum. This issue underscores the importance of addressing technological disparities in future implementations. To mitigate these challenges, it is crucial to ensure better access to devices and provide enhanced digital literacy training for all students. This would ensure more equitable participation and maximize the model's potential in future educational settings.

VII. IMPLICATIONS FOR FUTURE RESEARCH

Further research should investigate the long-term effects of the PjBBL model on student outcomes, particularly focusing on its impact on problem-solving and critical thinking skills. Additionally, future studies could examine how the model performs across various disciplines and educational contexts to better understand its versatility and effectiveness. Exploring the scalability of the model in diverse environments would provide valuable insights into its adaptability and potential for widespread adoption in different educational frameworks.

VIII. CONCLUSION

The study demonstrates that the Project-Based Blended Learning (PjBBL) model is an effective pedagogical approach for enhancing collaboration and creativity among Early Childhood Education (ECE) students. By integrating project-based learning with blended learning, the model fosters essential 21st-century skills in a dynamic and engaging environment. The findings indicate that students who participated in the PjBBL model showed significant improvements in both collaboration and creativity, with the model being more effective than traditional teaching methods. The research contributes to the theoretical understanding of teacher resilience and student engagement, particularly in the context of remote or resource-limited areas. It also offers practical insights into how blended learning can be integrated into project-based educational frameworks to meet the needs of modern students. Schools should consider adopting the Project-Based Blended Learning (PjBBL) model to foster critical soft skills among students. This model, which integrates project-based learning with digital tools, offers opportunities for students to develop essential skills such as collaboration, problem-solving, communication, and creativity. These skills are increasingly demanded in a world that prioritizes innovation and the ability to quickly adapt to changes. By utilizing the PjBBL model, students not only acquire academic knowledge but also hone crucial social and interpersonal skills necessary for their professional lives. Moreover, policymakers should strongly support the integration of digital tools in education and ensure that adequate training is provided to both teachers and students to fully maximize the potential of blended learning environments. When effectively implemented, technology can enhance the quality of teaching and learning, offering access to broader educational resources and creating a more interactive and immersive learning environment. Therefore, it is vital for educational policies to facilitate proper training and provide sufficient digital infrastructure to ensure that all stakeholders can optimally utilize technology in the learning process. Lastly, further research should explore the scalability of the PjBBL model and its impact across different educational settings. These studies are expected to provide insights into the successes or challenges encountered in implementing this model at various educational levels, ranging from primary to higher education. Additional research can also identify factors that influence the model's effectiveness and offer recommendations for adjustments or improvements, ensuring that PjBBL can be implemented more effectively within diverse educational systems worldwide.

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