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ORIGINAL

The Effect of the Hybrid Project-Based Learning (Hybrid-PjBL) Model on Critical Thinking and Creativity Skills

El efecto del modelo híbrido de aprendizaje basado en proyectos (Hybrid-PjBL) sobre el pensamiento crítico y las habilidades creativas

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ABSTRACT

Introduction: Hybrid-PjBL is an innovative learning model aligned with 21st-century demands but remains limited and rarely studied by Indonesian researchers. This study intends to test the effectiveness of implementing Hybrid-PjBL on students' critical and creative thinking skills.
Method: the pre-experimental method was used by combining a one-group pretest-posttest design in this study. The population consisted of fourth-semester Elementary Education students at Universitas Samudera. A single class was randomly selected from four classes, involving students enrolled in the Development of Language and Literature Learning in Elementary Schools course. A critical and creative thinking skills questionnaire was employed to collect data. The data were averaged to observe improvements before and after treatment and analyzed inferentially using a paired sample t-test.
Results: this study presents the finding of a probability value (sig) of 0,00 < 0,05, meaning that there is a significant difference before and after the Hybrid-PjBL model is applied, as seen from the pretest and posttest scores. Descriptive analysis also revealed an increase in the average pretest and posttest scores for critical and creative thinking skills in the Development of Language and Literature Learning course. The average critical thinking skill score increased from 13,74 to 18,15, while the average creative thinking skill score increased from 32,22 to 39,19. This demonstrates an improvement in both skills after applying the Hybrid-PjBL model.
Conclusions: this study concludes that there is a significant impact after implementing the hybrid-PjBL model on critical and creative thinking skills in the Language and Literature Learning Development course in Elementary Schools. This model encourages students to actively construct their own knowledge and solve problems, leading to improved critical and creative thinking skills.

Keywords: Hybrid-PjBL; Critical and Creative Thinking Skills; Pretest Dan Posttest.

RESUMEN

Introducción: el modelo híbrido PjBL es un modelo de aprendizaje innovador que se ajusta a las demandas del siglo XXI, pero sigue siendo limitado y rara vez estudiado por los investigadores indonesios. Este estudio tiene como objetivo examinar el efecto de la implementación del modelo híbrido PjBL en las habilidades de pensamiento crítico y creativo.
Método: el método utilizado fue preexperimental con un diseño de pretest-postest de un grupo. La población estuvo compuesta por estudiantes de cuarto semestre de Educación Primaria en la Universitas Samudera. Se seleccionó aleatoriamente una única clase de cuatro clases, que incluía a estudiantes matriculados en el curso de Desarrollo del Aprendizaje de Lengua y Literatura en Escuelas Primarias. Se empleó un cuestionario

de habilidades de pensamiento crítico y creativo para recopilar datos. Los datos se promediaron para observar las mejoras antes y después del tratamiento y se analizaron inferencialmente utilizando una prueba t de muestra pareada.
Resultados: los resultados mostraron un valor de probabilidad (sig) de 0,00 < 0,05, lo que indica una diferencia significativa entre las puntuaciones pretest y postest después de aplicar el modelo Hybrid-PjBL. El análisis descriptivo también reveló un aumento en los puntajes promedio de las pruebas previas y posteriores para las habilidades de pensamiento crítico y creativo en el curso de Desarrollo del aprendizaje de la lengua y la literatura. El puntaje promedio de la habilidad de pensamiento crítico aumentó de 13,74 a 18,15, mientras que el puntaje promedio de la habilidad de pensamiento creativo aumentó de 32,22 a 39,19. Esto demuestra una mejora en ambas habilidades después de aplicar el modelo híbrido-PjBL.
Conclusiones: los resultados indican que la implementación del modelo Hybrid-PjBL tiene un impacto significativo en las habilidades de pensamiento crítico y creativo en el curso de Desarrollo del aprendizaje de la lengua y la literatura en escuelas primarias. La implicación es que este modelo alienta a los estudiantes a construir activamente su propio conocimiento y resolver problemas, lo que conduce a una mejora en las habilidades de pensamiento crítico y creativo.

Palabras clave: PjBL Híbrido; Habilidades de Pensamiento Crítico y Creativo; Prueba Previa y Posterior.

INTRODUCTION

The socio-cultural changes of the 21st century demand a harmonious connection between innovation, research and community needs through community empowerment and maximum use of technology. Higher education curricula address global demands by incorporating activities that engage students in managing complex situations and equipping them to tackle challenges akin to future professional practices.[1,2] A significant innovation in educational technology is the implementation of hybrid or blended learning.[3,4]

This approach enables students to participate in active, student-centered learning activities that help them develop transversal competencies such as collaboration, communication, critical thinking, problem-solving, creativity, and social awareness.[5] All of these competencies are crucial for students and the general public. In particular, the role of creativity in developing the ability to produce new and practical ideas.[2,6]

Activities are central to active learning methods in blended learning classes. Resources position students as key actors in the learning process, enhancing time efficiency. Foundational knowledge related to core topics is delivered prior to class through virtual environments. The face-to-face meeting process needs to involve students so that they are active, especially in optimizing the acquisition of high-level thinking skills.[7]

However, in practice, critical thinking skills in learning activities remain low,[8,9,10,11,12] as the learning process often fails to involve students in critical problem-solving. Hybrid learning also has drawbacks, including student boredom due to monotonous and unengaging learning processes, leading to reduced interest in e-learning and completing assigned tasks.[13]

The lack of student engagement in class, such as asking questions and expressing opinions, impacts their critical thinking abilities.[14] Critical thinking skills are influenced by inappropriate teaching models and methods.[15,16] Based on the 2018 Trends in International Mathematics and Science Study (TIMSS) survey report, it was confirmed that Indonesian students' critical thinking skills scored below the international average score, namely only getting a score of 396.[17]

The survey data shows the weak competence of students in Indonesia internationally. This needs immediate prevention with a more flexible learning process and in line with current technological developments. Hybrid learning (a combination of online, offline, mobile, and face-to-face methods) can be an alternative that needs to be applied to all educators in Indonesia regardless of education level.[18,19] Many countries have implemented hybrid learning and become modern learning today. This approach not only engages students but can be integrated with other methods to enhance learning experiences. Training future scientists requires equipping them with project development skills. The integration of hybrid learning and project-based learning engages students in mastering specific and transversal competencies through real and complex problems.[20,21]

An effective learning process enables student teachers to achieve the competencies outlined in learning objectives optimally.[22,23] Students will be in the role of researchers during the project development process. This role requires them to formulate and interpret key questions, develop strategies, gather information, and apply solutions to problems or situations.[24,25] Learning objectives and process effectiveness are reflected in students' achievement scores. Proper learning models facilitate optimal learning outcomes,[26] while inappropriate models hinder achievement.

A second consideration is preparing students for competitive future careers by equipping them with essential life and thinking skills.[27,28,29,30] Learning processes should enhance students' critical thinking abilities (Genlott

& Gron, 2013; Prasertchara et al., 2015). Critical thinking involves deep, detailed analysis of information.[31] It helps students solve problems thoroughly and effectively,[32,33,34] in addition to increasing confidence in addressing real-world phenomena.[35,36]

Creative thinking skills are equally essential in the modern era.[37,38,39] It serves an important foundation for addressing complex challenges.[40] Students with good creative thinking skills may likely transform reuse, compose, or invent new ideas or products while analyzing information from diverse perspectives.[41,42] In other words, creative students are likely flexible and capable of identifying opportunities and tackling challenges in a rapidly evolving world.[43]

A study by Raval (2019) highlights that PjBL-assisted videos effectively explore students' creative mathematical thinking. The hybrid learning model is also reported to effectively support both knowledge acquisition and life skills development.[45] The education process should foster creative thinking.[42] Lecturers have a very leading position in designing learning among university students so that they are able to empower and optimize students' thinking abilities.[41,49]

The combination of learning methods facilitates students to think independently, collaborate with colleagues, and has the potential to optimize creative and critical thinking competencies.[50,51] The learning activity design should emphasize open-ended, complex, and real-world problems; group collaboration to critically share and evaluate project progress; and the lecturer's role as a facilitator.[52,53] Integrating these approaches aims to create a holistic learning environment, blending technological advantages with practical experiences. Theoretically, Hybrid PjBL offers engaging learning experiences while stimulating critical and creative thinking skills. Student involvement in learning projects bridges the gap between conceptual or theoretical mastery and their practical application.

Thus, a learning approach is very much needed in language learning specifically to optimize the development of critical and creative thinking skills. The limited research on the integration of PjBL with hybrid learning has prompted researchers to conduct this study. Although there is research reporting that Hybrid-PjBL has been effectively used in increasing students' metacognitive awareness.[4,23] Other reports state that a similar approach affects students' thinking skill.[54] On the other hand, there is research stating that PjBL was rarely modified during the previous pandemic due to limited knowledge and skills

This knowledge gap highlights the need for further research on Hybrid-PjBL integration. This study examines the impact of Hybrid-PjBL on critical and creative thinking in the Language and Literature Learning Development course for elementary schools, contributing empirical evidence and practical insights for educators and policymakers in designing innovative learning strategies.

METHOD

Quantitative research with experimental methods was used in this study. Pre-experimental design, specifically one-group pretest-posttest was adopted to execute the research process until data was obtained on the application of Hybrid-PjBL to critical and creative thinking skills.[55,56] This research process lasted for six months starting from February to July 2021 in Langsa City, Aceh Province.

This study selected students at the college level. The study was implemented at Samudera University. All fourth semester students of the Elementary Education Study Program at Samudera University were determined as the research population. The number reached 200 students. The population was then re-screened in determining the sample. The simple random sampling method was used in selecting samples with the same probability.[57,58]

The questionnaires used in this study were critical and creative thinking skill. The critical thinking questionnaire comprised 12 statements, and the creative thinking questionnaire consisted of 8 statements, both developed using a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree).[59,60] The critical thinking instrument was developed based on indicators such as sensitivity to surrounding conditions, critical attitudes toward the environment, explanation skills, and problem-solving abilities. The creative thinking instrument was based on indicators such as generating creative ideas, implementing innovations, and working creatively with others. The linguistic skills measured included listening, speaking, reading, and writing.[61,62,63]

Instrument validity was tested using content validity to determine whether each statement item aligned with the measured aspects.[64] Content validity focused on the instrument's relevance to data collection objectives. Statement items are classified according to clarity in assessing the effectiveness, suitability, and function of the research objectives. If there are invalid items, then the items will be revised or deleted. The validity of the content has been evaluated by experts in elementary education, especially language learning and thinking competencies. A language test was also conducted to ensure compliance with Indonesian linguistic rules (EYD). It was carried out on respondents not involved in the main study but with similar abilities or diverse backgrounds.[16,65] Three Indonesian language experts assessed and commented on the instrument.

The data were processed descriptively by calculating the average value and percentage of each questionnaire statement item about students' critical and creative thinking skills. In addition, the data were also analyzed by

applying inferential analysis. The sample t-test was used as a form of inferential analysis with the help of IBM Statistics 22. The test was examined to collect data on the differences in critical and creative thinking skills before and after implementing Hybrid-PjBL. The t-test process was carried out after all data were declared normal and homogeneous. This is called a prerequisite test. Data normality was tested using the Shapiro-Wilk test, while data homogeneity was tested using the Levene test.

RESULT

Normality and Homogenity Test

Critical and creative thinking skills were measured using learning questionnaires. The achievement of these parameters is influenced by the learning model applied in class. The results of the Shapiro-Wilk and Levene tests are presented in table 1. The Sig. values for critical and creative thinking skills from the Shapiro-Wilk test were 0,068 and 0,060, respectively, while the Levene test results showed a Sig. value of 0,205 for both skills. 0,205. Thus, all data met the assumptions of normality and homogeneity.

Table 1. Normality and Homogeneity Test Results

Data	Shapiro-Wilk Test	Levene Test
Critical Thinking Skills	0,068	0,205
Creative Thinking Skills	0,060	

Paired Sample T-Test

The Paired Sample T-Test was conducted after the pretest and posttest results were confirmed normal through the Shapiro-Wilk test and homogeneous through the Levene test. The normally distributed and homogeneous data were analyzed using the Paired Sample T-Test in SPSS 22, as shown in table 2.

Table 2. Uji Paired Sample T-Test

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	Pre Creative thinking - Post creative thinking	-6,963	3,094	0,596	-8,187	-5,739	-11,692	26	0,000
Pair 2	Pre Critical thinking - Post Critical Thinking	-4,407	2,223	0,428	-5,287	-3,528	-10,301	26	0,000

Based on the table, the Sig. (2-tailed) value was 0,000, which is less than 0,05 (0,000 < 0,05). This indicates a significant difference between the pretest results of critical and creative thinking skills before treatment and the posttest results after implementing the Hybrid-PjBL model in the Development of Language and Literature Learning course in elementary education. Thus, it can be concluded that the Hybrid-PjBL model had a significant effect on critical and creative thinking skills.

Descriptive analysis of the data revealed an increase in average scores. As shown in table 3, the average critical thinking skill score increased from 13,74 to 18,15, while the average creative thinking skill score increased from 32,22 to 39,19. This demonstrates an improvement in both skills after applying the Hybrid-PjBL model.

Table 3. The Average Score of Students' Critical and Creative Thinking Skills before and after the Implementation of Hybrid-PjBL model Paired Samples Test

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Creative Thinking	32,22	27	3,457	0,665
	Post Creative Thinking	39,19	27	2,856	0,550
Pair 2	Pre Critical Thinking	13,74	27	2,877	0,554
	Post Critical Thinking	18,15	27	1,748	0,336

DISCUSSION

Based on the results of data processing, the results were obtained an improvement in students' critical

and creative thinking skills after implementing the Hybrid-PjBL model. The Paired Sample T-Test indicates a significant difference between the pretest scores (before treatment) and posttest scores (after implementing Hybrid-PjBL). Descriptive analysis also revealed an increase in the average pretest and posttest scores for critical and creative thinking skills in the Development of Language and Literature Learning course, as presented in table 4.

In the learning design, students were encouraged to think critically and creatively to complete projects. PjBL emphasizes student-centered learning, involving participation in long-term, complex, and interdisciplinary projects.[66,67] These projects are designed to address real-world problems or relevant research questions, requiring students to independently plan, execute, and apply their work.[68,69]

The PjBL model was integrated with hybrid learning. Hybrid learning combines offline classroom learning with online learning, offering a holistic learning experience.[70] Typically, it employs a balanced ratio, with 50 % conducted face-to-face and 50 % online. The Hybrid-PjBL model begins by presenting a problem, which students solve through projects assigned with specific rules and timeframes. This aligns with the philosophy of empiricism and logicism, where knowledge is gained through observation and logical concepts are formed from the gathered information.[71] The Hybrid-PjBL model follows six stages:

1. Starting with the Big Question: 1) Engaging students' interest in the topic (aperception); 2) Encouraging critical thinking; 3) Developing students' ability to connect surrounding events with the discussed topic.
2. Designing a Plan for the Project: 1) Organizing students into workgroups; 2) Fostering teamwork among students; 3) Building communication between students; 4) Involving students in the planning process; 5) Determining and developing project designs.
3. Hybrid Learning Process: Organizing plans using a hybrid model (synchronous and asynchronous).
4. Creating a Schedule: 1) Develop authentic investigative skills; 2) Identifying real-world problems; 3) Seeking sources of information.
5. Monitoring Students and Project Progress: 1) Facilitating investigative experiences (experimentation); 2) Fostering critical thinking, creativity, collaboration, and communication skills; 3) Analyzing and link real-world conditions to the problem; 4) Encouraging sharing and teamwork; 5) Building communication skills; 6) Developing decision-making abilities; 7) Utilizing media and ICT resources.
6. Assessing the Outcome: 1) Preparing presentation materials; 2) Presenting project results using ICT; 3) Answering questions during discussions; 4) Showcasing work results through media/ICT; 5) Packing the product; 6) Documenting project stages using ICT; 7) Displaying the final product using media/ICT.
7. Evaluate the Experience: 1) Analyzing project outcomes and 2) Developing decision-making skills.

The project involved analyzing issues arising in students' surroundings. The process of analyzing problems fostered critical thinking skills, while creative thinking was employed to provide solutions. In this regard,[72] state that critical thinking can be enhanced through problem-solving. Each step in designing solutions—setting objectives, posing questions, selecting information, and identifying solutions—may contribute to skill development.[73] Survey results indicated that students demonstrated sensitivity and respect toward their surroundings, critical attitudes, explanatory abilities, and problem-solving skills during the Development of Language and Literature Learning course. This aligns with indicators of critical thinking, including effective reasoning, systematic thinking, evaluation, judgment-making (e.g., analyzing and evaluating arguments, synthesizing, interpreting information, and reflecting), and problem-solving (e.g., tackling unfamiliar problems, clarifying viewpoints, and generating better solutions).[74]

Similarly, creative thinking skills were developed through problem-solving activities.[75] Survey results showed that students expressed creative ideas, innovated, and collaborated effectively with peers, particularly in designing Lesson Plans. This aligns with creativity indicators, such as employing diverse ideation techniques, generating valuable ideas, refining ideas, working creatively with others (e.g., communicating ideas, embracing different perspectives, showing originality, self-directed work), and implementing innovations (e.g., contributing to practical applications).[74]

[76] explaining that the implementation of project activities in learning is a shortcut that can upgrade the learning process into a means of developing creativity. Similarly,[77] state that project activities require students to solve problems by creatively developing a product.

In Hybrid-PjBL, students construct knowledge through experiential learning. Learning through practice significantly develops productive learning habits, providing high-quality experiences. Contextual real-life problems also help students understand material more effectively.[78] Hybrid-PjBL aligns with Dewey's philosophy, emphasizing practical learning, as supported by Rahardjanto's research, which revealed its significant impact on learning outcomes and creative thinking skills.[28]

Studies consistently demonstrate that Hybrid-PjBL effectively enhances creative thinking,[79] further indicates that Hybrid-PjBL positively affects learning outcomes, creative thinking skills, and student motivation.

Creative thinking skills were found to be higher than critical thinking skills. It is consistent with [80], who asserts that problem-based learning fosters creative thinking more effectively than critical thinking. The difference arises as Hybrid-PjBL learning emphasizes critical thinking during problem analysis, solution identification, and evaluation, while creative thinking is predominantly exercised in generating solutions.

These findings collectively indicate that the Hybrid-PjBL model significantly influences critical and creative thinking skills. Research by Anazifa and Wyness supports this, showing that project-based learning positively impacts these skills.[81,82] Similarly, [83] emphasized that PjBL enhances students' creative thinking abilities, supporting [54] assertion that Hybrid-PjBL effectively develops thinking skills . Further studies suggest Hybrid-PjBL stimulates three thinking components: self-regulation, critical thinking, and creative thinking.[84,85,86,87]

Research on hybrid and PjBL learning models consistently highlights their role in fostering students' metacognitive awareness and enhancing thinking skills.[4,54] A study by [84] demonstrates that Hybrid-PjBL significantly impacts learning outcomes and creative thinking skills.[88] study revealed that combining Hybrid-PjBL with Cooperative Script (CS) resulted in a metacognitive awareness average of 73,67 (SD=5,779) compared to 52,53 (SD=6,882) in the lecture method, with significant effects on metacognitive awareness in environmental pollution topics. Similarly, Ilma et al.[89] ANCOVA analysis confirmed the positive impact of Hybrid-PjBL on problem-solving and creativity skills, with significant differences ($p<0,005$). Classes employing HPBL achieved the highest post-test scores, demonstrating its effectiveness in improving problem-solving and creativity skills.

This study has several limitations which are described as follows. First, it involved a small sample size and a single educational level, limiting the generalizability of the findings. Second, the instruments used to assess critical and creative thinking skills were applied only at the beginning and end, providing no insights into these skills during each phase of the learning process. Additionally, the findings may have limited applicability, as the study focused exclusively on students enrolled in the Development of Language and Literature Learning course for elementary education. The one-semester duration raises concerns about capturing the long-term effects of the Hybrid-PjBL model on outcomes, retention, and students' professional development.

CONCLUSIONS

The present study demonstrates a significant difference between the pretest and posttest scores of critical and creative thinking skills after the implementation of the Hybrid-PjBL model. Students exhibit score improvement after engaging with Hybrid-PjBL activities. Therefore, it is recommended to consider this model as an alternative approach to enhance critical and creative thinking skills.

There are several recommendations for educators and higher education institutions. First, educators should consider adjusting teaching models to align with the preferences and needs of their students, similar to the successful outcomes achieved with the Hybrid-PjBL model. Technology as a learning support must be upgrade to be in line with digital multimedia, and interactive content advances in realizing interactive learning.

With the advancement of time, future research efforts should explore the broader application of the Hybrid-PjBL model across various fields and educational environments. It is important to investigate its impact in different learning contexts and its potential to meet the needs of diverse demographics. Additionally, further studies should assess the application of Hybrid-PjBL on other parameters to uncover its positive impact more comprehensively. Extending the duration of learning is also recommended to analyze the long-term effects of the Hybrid-PjBL model.

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