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Evaluation of Digital Project Based Blended Learning Model to Improve Students' Critical Thinking and Problem Solving Skills

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Abstract

In the digital era, there is a growing demand for innovative educational models that foster critical thinking and problem-solving skills. This study evaluates the effectiveness of the Digital Project-Based Blended Learning (DPBBL) model in enhancing these competencies among university students in Kalimantan, Indonesia. Utilizing a mixed-methods approach, the research combined quantitative analysis through a pre-test and post-test design with qualitative insights from interviews and focus group discussions. The study involved 548 students from multiple universities, with data analyzed using paired t-tests, N-Gain scores, and thematic analysis. The findings revealed a statistically significant improvement in students' critical thinking (pre-test mean = 47.01; post-test mean = 82.67) and problem-solving skills (pre-test mean = 50.52; post-test mean = 79.87) after implementing the DPBBL model. The N-Gain scores indicated moderate effectiveness, with 66.79% for critical thinking and 58.63% for problem-solving. Qualitative feedback further highlighted increased student engagement, motivation, and collaborative learning. However, challenges in defining and proposing solutions were identified, suggesting the need for more structured support during the project phases. The study concludes that the DPBBL model is a promising pedagogical approach for integrating digital tools to develop essential cognitive skills in higher education. The results underscore the importance of combining project-based learning with blended instructional strategies to address the demands of the 21st-century workforce. Future research should explore scaling this model across diverse educational contexts to validate its broader applicability.

Keywords: *Digital Project-Based Blended Learning, Critical Thinking, Problem-Solving Skills.*

Introduction

The application of the Digital Project-Based Blended Learning (DPBBL) model is very important for lecturers who want to encourage active, relevant, and flexible learning experiences in today's digital era. This model combines project-based learning, which emphasizes problem-solving, creativity, and real-world application, with blended learning, which leverages online and in-person learning to improve accessibility and engagement (Mondlane 2005). DPBBL encourages students to take ownership of their learning by working on projects that are meaningful and connected to their future professional lives, which encourages critical thinking and collaboration. In addition, the integration of digital tools and platforms allows students to access resources, communicate, and collaborate beyond the confines of traditional classrooms, making learning more interactive and independent (Noor, Younas, and Aldayel 2022; Rafiq 2024). By adopting this model, educators can create an inclusive and adaptive learning environment that meets the diverse needs of students and prepares them for a complex, technology-driven world.

In recent years, the rapid advancement of digital technology has transformed the educational landscape, creating new opportunities and challenges in pedagogical practice (Sari, Priatna, and Juandi 2022). Among these transformative models is Digital Project-Based Blended Learning (DPBBL), a method that combines online and in-person learning environments with project-oriented assignments. This approach has received great attention for its potential in fostering critical thinking and problem-solving skills—important competencies for students in the 21st century(Rafiq 2024). In a world characterized by complex social issues, employers and educators alike are prioritizing these skills to equip students with real-world problem-

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solving (Chang et al., 2023; Kim & Lee, 2022). The need for critical thinking and problem-solving skills is more urgent than ever. The dynamic nature of the global economy demands individuals who can analyze, evaluate, and design innovative solutions, making these competencies an important educational outcome (Changwong 2018; Dumitru and Halpern 2023), and experts argue that critical thinking and problem-solving skills tend to be domain-specific, relying more on contextual knowledge and content than on universally applicable cognitive skills. This perspective suggests that critical thinking needs to be instilled in relevant content areas rather than being taught as abstract and independent skills (Horn and Veermans 2019). Improving the development of critical thinking and problem-solving skills is considered important by various national education groups, teachers' unions, higher education organizations, and workforce development groups as an urgent need for students today (Monteiro et al. 2020). Critical thinking skills are necessary to process information and make good decisions, which in turn can improve professional competence, decision-making, and problem-solving, students(Ahmady and Shahbazi 2020).

To support the improvement of these skills, traditional teaching methods often fail to develop critical thinking and problem-solving skills due to limited involvement with real-world applications (Dumitru and Halpern 2023). Here, DPBBL presents a promising alternative, as it engages students in collaborative projects supported by technology that mimic the professional environment, thereby enhancing their analytical and decision-making skills. Previous studies have highlighted that blending project-based learning with digital elements increases student engagement, autonomy, and motivation (. However, a comprehensive evaluation of the effectiveness of DPBBL in improving critical thinking and problem-solving is needed to support these claims in various educational contexts.

This study aims to overcome this gap by evaluating the effectiveness of the Digital Project Based Blended Learning (DPBBL) model in improving students' critical thinking and problem-solving skills through a combination of quantitative and qualitative methods. The quantitative aspect includes pre- and post-intervention assessments that measure student performance in these competencies. Qualitatively, we gathered insights from interviews and focus group discussions with students and educators to understand their experiences, challenges, and perceptions of the Digital Project Based Blended Learning (DPBBL) model. This dual approach allows for a holistic understanding of the model's impact and helps identify factors that facilitate or hinder skill development in project-based and digital blended learning environments.

This research is organized into distinct sections to ensure a systematic exploration of the Digital Project-Based Blended Learning (DPBBL) model and its effects on student learning outcomes. First, a comprehensive review of the existing literature on DPBBL is provided, with a particular focus on its documented impact on student critical thinking and problem-solving skills. This review synthesizes prior findings and identifies gaps that this study aims to address. Following the literature review, the research methodology is presented, detailing a mixed-methods approach that combines a quasi-experimental design with a phenomenological analysis of participant feedback. The quasi-experimental component allows for a robust assessment of the DPBBL model's effectiveness through quantitative measures, while the phenomenological analysis captures participants' subjective experiences and insights, adding depth to the quantitative findings. The findings section subsequently reports the results derived from both quantitative and qualitative data, providing a balanced analysis that highlights the model's strengths and limitations, along with its practical applications in various educational contexts. This section discusses the broader implications of adopting DPBBL, offering insights into how it may enhance student engagement and foster skill development in complex problem-solving tasks. Finally, the study concludes with a set of recommendations targeted at educators and policymakers interested in implementing the DPBBL model. These recommendations emphasize the model's potential to cultivate critical thinking and problem-solving skills, as well as to support an active, student-centered learning environment. This concluding section also proposes directions for future research to further refine the model and expand its application across diverse educational settings.

The Digital Project-Based Blended Learning (DPBBL) model is theoretically grounded in constructivist learning theory, which asserts that knowledge is actively constructed by learners through direct engagement in meaningful tasks (Piaget, 1970; Vygotsky, 1978). This model integrates project-based learning with digital

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tools within a blended learning framework, aiming to create an interactive, flexible, and student-centered environment that fosters critical thinking and problem-solving competencies. Constructivist theory, which underpins DPBBL, emphasizes experiential learning where knowledge acquisition is deeply connected to contextual, real-world activities. By involving students in project-based tasks that mirror real-life applications, DPBBL applies constructivist principles to enhance both cognitive and social development. These tasks not only stimulate analytical reasoning but also enable students to approach problems collaboratively, leading to higher levels of engagement and self-regulated learning (Dewey, 1938). Incorporating digital tools into this framework aligns with the evolving educational landscape, which increasingly favors blended and active learning models that prioritize student autonomy, interactivity, and collaborative engagement (Xie et al., 2022). The blended learning element within DPBBL provides an adaptable platform that allows for both online and offline interactions, meeting the diverse needs of learners and promoting deeper conceptual understanding. This integration supports a dynamic learning environment, in which students have more control over their learning pace, enabling differentiated instruction and personalized feedback, which are key elements for fostering critical skills. This research adds to the discourse on innovative educational methodologies, specifically examining the intersection of digital project-based approaches with blended learning in developing essential 21st-century skills. It lays a foundation for further investigations into the potential of digital platforms in enhancing cognitive skills within constructivist frameworks, contributing valuable insights into the future direction of education in an increasingly digitalized world.

Literatur Review

Digital Project Based Blended Learning Model

Digital refers to the representation of data or information in a format that uses numbers, usually in binary form (0 and 1). In the context of technology, digital refers to a system or device that processes, stores, and transmits data in this format. Examples of digital technologies include computers, smartphones, and a variety of other electronic devices that use digital signals to operate (Kumar et al. 2024).

Digital, in the context of a given document, refers to technologies and systems that utilize digital representations of physical entities and processes. In particular, the document highlights the concept of "digital twin" technology, which creates a virtual model of a physical object or system that can simulate its real-time operation and behavior (J. Zhang et al. 2024).

Project-based learning (PBL) is a student-centered learning approach, in which students engage in complex and challenging projects to solve real problems. (Zhang 2024). PBL eliminates mechanical and substitutionary modes of education, develops students' moral awareness, and promotes the formation of their values. Students experience growth in PBL, feel the impact of values in inquiry, and experience the power of emotions in practice. PBL allows for the acquisition of problem-solving skills and the sustainable growth of student values, which is a long-term task that teachers must continue to explore.

Project-based learning (PjBL) is a student-centered learning approach, in which students engage in in-depth exploration of specific topics through projects designed to solve real problems or answer complex questions. This method encourages students to learn in a more active and collaborative way, as well as develop critical thinking and problem-solving skills (Munir et al. 2024)

Project-based learning (PjBL) is a student-centered pedagogical approach, in which learning is organized around projects that are usually based on real-life problems. This method requires students to actively participate in the process of acquiring knowledge and developing their leadership, communication, and social skills(Uotila et al. 2024). Project-based learning (PBL) is an educational approach that emphasizes learning through active involvement in real projects(Kibet et al. 2024)

Based on some of the explanatory opinions above, it can be concluded that the Digital Project Based Blended Learning model is an educational approach that combines the principles of project-based learning with digital technology. This approach involves students actively involved in complex real-world projects

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using digital devices such as computers, smartphones, and virtual models (e.g., digital twin technologies). This method encourages critical thinking, problem-solving, and collaboration, while expanding learning opportunities through digital platforms. By integrating digital technologies, students can simulate real-life scenarios, enhance their creativity, and develop leadership, communication, and social skills in a student-centered, technology-driven learning environment

Blended Learning,

Blended learning is a learning method that combines online and face-to-face learning. In the context of astronomy education, blended learning is considered effective not only for delivering astronomy lessons but also for teacher training. This method allows the integration of face-to-face seminars with online learning, both individually and collaboratively, which can improve teachers' content knowledge and pedagogy (Bersamin et al. 2024)

Blended Learning (BL) is a learning approach that combines the advantages of face-to-face learning and online learning. In the literature, there are various conceptualizations of BL. For example, Oliver and Trigwell (2005a) see BL as an amalgamation of various media and educational approaches, while Bliuc et al. (2007) define it as a blend of physical and technology-mediated interactions. Staker and Horn (2012) classify BL as a formal training program that integrates online delivery with supervised face-to-face sessions. Despite the variations, these studies emphasize the dual nature of BL, which combines online and in-person components.

Blended learning is a learning model that combines traditional learning methods with online experiences and spaces. It allows students to learn through a combination of face-to-face classroom and digital learning activities. Blended learning offers greater flexibility and accessibility, allowing students to learn at their own pace and learning style. However, despite its many advantages, blended learning can also lead to digital disruptions that can negatively impact students' mental and physical health

Critical Thinking

Critical thinking as a skill needed in the 21st century workforce involves drawing conclusions from understanding and knowledge, justification of beliefs and theories, exploration of alternatives considering evidence, and the offering of counterarguments. This process includes analysis, reasoning, questioning, evaluation, and decision-making or Action (Tang, Vezzani, and Eriksson 2020)

Critical thinking is defined as the ability to think rationally and reflectively. It involves intellectual processes such as conceptualizing, applying, analyzing, synthesizing, and evaluating information. Critical thinking requires a high level of reasoning to achieve the desired outcome and involves questioning the source of knowledge, testing the validity and reliability of information, and providing appropriate explanations for specific tasks or situations.(Hidayati et al. 2019)

Critical thinking is often described as a skill that involves a separate set of mental and dispositional skills or operations, such as judgment, analysis, evaluation, and inference, which can be generalized to a variety of contexts. Critical thinking also includes attitudes such as being curious, knowledgeable, open-minded, and flexible (Monteiro et al. 2020). Critical thinking is defined as analyzing, evaluating, or synthesizing relevant information to form an argument or reach a conclusion supported by evidence (Reynders et al. 2020)

Based on Some of the above Opinions, it can be concluded that Critical Thinking is a set of advanced cognitive skills that are essential for interpretation, analysis, evaluation, inference, explanation, and self-regulation, which involves not only mental operations but also an open-minded and reflective attitude.

Problem Solving Skills

Problem solving, according to the article, is a process in which students apply their knowledge to achieve a specific goal, i.e. the solution to the problem at hand. In the context of education, problem solving involves

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understanding and applying solution strategies, as well as the ability to assess the extent to which they have mastered these skills after solving problems. Monitoring accuracy, or monitoring accuracy, is an important aspect of learning problem solving because it relates to students' decisions to continue or stop the practice, which in turn affects their success in future tasks (Janssen and Lazonder 2024)

Problem solving is an important skill that students must have during the learning process. These skills allow students to develop critical mindsets, demonstrate responsibility, collaborate effectively, and engage in discussions and ask questions with confidence, especially in specific areas of study. In addition, problem-solving skills are also important to face a competitive global environment and provide opportunities for students to think creatively (Purnomo et al. 2024)

Problem-solving is defined as the process of achieving a state of goal that is different from the initial state by performing a series of cognitive or motor actions. This process is usually characterized by four interdependent phases: (a) understanding and representing the problem mentally, (b) developing a plan and strategy to solve it, (c) implementing the plan practically, and (d) evaluating the results (X. Zhang et al. 2024)

Problem-solving can be concluded as a multifaceted cognitive process that plays an important role in education. This process involves applying knowledge to achieve a specific goal and is characterized by the ability to understand, plan, implement, and evaluate solutions. Problem-solving not only enhances critical thinking but also fosters creativity, responsibility, collaboration, and effective communication among students. This is an essential skill in preparing students to face the challenges of a competitive global environment, as it encourages continuous learning and adaptation through self-monitoring and reflection during the problem-solving process.

Methods

Through the learning model development procedure, refer to the system model of Dick and Carey (2015) which can be explained as follows:

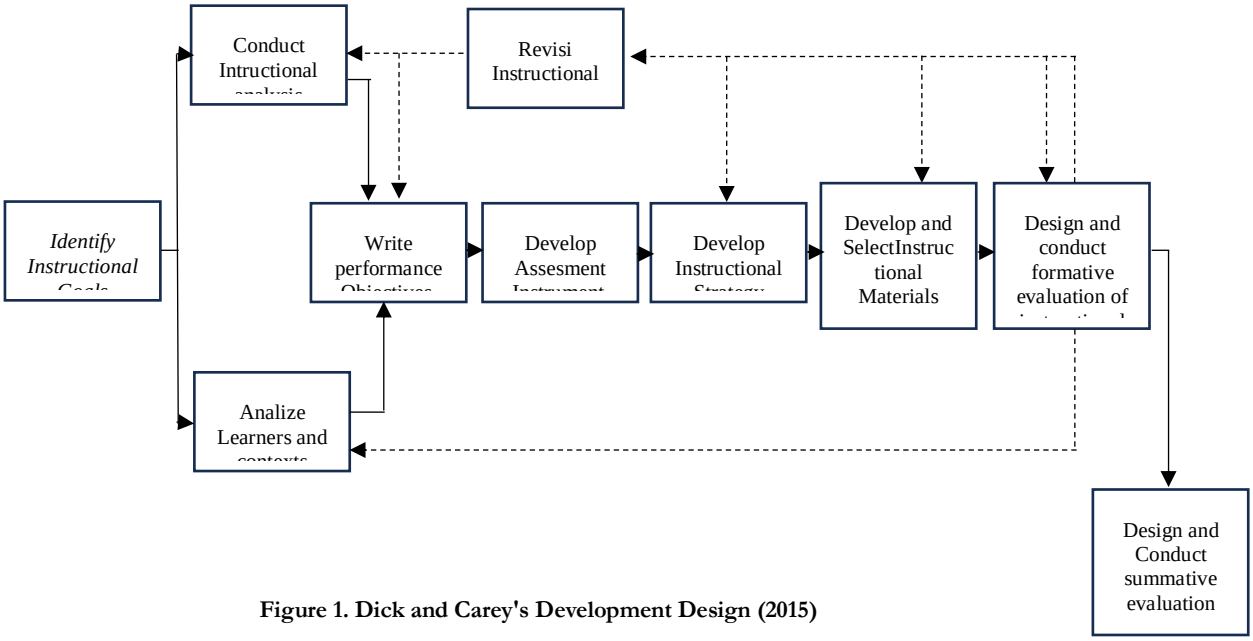

Figure 1. Dick and Carey's Development Design (2015)

Based on the Dick and Carey Development Design that has been carried out on the Digital Project Based Blended Learning (DPBBL) model and its devices, the following results are obtained:

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Model Syntak Digital Project Based Blended Learning (DPBBL)

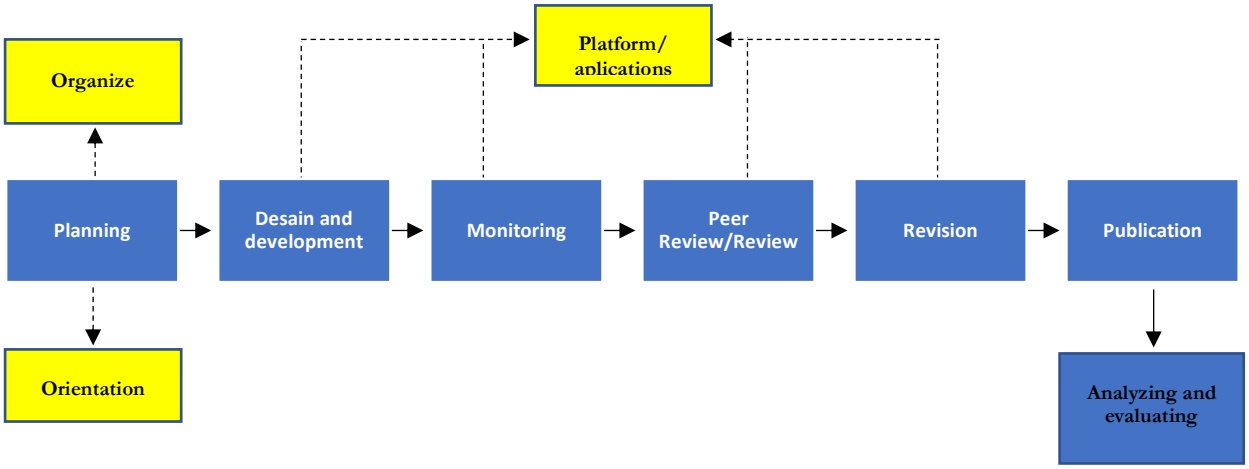

Figure 2. Hasil Desain Model Digital Project Based Blended Learning (DPBBL)

Table 1. Device Validation Results Digital Project Based Blended Learning (DPBBL)

	DPBBL Model Device	Percentage
1	Learning Model	100%
2	Semester Learning Tools Lesson Plan	96,9%
3	Perangkat Pembelajaran SAP	95%
3	Teaching Module Learning Tools	96%
Average		98,8%

Source: (2024 Research Results)

The structure and efficacy of the developed Digital Project-Based Blended Learning model (DPBBL) as a result of the systematic literature review and statistical analysis of the prior research outcomes are credited. Therefore, the research went on to conduct a sweeping, bigger scale study that incorporates both, quantitive and qualitive research methods. Indeed, this approach was used to systematically evaluate the extent to which the DPBBL model improved students' analytical thinking and problem solving ability. The quantitative domain is based on the assessment of the enhancement of these skills while the qualitative component offers rich understanding of student's learning processes and attitudes. This paper has the following objectives: This is in a bid to provide empirical evidence on the effectiveness of the DPBBL model, and to enhance the formulation of teaching strategies that enhance the development of higher order cognitive skills among the learners.

Research Design

The design of *this one group pretest - posttest* research was measured by using a pre-test conducted before being treated and a post-test conducted after being given treatment(Alessandri, Zuffianò, and Perinelli 2017; Dimitrov and Rumrill 2003; Stratton 2019).

$$O_1 \; x \; O_2$$

Information:

O1 : pretest,

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O2 : Posttest

X : Treatment (in this study is the DPBBL Model)

Research Subject

In this study, the researcher collaborated with several universities on the island of Kalimantan. The research subjects include all guidance and counseling students on the island of Kalimantan, who represent various abilities to ensure diversity in data.

Table 2. Number of Guidance and Counseling Students in Kalimantan Universities

No	Universities in East Kalimantan and North Kalimantan	Number of Students of Guidance and Counseling Study Program
1	Mulawarman University	82
2	Borneo University	83
3	Lambung Mangkurat University	124
4	UINSI Samarinda	52
5	Palangkaraya University	85
6	Tanjung Pura University	122
Sum		548

The study then used the Digital Project-Based Blended Learning (DPBBL) paradigm in order to determine if this actually improves students' learning outcomes. The participants of the study included 548 university students; those who were included in the implementation of the DPBBL model's instructional features were in charge of descriptions of challenges and accomplishments. The instrument validation was made on a sample of 40 students of Mulawarman University to considering the reliability and validity. The research spanned seven months, structured into three distinct phases: the pre- test, a six month intervention phase where DPBBL model will be implemented, and a last phase involving post- test administration and qualitative interviews. This methodologically sound schedule ensured all data sources were well captured and as such enhanced validity besides enhancing the quality of conclusions drawn by the study.

Data Collection

This research work adopted the mixed research method to include both the quantitative and qualitative research method. The quantitative part consisted of a critical thinking and problem solving pre and post test which is a standardized equipment implemented before and after the enhanced learning sessions. These assessments allowed for a formal analysis of learning progression of the given skills, thus it was possible to use quantitative data to assess the effectiveness of the Digital Project-Based Blended Learning (DPBBL) model on critical thinking and problem-solving skills improvement. Such enhanced structure protected study results from extreme fluctuations and also kept them maximally consistent with study goals. (Dimitrov and Rumrill 2003). Semi structured interviews were used on a selected group of students and lecturers to gather qualitative data with a view of exploring the participants' perceptions of the Digital Project-Based Blended Learning (DPBBL) model. These interviews were meant to analyze the effectiveness of the above mentioned model in enhancing students' critical thinking and problem solving skills. Also, data was also collected from the lecturers in order to get an insight into the successes and pulls experienced during the teaching process. Quantitative data given by this approach were supported by contextual rich data collected through this study, thus providing a rich and encompassing picture of the DPBBL model impact.

Data Analysis

Test validity test

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Pearson Product-Moment Corelation Coefficient analysis technique (Avelar et al. 2024; Varela-Olalla et al. 2024) with the following formula:

$$r_{xy} = \frac{\sum nXY - \sum X \sum Y}{\sqrt{\left(\left(n\sum X^2 - \left(\sum X\right)^2\right)\left(\left(n\sum Y^2 - \left(\sum Y\right)^2\right)\right)\right.}}$$

Information:

r_{xy} : Pearson's correlation coefficient between the instrument item to be used and the variable in question

X : Score of the instrument item to be used

Y : The score of all instrument items in that variable

n : Number of respondents

To test the significance of the valid or invalid $\mathbf{r_{xy}}$ coefficient, a t-test will be used, which is carried out by comparing the tcount with the ttable (Sreedevi 2022). Where the calculation is searched using the formula from Husein Umar (1998: 197) as follows:

$$t = \frac{r\sqrt{(n-2)}}{\sqrt{1-r^2}}$$

Where r is the Pearson correlation coefficient and db is the degree of freedom. The decision to test the validity of the instrument using the 5% significance level is as follows: valid if t_{hitung} greater than or equal to t_{tabel}, and is invalid if t_{hitung} smaller than t_{tabel}.

Reliability test

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum \sigma_t^2}{\sigma_t^2}\right)$$

Information:

r11 = Reliability sought

n = Number of question items tested

$\sum \sigma_t^2$ = the number of variance of the score for each itemx

σ_t^2 = Varians total (Avelar et al. 2024; Varela-Olalla et al. 2024).

The criteria for the degree of reliability of the evaluation tool can be used as a benchmark made by Guilford (Adams and Ed 2011) as follows:

$0.90 < r_{11} < 1.00$ degrees of ultra-high reliability

$0.70 < r_{11} < 0.90$ degree high reliability

$0.40 < r_{11} < 0.70$ degrees of moderate reliability

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$0.20 < r_{11} < 0.40$ degree low reliability

$r_{11} < 0.20$ degrees of ultra-low reliability

The reliability test in this study uses SPSS 22.00. Reliability testing using *Cronbach alpha*.

In the quantitative analysis of this study, Descriptive statistics and paired sample t-test were used to test for the significance of improvement in students' critical thinking and problem solving skills between before and after the application of DPBBL. This was done to determine the overall performance of the DPBBL model based on the obtained results through N-gain test. The qualitative analysis was done using the thematic content analysis of data collected through the interviews done with the participants. All the interviews conducted were taped and transcribed word for word, then using a coding frame approach a rigorous analysis of the data was undertaken in order to come up with repeated patterns of the experiences, perceived benefits and challenges of the students regarding the DPBBL model. Thus, the presented analytical approach helped to get the detailed understanding of factors enhancing and inhibiting the development of critical thinking and problem-solving skills in the context of the DPBBL model and, therefore, increasing the chances to evaluate its educational effects.

Result and Discussion

Research Results

Table 3. Validation Results of Problem solving questions

No	Indicator	r_{count}	r_{table}	Criterion
1	Problem Identification:	3.81	0.31	Valid
2	Define the Problem	2.26	0.31	Valid
3	Propose a Solution	3.63	0.31	Valid
4	Implement the Solution	1.68	0.31	Valid
5	Evaluate Results	5.05	0.31	Valid

Table 4. Reliability Statistics

Cronbach's Alpha	N of Items
0.618	6

As presented in Table 3, each indicator surpasses the critical threshold, thereby confirming the content validity of the descriptive test items used to assess problem-solving ability. Notably, the "Evaluation of Results" indicator demonstrated the highest correlation coefficient (5.05), indicating a robust alignment with the overall construct. Furthermore, Table 4 reports a Cronbach's Alpha of 0.618, reflecting a moderate level of reliability. These findings suggest that the assessment instrument is both valid and reasonably reliable for evaluating problem-solving skills within the framework of this study.

Table 5. Test question validation results Critical Thinking

No	Indicator	r_{count}	r_{table}	Criterion
1	Identifying Key Issues	3.62	0.31	Valid
2	Solution Criteria	1.04	0.31	Valid
3	Conclusions and Implications	3.08	0.31	Valid
4	Finding Similarities	6.19	0.31	Valid
5	Technology Application	3.49	0.31	Valid

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6	Exploring Alternatives	2.29	0.31	Valid

Table 6. Reliability Statistics

Cronbach's Alpha	N of Items
0.193	6

As indicated in Table 5, content validity is satisfactory on each item and especially the indicator Finding Similarities (Identifying Similarities) with a correlation of 6.19. They found this to be meaning that some of the parameters more closely reflected the cognitive functions within the confines of the tested environment. However, as indicated in Table 6, the overall reliability of the scale was measured at a very low level of Cronbach's Alpha of 0.193. This implies that though the items are construct valid the internal consistency reliability of the instrument should be enhanced to enable it to accurately assess the cognitive level of the sampled patient population on critical thinking skills.

Table 7. Results of the questionnaire response to the attractiveness of DPBBL Model students

No.	Statement	Average Score	Criterion
1	The learning atmosphere builds a desire to know more design material or knowledge	95,1%	Excellent
2	Fun learning atmosphere	93,8%	Excellent
3	The learning atmosphere facilitates the creation, construction, and organization of one's own knowledge.	93,8%	Excellent
4	The learning steps facilitate mastery in project design creation.	95,8%	Excellent
5	The learning steps foster critical thinking skills.	95,8%	Excellent
6	Learning steps to develop problem-solving skills	96,5%	Excellent
7	Learning steps to develop collaborative skills	95,1%	Excellent
8	Response if the DPBBL Model is applied to other courses.	97,2%	Excellent
	Average	95,4 %	Excellent

Source: Research results

The model's average rating of 95.4% placed it in the "excellent" category, which indicates strong student satisfaction and perceived effectiveness.

Table 8. Results of student response, ease of implementation of the DPBBL Model

No.	Statement	Percentage	Category
1	Design project information development process using the DPBBL Model	76,8%	Excellent
2	The process of determining the scope and steps to complete the design project using the DPBBL Model	77,8%	Excellent
3	Formulation of communication concepts and design project criteria standards using the DPBBL Model	79,2%	Excellent
4	Creative exploration development process of design projects using the DPBBL Model	73,6%	Good
5	The process of creating a visual exploration of a design project using the DPBBL Model	74,8%	Good

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No.	Statement	Percentage	Category
6	Design project testing and evaluation process using the DPBBL Model	77,3%	Excellent
	Averge	76,6%	Excellent

The results of the Digital Project-Based Blended Learning (DPBBL) model reveal the model's effectiveness yields a percentage average of 76.6%, categorized as "Excellent." The students were most active during planning, audience, and assessment phases of the class projects. Nevertheless, it could be conceptualized that special refinement of aspects like generative search and overall design may help boost the quality of the projects. These domains have continued to be developed over the years with a need perhaps for more procedural explication, and more creative support if the benefits of the DPBBL model to students and to learning outcomes generally could be taken to another level.

Figure 3. Implementation of the DPBBL Model

Table 9. Results of the average score of Pretest and Posttest critical thinking students Guidance and counseling:

No	Universities in East Kalimantan and North Kalimantan	Pretest	Posttest
1	Mulawarman University	46,59	85,37
2	Borneo University	46,81	85,50
3	Lambung Mangkurat University	44,71	83,67
4	UINSI Samarinda	45,93	80,83
5	Palangkaraya University	49,35	81,25

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No	Universities in East Kalimantan and North Kalimantan	Pretest	Posttest
6	Tanjung Pura University	48,52	79,73
Average Score		46,99	82,73

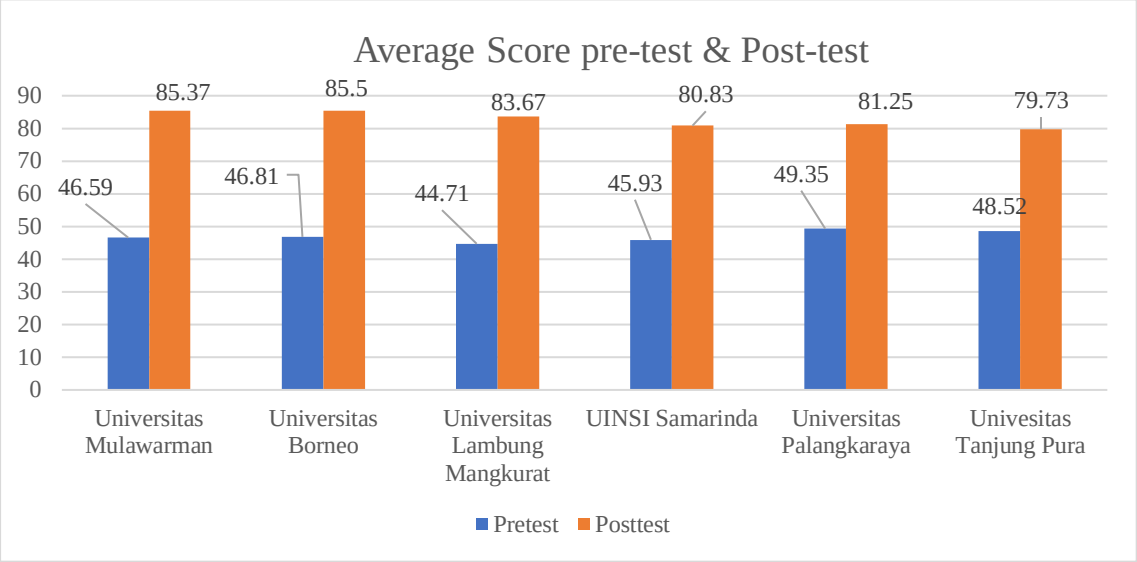

Figure 4. Average *pre-test & Post-test critical thinking*

Based on Table 9 and figure 4, it is shown that: The average score increased from 46.99 in the pre-test to 82.73 in the post-test, which shows the positive impact of the intervention on students' critical thinking skills.

Table 10. Results of indicators from post-test *critical thinking*

No	SKOR					
	Identifying Key Issues	Solution Criteria	Conclusion and Implications	Finding Commonalities	Application of Technology	Exploring Alternatives
Mulawarman University	8.98	8.28	8.72	8.66	8.17	8.41
Borneo University	8.90	8.35	8.76	8.59	8.19	8.51
Lambung Mangkurat University	8.48	7.98	8.48	8.55	8.38	8.32
UINSI Samarinda	8.44	7.58	8.25	8.06	8.12	8.06
Palangkaraya University	8.42	7.49	8.21	8.25	8.14	8.24
Tanjung Pura University	8.44	7.41	8.02	8.09	7.75	8.13
Average	8.61	7.85	8.41	8.37	8.12	8.28

Regarding identifying key issues as presented in table 10 above, the mean score was 8.61 showing that the students have a good handle on defining key issues, which is a fundamental of critical thinking. Nonetheless, the average response of 7.85 to the establishment of solution criteria indicates that ordinal data analysis may

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pose some problems to the students in defining correct procedures for selecting standards typical of the solutions to be adopted. Another set of useful skill revealed by means of scores is in drawing conclusions and implications, which equals 8.41; that indicates students' satisfactory level of competence in logical thinking. Average scores attained in relation to finding similarities (8.37) and inaping into fresh possibilities (8.28) confirm students' ability of pattern identification and appreciation in other perspectives, while showing that they still have certain limitations in flexibility adn creativity in the aforementioned subareas. The score of the application of technology is 8.12, which means that students come to class with some knowledge of the use of technologies in problem-solving processes known to them, but more engagement of the high technological resources would help students to further develop their critical thinking skills in technological environement.

Table 11. Results of the average score of Pretest and Posttest Problem solving students Guidance and counseling:

No	Universities in East Kalimantan and North Kalimantan	Pretest	Posttest
1	Mulawarman University	51, 20	80,73
2	Borneo University	50,53	79,98
3	Lambung Mangkurat University	51,77	79,58
4	UINSI Samarinda	50,54	79,85
5	Palangkaraya University	50,87	79,88
6	Tanjung Pura University	48,54	79,52
Average Score		50,58	79,92

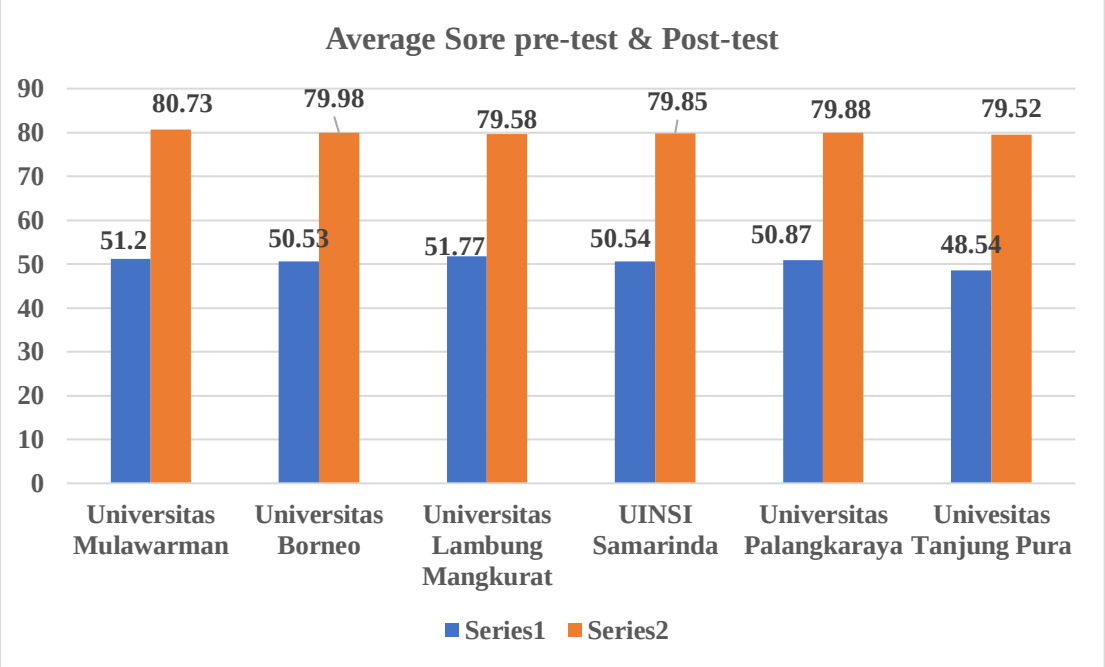

Figure 5. Average Score pre-test & Post-test Problem solving

From the above Table 11 and figure 5, we have computed the pre-test mean of 50.58, which depicts the basic problem solving skills of the students before the use of interventions. The real improvement was seen through the post test scores which were on an average 79.92, after learning activities or the intervention. Such a marked increase can be attributed to the instructional method or strategy which was used in the improvement of students' problem-solving skills. According to the results, the intervention was successful in enhancing the students' problem solving skill, thus calling for effective approach in problem solving.

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Table 12. Indicator results from posttest problem solving

No	Skor Rata-rata				
	Problem Identification:	Define the Problem	Propose a Solution	Implement the Solution	Evaluate Results
Mulawarman University	8.63	7.55	8.24	7.95	7.99
Borneo University	8.71	7.64	7.89	7.90	7.84
Lambung Mangkurat University	8.60	7.56	7.81	7.89	7.94
UINSI Samarinda	8.63	7.52	7.92	7.87	7.98
Palangkaraya University	8.48	7.40	8.11	7.95	8.00
Tanjung Pura University	8.48	7.48	7.78	8.05	7.97
Average Score	8.59	7.53	7.96	7.93	7.95

The score highlighted in Table 12 is a high score, 8.59 in problem identification, thus showing that students exhibit good competence in problem formulation which is the very first and important step of solving a problem. Still, the average of point 3 – proposing solutions (7.53) is slightly lower than for the other aspects, which alludes to the problem with ideation or creative thinking; there is a necessity to develop the specific action plan to boost the brainstorming process. The mean scores of applying solutions (7.96) and evaluating results (7.93) suggested that moderate level of competence and practical comprise indicating the difficulties in the process of solution applying and in carrying out critical reflection about the results. These observations indicate that improving these competencies through practice and regulative reflection may help students acquire better written and practical thinking skills and significantly develop the ability to assess results in order to refine the problem-solving process.

Based on Table 9 and Table 11, the diagram is obtained as follows:

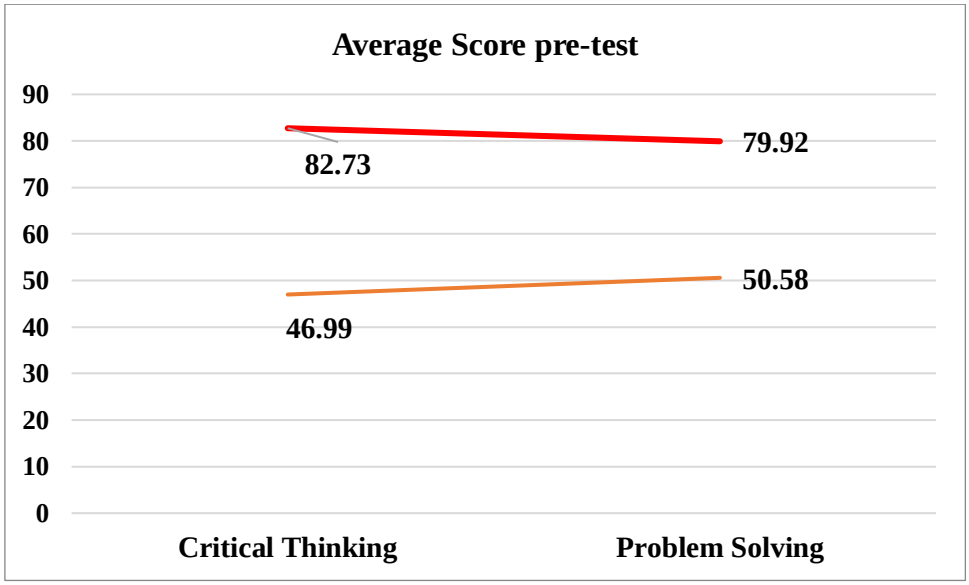

Figure 6. Average Score pre-test & Post-test critical thinking and Problem solving

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Based on the following figure, it is explained that the results in the posttest on critical thinking and problem solving skills, the results explain that the results of critical thinking skills are higher than the problem solving skills after implementing the DPBBL model.

Tabel 13. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Critical Thinking	Pretest	47,0071	548	6,06224	0,25897
	Posttest	82,6724	548	7,27821	0,31091
Problem Solving	Pretest	50,5219	548	6,51124	0,27815
	Posttest	79,8723	548	7,56436	0,32313

Table 13 describes the descriptive statistics for critical thinking and problem-solving scores where: The average score of the pre-test was 47.01, while the average score of the post-test increased significantly to 82.67. This indicates an improvement in critical thinking skills after the intervention, and the average pre-test score was 50.52 which rose to 79.87 in the post-test, indicating a substantial improvement in problem-solving skills. The significant improvements observed in critical thinking and problem-solving skills are in line with previous research demonstrating the effectiveness of blended learning models in improving cognitive competence (Xie et al., 2022; Monteiro et al., 2020). Similar to the findings of Sari et al. (2022), the integration of digital devices in project-based learning environments has been shown to increase student engagement and encourage deeper learning. However, this study advances the existing literature by showing the specific impact of the Digital Project-Based Blended Learning (DPBBL) model in the context of higher education in Indonesia. Unlike previous studies that primarily focused on Western educational contexts, this study highlights the adaptability and effectiveness of DPBBL in a variety of cultural and technological settings, suggesting that DPBBL can be a viable pedagogical approach to developing critical thinking skills in underrepresented areas of education.

Tabel 14. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest_CriticalThinking - Posttest	-35.66533	9.67749	0.41340	-36.47738	-34.85328	-86.273	547	0.000
Pair 2	Pretest_Problem - Posttest_problem	-29.35036	10.01139	0.42767	-30.19043	-28.51030	-68.629	547	0.000

Critical thinking and problem solving can be seen in table 14 below. Critical thinking mean difference pre and post –test was computed at = -35.67 and the t-test statistic produced a significant result at $p < 0.005$ stating high level improvement in the students' critical thinking faculty after the intervention. Likewise, in problem solving the mean difference between pre-test and post-test score was -29.35 which clearly suggests that students made significant improvement in problem solving abilities after the intervention and the t-test was also significant ($p < 0.005$). This means that the results have provided a meticulous evidence showing that the intervention was useful in enhancing the tests that were measuring critical thinking and problem-solving abilities.

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Tabel 15. Descriptives

NGain_Persen (Critical Thinking)	Mean	66,7989
	Minimum	25,00
	Maximum	92,50
NGain_Persen (Problem Solving)	Mean	58,6313
	Minimum	20,00
	Maximum	87,88

In relation to Table 15, critical thinking results on the Digital Project-Based Blended Learning (DPBBL) model yielded the average N-gain of 66.79% (Moderately Effective) while the problem solving yielded the average N-gain of 58.63% (Moderately Effective). Such findings indicate that the use of the proposed DPBBL model can be considered as slightly helpful in improving the Johanssen's skills of critical thinking and problem solving among students. Furthermore, discussions among the research team and observations of the DPBBL model's implementation using the Canva platform led to the conclusion that the following criteria define an appropriate platform for delivering the DPBBL model:

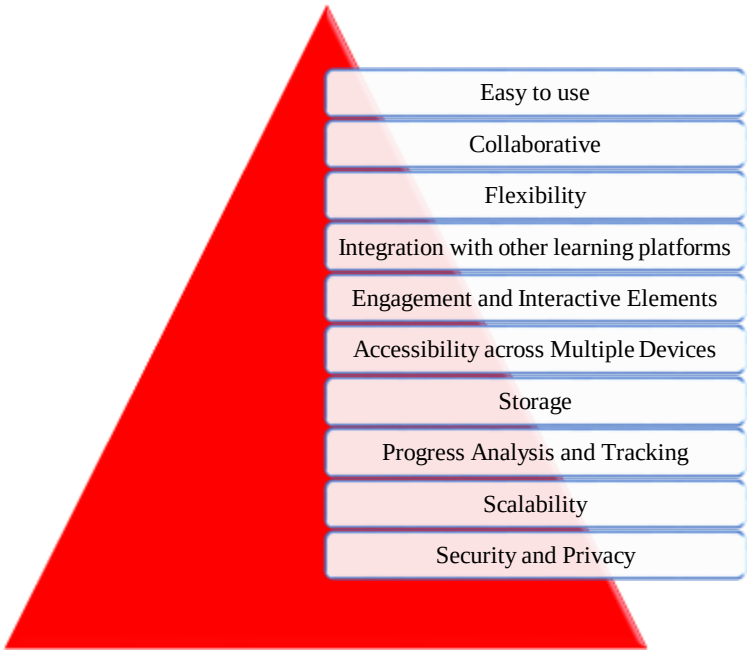

Figure 7. Platform Criteria Used by the DPBBL Model

Discussion

The results of qualitative feedback revealed that students and educators experienced increased engagement, motivation, and autonomy through the Digital Project Based Blended Learning model(Green and du Plessis 2023; Sari et al. 2022) The project-based approach to this model allows students to collaborate on real-world tasks, which not only supports skill development but also encourages active participation and accountability. However, while critical thinking and problem-solving skills are improving, critical thinking is experiencing a slightly higher improvement, perhaps due to the emphasis on analysis and synthesis within the DPBBL's collaborative framework. These results are in line with the existing literature showing that project-based environments encourage higher-order thinking by requiring students to apply analytical skills in complex scenarios (Zhang 2023)

Despite these positive results, the findings highlight areas where the DPBBL model can be further optimized. Certain problem-solving indicators, such as defining and proposing solutions to complex

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problems, show lower improvement compared to other indicators. This shows the need to improve the model with more structured planning to better support the stages of problem definition, especially when students are faced with open tasks (Lerchenfeldt et al. 2023; Urch and Carpenter 2019). Combining real-world scenarios and regular peer review sessions can further strengthen problem-solving abilities by requiring students to articulate and evaluate their approaches in a structured (KARADAĞ and YALÇIN 2023; Lerchenfeldt et al. 2023)

The study also highlights practical considerations for implementing DPBBL, in particular the importance of choosing collaborative digital tools that are easy to use. Platforms like Canva are considered effective, providing an intuitive interface and supporting real-time collaboration that is essential for DPBBL's unified environment. However, future implementations could benefit from integrating the device with advanced analytics to track student progress and AI-based applications to support the idea and exploration of alternative solutions.

In this study, the researchers proved how the DPBBL was highly efficient for the improvement of critical thinking and problem solving among learners. A quantitative evaluation has identified this trend as being statistically significant, based on average scores of the pre and post test of the learners' performance for both skills. , more so, the critical thinking score enhance from 47.01 to 82.67 Similarly, the problem solving score enhanced from 50.52 to 79.87. The Significance tests for these changes yielded t-values which were all statically significant confirming the efficacy of the intervention. These results indicate that DPBBL approach effectively addresses the development of the competencies relevant to performing tasks in the modern world. In addition to this, the study correlates with earlier research that suggests students learning through DBL get to build critical reasoning skills in addition to developing a strong grasp on their conceptual understandings. Thus, the DPBBL model promotes the development of critical thinking skills as well as problems solving skills in an integrated project based learning environment. This study highlights how collaborative project-based tasks encourage deeper learning experiences, thus supporting the argument that an integrated learning environment can effectively nurture critical thinking and problem-solving skills (Nduka and Abosede Ajoke 2016; Renda and Ganesha 2013) The results of this study not only validate the usefulness of DPBBL in higher education but also provide actionable insights for educators who want to apply similar frameworks in various educational settings.

According to Table 15, the average N-gain score for critical thinking is 66.79%, which indicates a fairly effective impact, while the average N-gain score for problem-solving is 58.63%, also within a fairly effective range. These findings show that the DPBBL model is very promising in improving students' higher-level cognitive skills, which are crucial for academic success and real-world application. These results are in line with the literature that discusses how innovative pedagogy can bridge the gap between theory and practice, improving students' higher-level cognitive skills (Morley and Jamil 2020) From a pedagogical point of view, a fairly effective classification suggests that although the DPBBL model facilitates improvements in critical thinking and problem-solving, there may be areas for optimization. For example, deeper integration of adaptive feedback mechanisms or individual learning paths within the DPBBL framework has the potential to improve the outcomes of this skill development. In addition, the observed variance between the minimum and maximum scores showed different impacts among college students, which indicates the importance of further research to explore the factors that affect individual gain. Overall, this study underscores the practical utility of the DPBBL model in the context of digital learning, which contributes to the growing body of literature supporting blended learning as a viable approach to fostering critical cognitive skills and problem-solving in higher education. Based on the results of the team's discussions and observations during the implementation of the Digital Project-Based Blended Learning (DPBBL) model using the Canva platform, the criteria for the right and feasible platform have been determined. The platform for the DPBBL model should support interactivity, ease of use, and flexibility in integrating different media formats to enhance critical thinking and collaboration. These results are in line with research findings that suggest that visual tools like Canva can improve student understanding and engagement, supporting the idea that interactive platforms can significantly benefit project-based learning methodologies(Hutasuhut et al. 2020).

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First, interactivity is essential to encourage engagement in a digital project-based learning environment. A platform should allow learners to actively participate, communicate, and receive live feedback, which has been shown to increase motivation and engagement in the learning process. Tools that facilitate real-time collaboration, such as shared documents, live annotations, and discussion forums, support the collaborative requirements of projects by allowing learners to work together efficiently, even when separated by physical distancing.

Second, the platform's ease of use plays a crucial role in supporting smooth adoption and reducing the cognitive burden associated with using the technology. The system must be intuitive and accessible, requiring minimal training for teachers and students. This reduces potential barriers to engagement and allows participants to focus on the content and learning objectives rather than understanding the complex functionality of the platform. Canva, for example, has demonstrated ease of use that allows teachers to adapt its features for instructional design without extensive technical expertise.

In addition, the flexibility of multimedia integration is essential. The platform should support different forms of content, such as videos, graphics, documents, and interactive quizzes, as these resources cater to different learning styles and help contextualize information in a more relevant way. This flexibility also supports a blend of local wisdom and modern knowledge, making the platform culturally relevant and adaptable to local contexts, which is invaluable in regions with rich cultural heritage, such as Borneo. These criteria ensure that the platform is not only aligned with the goals of the digital project-based model but also improves critical thinking and problem-solving skills in learners. Through continuous evaluation, adjustments can be made to refine the platform's efficacy and better align with evolving educational needs.

This study contributes to a growing body of research on blended learning models by providing empirical evidence on the effectiveness of integrating digital platforms like Canva into project-based learning frameworks. Unlike traditional blended learning approaches that may not emphasize student autonomy, the DPBBL model empowers students to take ownership of their learning through technology-enabled collaborative projects. This is in line with the principles of constructivist learning theory, which emphasizes the active involvement of learners in real-world problem-solving tasks (Dumitru & Halpern, 2023). By expanding the use of blended learning beyond content delivery to include project-based assignments, the study addresses gaps in the literature on how digital tools can be leveraged to develop high-level cognitive skills in diverse educational contexts.

As much as this study has shown that DPBBL increases critical thinking and problem-solving skills, some limitations we note deserve consideration. Firstly, the study included only students of universities from Kalimantan area and, therefore, the generalization of results to other areas or school settings is limited. Apart from that, the study employed qualitative interviews to obtain data which often present response bias because the students may give only appropriate answers. To avoid bias in the findings, future research should use other source of data that are independent, like, digital analysis or Performance evaluations.

Moreover, the application of the canva platform was helpful; however, as a next step, the research is suggested to consider the Further analysis of AI-oriented instruments for better understanding of the individual learning paths and data-driven feedback. It is recommended that future research endeavor to understand the generalizability of the DPBBL model in other education settings and for other courses. Considering the continuous growth of the technology or the educational technology in particular, longitudinal research is crucial to measure potential benefits and affects of using the digital project-based learning model on the cognitive and none-cognitive performers of students. Furthermore, the prospect of including the application of artificial intelligence analytic within the DPBBL framework opens a possibility of expanding the sphere of further developments for the system, with an emphasis on the focus on the learning differences between individual students and finding the most effective approaches to teaching them.

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Conclusion

Thus, this study successfully proves the usefulness of the Digital Project-Based Blended Learning model for improving university students' critical thinking skills and problem-solving abilities. The statistical analysis revealed a substantial improvement in both competencies, as evidenced by the increase in average scores from pre-test (critical thinking: 47. From pre-test to post-test data critical thinking improved from pre-test mean 01 to 82.67; problem solving improved from a mean 50.52 of the pre-test to 79.87 of post-test. The results of the paired sample t-Test were also significant at 0.005 level of significance thus supporting the use of the model. N-Gain scores also support the findings reinforcing the moderateness of the impact of the model on critical thinking at moderately effective level (66.79%) and the problem-solving at a moderately effective level (58.63%). These findings have implications in constructivist learning theories that point to the need of incorporating digital forms of tools into activity-based approaches such as project-base learning since it not only boosts the thinking depth levels among students but the co-operation as well.

A review of written feedback generated by participants of the focus group interviews with regards to their experiences in the DPBBL model suggests that DPBBL has the potential to foster greater motivation, dropout rates, and voluntary study and work among students. But the issues in elaborating and formalizing the concepts of a multifaceted issue and the ideas for its alterative development point to the need for more support during the implementation stage. In balance, the present DPBBL model offers an effective and applicable teaching strategy that may be useful in different educational settings and facilitate compliance with the requirements of the modern workplace environment. Subsequent studies should investigate the possibilities of its application on a large scale and its incorporation with more progressive solutions, including artificial intelligence-based analysis, for enhancing the characteristics of learning processes that shape skills.

Implication

Improving Critical Thinking and Problem-Solving Skills: The application of the Digital Project-Based Blended Learning (DPBBL) model has shown a significant improvement in students' critical thinking and problem-solving skills. This is evidenced by a significant increase in post-test scores compared to pre-test scores, as well as high levels of student satisfaction. These results suggest that integrating digital project-based learning, especially with platforms like Canva, can be an effective pedagogical strategy for developing 21st-century skills that are essential to the world of work.

Curriculum Development: These findings highlight the need for curriculum designers to incorporate project-based learning frameworks that emphasize collaboration and independent critical thinking. Integrating digital devices within this framework can increase student engagement, motivation, and autonomy in learning. This approach can be particularly effective in higher education, where self-study and problem-solving are essential.

Pedagogical Strategies: The effectiveness of the model in promoting engagement and cognitive skills implies that educators should adopt a blended learning model that balances digital and in-person interactions. DPBBL's approach is in line with constructivist principles, promoting deeper learning through real-world applications and collaborative projects. Institutions should consider training educators to effectively utilize these digital platforms to maximize learning outcomes.

Technology Integration in Education: The positive impact of using collaborative digital tools like Canva shows that educational institutions must invest in technology that encourages interactivity, creativity, and collaboration. It is important to adapt to the ever-evolving digital landscape, especially in a remote or hybrid learning environment.

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Conflict of Interest

The authors have no competing financial interests and no personal interests to report that may have influenced the content presented in the paper.

Data Availability Statement

Data are available from the authors upon request.

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References

Adams, Frances J., and D. Ed. 2011. Teacher Evaluation Program (TEP).

Ahmady, Soleiman, and Sara Shahbazi. 2020. "Impact of Social Problem-Solving Training on Critical Thinking and Decision Making of Nursing Students." BMC Nursing 19(1):1–8. doi: 10.1186/s12912-020-00487-x.

Alessandri, Guido, Antonio Zuffianò, and Enrico Perinelli. 2017. "Evaluating Intervention Programs with a Pretest-Posttest Design: A Structural Equation Modeling Approach." Frontiers in Psychology 8(MAR):1–12. doi: 10.3389/fpsyg.2017.00223.

Avelar, Bruna Aparecida, Adriano Akira Ferreira Hino, Anabele Pires Santos, Larissa Loures Mendes, Júlia Cristina Cardoso Carraro, Raquel De Deus Mendonça, and Mariana Carvalho De Menezes. 2024. "Validity and Reliability of the Perceived Nutrition Environment Measures Survey (NEMS-P) for Use in Brazil." Public Health Nutrition 27(1):1–10. doi: 10.1017/S1368980023002653.

Bersamin, Alvin Espiritu, Mark Bedoya Ulla, Aree Saripa, and Korawan Suebsom. 2024. "Exploring Social Presence through Group Collaboration in Blended Learning." Tesl-Ej 28(1):1–16. doi: 10.55593/ej.28109int.

Changwong, Ken. 2018. "Critical Thinking Skill Development : Analysis of a New Learning Management Model for Thai High Schools." 11:37–48. doi: 10.14254/2071-8330.2018/11-2/3.

Dimitrov, Dimiter M., and Phillip D. Rumrill. 2003. "Pretest-Posttest Designs and Measurement of Change." Work 20(2):159–65.

Dumitru, Daniela, and Diane F. Halpern. 2023. "Critical Thinking : Creating Job-Proof Skills for the Future of Work."

Green, Shawn Lourens, and Elizabeth Catharina du Plessis. 2023. "Project-Based Learning to Promote Learner Autonomy in Training Hospitality Education at a Technical and Vocational Education and Training College." International Journal of Learning, Teaching and Educational Research 22(7):136–55. doi: 10.26803/ijlter.22.7.8.

Hidayati, Nurkhairo, Siti Zubaidah, Endang Suarsini, and Henry Praherdhiono. 2019. "Examining the Relationship between Creativity and Critical Thinking through Integrated Problem-Based Learning and Digital Mind Maps." Universal Journal of Educational Research 7(9A):171–79. doi: 10.13189/ujer.2019.071620.

Horn, Shane, and Koen Veermans. 2019. "Critical Thinking Efficacy and Transfer Skills Defend against 'Fake News' at an International School in Finland." Journal of Research in International Education 18(1):23–41. doi: 10.1177/1475240919830003.

Hutasuhut, Saidun, Irwansyah, Agus Rahmadsyah, and Reza Aditia. 2020. "Impact of Business Models Canvas Learning on Improving Learning Achievement and Entrepreneurial Intention." Cakrawala Pendidikan 39(1):168–82. doi: 10.21831/cp.v39i1.28308.

Janssen, Noortje, and Ard W. Lazonder. 2024. "Meta-Analysis of Interventions for Monitoring Accuracy in Problem Solving." Educational Psychology Review 36(3). doi: 10.1007/s10648-024-09936-4.

KARADAĞ, Yeşim, and Seher YALÇIN. 2023. "The Impact of Peer Feedback on Collaborative Problem-Solving Skills in the Online Environment." International Journal of Assessment Tools in Education 10(3):563–79. doi: 10.21449/ijate.1290901.

Kibet, Caleb K., Jean Baka Domelevo Entfellner, Daudi Jjingo, Etienne Pierre de Villiers, Santie de Villiers, Karen Wambui, Sam Kinyanjui, and Daniel Masiga. 2024. "Designing and Delivering Bioinformatics Project-Based Learning in East Africa." BMC Bioinformatics 25(1):1–16. doi: 10.1186/s12859-024-05680-2.

Kumar, Chetan, K. B. Rangappa, S. Suchitra, and Huchhe Gowda. 2024. "Digital Distractions during Blended Learning and Its Negative Repercussions: An Empirical Analysis." Asian Association of Open Universities Journal 19(1):1–18. doi: 10.1108/AAOUJ-02-2023-0024.

Lerchenfeldt, Sarah, Suzan Kamel-ElSayed, Gustavo Patino, Stephen Loftus, and David M. Thomas. 2023. "A Qualitative Analysis on the Effectiveness of Peer Feedback in Team-Based Learning." Medical Science Educator 33(4):893–902. doi: 10.1007/s40670-023-01813-z.

Mondlane, Eduardo. 2005. "Blended Online and Face-to-Face Learning : A Pilot Project in the Faculty of Education , Eduardo Mondlane University Xavier Muianga." 1(2):130–44.

Monteiro, Sandra, Jonathan Sherbino, Matthew Sibbald, and Geoff Norman. 2020. "Critical Thinking, Biases and Dual Processing: The Enduring Myth of Generalisable Skills." Medical Education 54(1):66–73. doi: 10.1111/medu.13872.

Morley, Dawn A., and Md Golam Jamil. 2020. Applied Pedagogies for Higher Education: Real World Learning and Innovation across the Curriculum.

Munir, M., Dwi Fitria Al Husaeni, R. Rasim, Laksmi Dewi, and Azizah Nurul Hoirunnisa. 2024. "Bibliometric Mapping of Trends of Project-Based Learning with Augmented Reality on Communication Ability of Children with Special Needs (Autism)." Data and Metadata 3. doi: 10.56294/dm2024261.

Nduka, Wonu, and Arokoyu, Abosede Ajoke. 2016. "Design-Based Learning Model and Senior Secondary Students' Learning Achievement in Solid Geometry." European Scientific Journal, ESJ 12(34):272. doi: 10.19044/esj.2016.v12n34p272.

Noor, Uzma, Muhammad Younas, and Hessah Saleh Aldayel. 2022. "Learning Behavior , Digital Platforms for Learning and Its Impact on University Student ' s Motivations and Knowledge Development." (November):1–12. doi: 10.3389/fpsyg.2022.933974.

Purnomo, Eko, Nina Jermaina, Eddy Marheni, Agus Gumilar, Aditya Hanum Widarsa, Angga Elpatsa, and Nor Eeza Zainal Abidin. 2024. "Enhancing Problem-Solving Skills Through Physical Education Learning: A Comprehensive Analysis Mejora de Las Habilidades Para Resolver Problemas Mediante El Aprendizaje de Educación Física: Un Análisis Integral." Retos 58:435–44. doi: 10.47197/retos.v58.106838.

Rafiq, Shahid. 2024. "The Impact of Digital Tools and Online Learning Platforms on Higher Education Learning Outcomes." (May).

Renda, Ndara Tanggu, and Universitas Pendidikan Ganesha. 2013. "(Dbl) Berbantuan Media Gambar Terhadap Hasil Belajar Ips Di Gugus Kecamatan Kintamani Kabupaten Bangli."

Reynders, Gil, Juliette Lantz, Suzanne M. Ruder, Courtney L. Stanford, and Renée S. Cole. 2020. "Rubrics to Assess Critical Thinking and Information Processing in Undergraduate STEM Courses." International Journal of STEM Education 7(1). doi: 10.1186/s40594-020-00208-5.

Sari, Rika Mulyati Mustika, Nanang Priatna, and Dadang Juandi. 2022. "Implementing Project-Based Blended Learning Model Using Cognitive Conflict Strategy to Enhance Students' Mathematical Spatial Literacy." European Journal of Educational Research 11(4):2031–41. doi: 10.12973/eu-jer.11.4.2031.

Sreedevi, S. 2022. "STUDY OF TEST FOR SIGNIFICANCE OF PEARSON'S CORRELATION COEFFICIENT." 816(2):86–89.

Stratton, Samuel J. 2019. "Quasi-Experimental Design (Pre-Test and Post-Test Studies) in Prehospital and Disaster Research." Prehospital and Disaster Medicine 34(6):573–74. doi: 10.1017/S1049023X19005053.

Tang, Tang, Valentina Vezzani, and Vikki Eriksson. 2020. "Developing Critical Thinking, Collective Creativity Skills and Problem Solving through Playful Design Jams." Thinking Skills and Creativity 37(May):100696. doi: 10.1016/j.tsc.2020.100696.

Uotila, Ulrika, Kimmo Keskiniva, Juha Matti Junnonen, and Arto Saari. 2024. "Developing Engineering Students' Generic and Professional Skills through a Consultative Approach to Project-Based Learning." European Journal of Engineering Education 49(4):667–82. doi: 10.1080/03043797.2023.2286329.

Urch, Geoffrey, and Yuen-ying Carpenter. 2019. "Conversations and Perspectives on Peer Feedback for Problem Solving." Papers on Postsecondary Learning and Teaching 3:81–86.

Varela-Olalla, Daniel, Carlos Balsalobre-Fernández, Blanca Romero-Moraleda, and Sergio L. Jiménez-Sáiz. 2024. "Reliability and Validity of the Strain Gauge 'GSTRENGTH' for Measuring Peak Force in the Isometric Belt Squat at Different Joint Angles." Sensors 24(10). doi: 10.3390/s24103256.

Zhang, Jie, Jingdong Zhu, Weiwei Tu, Minkai Wang, Yiling Yang, Fang Qian, and Yeqing Xu. 2024. "The Effectiveness of a Digital Twin Learning System in Assisting Engineering Education Courses: A Case of Landscape Architecture." Applied Sciences (Switzerland) 14(15). doi: 10.3390/app14156484.

Zhang, Liping. 2024. "An Analysis of the Values of Project-Based Learning in English Language Teaching and the Cultivating Functions It Displays." Applied Mathematics and Nonlinear Sciences 9(1):1–12. doi: 10.2478/amns-2024-0308.

Zhang, Lu. 2023. "A Study of the Impact of Project-Based Learning on Student Learning Effects : A Meta-Analysis Study." (July):1–14. doi: 10.3389/fpsyg.2023.1202728.

Zhang, Xue, Adam Pines, Patrick Stetz, Andrea N. Goldstein-Piekarski, Lan Xiao, Nan Lv, Leonardo Tozzi, Philip W. Lavori, Mark B. Snowden, Elizabeth M. Venditti, Joshua M. Smyth, Trisha Suppes, Olusola Ajilore, Jun Ma, and Leanne M. Williams. 2024. "Adaptive Cognitive Control Circuit Changes Associated with Problem-Solving Ability and Depression Symptom Outcomes over 24 Months." Science Translational Medicine 16(763). doi: 10.1126/scitranslmed.adh3172.