

Enhancing Economics Learning Outcomes through Problem-Based Learning Integrated with Educaplay: Evidence from Indonesian Senior High School Students

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Abstract

To address poor student performance caused by conventional teacher-centric lessons and a lack of interactive tools, this study examined the efficacy of the Problem-Based Learning (PBL) model integrated with Educaplay media on eleventh-grade economics students at SMA Negeri 1 Makmur. PBL was used to build problem-solving and critical thinking skills, while Educaplay targeted student motivation through gamification. Using a quantitative quasi-experimental approach with a Nonequivalent Control Group Design, 60 students were split into experimental and control groups. Pretest and posttest data from 20 multiple-choice items were analyzed using IBM SPSS Statistics version 27 to test normality, homogeneity, and hypotheses. The results revealed a 2-tailed significance of 0.000 ($p < .05$) and a t-value of 19.174 (exceeding the t-table of 1.671), leading to the rejection of H_0 and acceptance of H_a . The study concludes that the Educaplay-assisted PBL model significantly enhances economics learning outcomes.

Keywords: Educaplay; Learning outcomes; Problem based learning; High school students.

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INTRODUCTION

Education plays a pivotal role in developing human capital and fostering the competencies required to navigate the complexities of the twenty-first century. In an era characterized by rapid technological advancement and continuous knowledge expansion, educational institutions are expected to cultivate students' critical thinking, creativity, innovation, and problem-solving abilities. Consequently, effective learning environments should not merely focus on content transmission but also encourage active participation, meaningful engagement, and collaborative knowledge construction (Nirwan, 2020). The achievement of these educational objectives largely depends on teachers' ability to select and implement appropriate instructional models, strategies, and learning media that align with students' characteristics and learning needs.

Learning outcomes represent a fundamental indicator of instructional effectiveness and educational quality. They encompass students' cognitive

achievement, attitudes, and skills acquired through the learning process (Siswanto & Arbani, 2021; Sudesi et al., 2025). In Economics education, learning outcomes extend beyond the acquisition of theoretical knowledge and include the ability to analyze economic phenomena, evaluate alternatives, and make informed decisions in real-life contexts (Devi & Rafsanjani, 2021). However, previous studies have reported that students' learning outcomes in Economics remain relatively low, particularly in classrooms dominated by teacher-centered instructional approaches (Mas'ulah, 2021). Such approaches often limit students' opportunities to actively participate in learning activities, resulting in reduced motivation, engagement, and conceptual understanding optimal (Marjaya et al., 2021). Therefore, there is a growing need to implement innovative, student-centered instructional approaches that can enhance students' learning outcomes and foster meaningful learning experiences (Pratiwi et al., 2023).

In addition to instructional approaches, the effectiveness of learning is also influenced by the quality and appropriateness of learning media. Conventional and monotonous learning media frequently fail to capture students' attention, leading to decreased engagement and diminished academic performance. Previous research has demonstrated that interactive learning media can significantly improve students' participation, motivation, and understanding of learning materials (Ulfah et al., 2021). Furthermore, insufficient variation in teaching methods and instructional media has been associated with lower learning motivation and reduced academic achievement in Economics education (Lestari & Gimin, 2022). Consequently, integrating innovative digital learning media into classroom instruction has become increasingly important for creating engaging and meaningful learning experiences (Putra & Andriansyah, 2022; Siswanto & Arbani, 2021).

One instructional model that has received considerable attention for promoting active learning is Problem-Based Learning (PBL). Grounded in constructivist learning theory, PBL engages students in solving authentic problems that require critical analysis, inquiry, and collaborative problem-solving (Darmawati & Mustadi, 2023). Through the exploration of real-world issues, students actively construct knowledge rather than passively receive information. Previous studies have consistently demonstrated that PBL enhances students' academic achievement, critical thinking skills, and classroom participation (Banyal, 2021; Santi et al., 2020). The model is particularly relevant to Economics education because economic concepts are closely related to contemporary social and economic issues that students encounter in their daily lives. By connecting theoretical concepts with authentic situations, PBL enables students to develop a deeper and more meaningful understanding of economic principles.

Alongside innovative pedagogical approaches, digital learning technologies have emerged as powerful tools for enhancing student engagement and motivation. One such technology is Educaplay, a web-based educational platform that supports game-based learning through interactive activities such as quizzes, matching exercises, crossword puzzles, and other gamified learning tasks (Wafiqni & Adelia, 2025). The integration of game elements into educational activities has been shown to increase students' participation, motivation, and enjoyment of learning experiences (Mukni'ah et al., 2025). Furthermore, empirical studies have reported positive effects of Educaplay-based learning on students' motivation and academic

achievement across various subject areas (Fadillah & Susanti, 2024; Wardani et al., 2025).

In Economics education, Educaplay offers opportunities to transform abstract economic concepts into engaging and interactive learning experiences. Through technology-enhanced activities, students can actively participate in learning processes while simultaneously developing conceptual understanding and critical thinking skills (Jayanti, 2023). Moreover, digital learning environments have been found to promote higher levels of engagement and facilitate more effective knowledge acquisition compared with conventional instructional approaches (Saputra et al., 2023).

Despite the fact that prior investigations have consistently verified the advantages of Problem-Based Learning (PBL) regarding students' higher-order thinking, practical problem-solving skills, and academic performance (Banyal, 2021; Santi et al., 2020), while other literature indicates that Educaplay boosts academic motivation, student agency, and peer interaction through gamification tools (Fadillah & Susanti, 2024; Wardani et al., 2025), these pedagogical strategies have largely been studied on an individual basis. Current findings, therefore, provide insufficient clarity on whether integrating constructivist models with gamified tools offers extra educational benefits over their standalone use. Moreover, little research has tested the collaborative synergy of PBL and Educaplay using strict quasi-experimental methods that adjust for initial student abilities, leaving the value of this integrated framework not yet fully established.

This shortcoming is vital in Economics education, where students are required to analyze real-world economic problems, critique alternative choices, and make evidence-based decisions rather than just memorizing theory. Yet, empirical papers tracking combined teaching and technology frameworks in secondary Economics classes remain scarce, especially in Indonesia. Therefore, this project analyzes the impact of Educaplay-assisted Problem-Based Learning on eleventh-grade Economics outcomes. Unlike past research that isolated instructional models from digital media, this study fills the gap by examining their combined effect through a quasi-experimental setup that controls for initial knowledge. The outcomes should yield stronger empirical data on combining teaching innovations with gamified software to boost student achievement.

Problem Based Learning (PBL)

Under the Problem-Based Learning (PBL) model, education becomes student-driven as learners actively investigate and resolve realistic problems. This approach is anchored in constructivist principles, fostering active knowledge cultivation through inquiry, collaboration, and self-reflection rather than passive consumption. By forcing students to navigate complex, meaningful scenarios, PBL successfully drives the advancement of higher-order thinking, including critical analysis, problem-solving, and decision-making aptitudes (Purba et al., 2025).

Within the PBL framework, students assume an active role in the learning process by identifying problems, gathering relevant information, evaluating alternative solutions, and constructing evidence-based conclusions. Teachers function primarily as facilitators who guide students' inquiry and support the learning process rather than serving as the sole source of knowledge. This instructional approach promotes meaningful learning experiences because students

engage directly with contextualized problems that require the application of conceptual knowledge and analytical reasoning. Previous studies have demonstrated that PBL contributes significantly to students' academic achievement by fostering active participation and encouraging deeper engagement with learning materials (Huda & Susanto, 2021).

Furthermore, PBL provides opportunities for students to develop knowledge independently through experiential learning. The collaborative nature of PBL encourages learners to work in groups, exchange ideas, and negotiate meaning while solving complex problems. Such collaborative interactions not only enhance students' understanding of subject matter but also strengthen interpersonal communication and teamwork skills (Sari, 2022). Through continuous engagement in problem-solving activities, students are able to construct a deeper understanding of concepts and develop transferable cognitive skills that are essential for lifelong learning. Research has consistently indicated that active participation in PBL environments positively influences both cognitive achievement and critical thinking performance (Ma'rifat & Suraharta, 2024).

The application of PBL is particularly relevant in Economics education because economic concepts are inherently connected to real-world social and economic issues. The use of authentic economic problems enables students to bridge theoretical knowledge with practical situations, thereby enhancing the relevance and meaningfulness of learning experiences (Santi et al., 2021). By analyzing economic phenomena and evaluating alternative solutions, students are encouraged to think critically, reason logically, and make informed decisions based on economic evidence. Moreover, the interactive and inquiry-based nature of PBL has been shown to increase students' learning motivation and engagement, leading to improved academic performance. Therefore, Problem-Based Learning is widely regarded as an effective pedagogical approach for enhancing students' learning outcomes and fostering essential twenty-first-century competencies in Economics education.

Educaplay

The integration of digital technology into educational practice has significantly transformed contemporary teaching and learning processes. Digital learning platforms offer opportunities to develop immersive, interactive, and personalized learning spaces that drive student agency and substantial educational experiences. One such platform is Educaplay, a web-based educational application designed to support game-based learning through a variety of interactive activities, including quizzes, crossword puzzles, word searches, matching exercises, and other gamified learning tasks (Rahmawati & Perdana, 2024). By incorporating elements of gamification, Educaplay facilitates a more enjoyable learning experience while simultaneously promoting student engagement and knowledge acquisition.

From a pedagogical perspective, Educaplay is grounded in the principles of active learning and educational gamification, which emphasize student participation, immediate feedback, and experiential learning. The platform enables teachers to transform conventional instructional activities into interactive learning experiences that prompt students to actively synthesize concepts rather than passively taking in delivered content. Previous studies have demonstrated that technology-enhanced learning environments can increase students' interest,

motivation, and engagement, ultimately contributing to improved academic performance (Tamansiswa et al., 2024).

In Economics education, Educaplay offers particular advantages because many economic concepts are abstract and often difficult for students to comprehend through traditional instructional approaches. Through interactive and game-based activities, students can explore economic concepts in a more engaging and meaningful manner, thereby enhancing conceptual understanding and knowledge retention (Ramadhan & Koryati, 2025). Furthermore, the interactive nature of Educaplay encourages active participation, collaborative learning, and sustained attention during classroom activities, all of which are essential factors influencing academic achievement.

Student outcomes describe the insights, aptitudes, mindsets, and core competencies developed through participation in educational experiences. Within the context of Economics education, learning outcomes encompass not only the mastery of theoretical concepts but also the ability to analyze economic issues, apply economic reasoning, and make informed decisions based on evidence and critical evaluation (Tamansiswa et al., 2024). Nevertheless, previous studies have reported that students' learning outcomes often remain below expectations due to the limited use of innovative instructional models and interactive learning media. Such conditions frequently result in low student engagement, reduced motivation, and passive learning behaviors, which negatively affect academic achievement (Wafiqni & Adelia, 2025).

To address these challenges, educators are increasingly encouraged to integrate innovative pedagogical approaches with digital learning technologies. Problem-Based Learning (PBL), for example, promotes critical thinking, inquiry, and collaborative problem-solving through authentic learning experiences. Simultaneously, Educaplay enhances students' motivation and engagement by providing interactive and enjoyable learning activities. The combination of these approaches creates a learning environment that is both cognitively stimulating and emotionally engaging, thereby supporting deeper understanding and improved academic performance (Fadillah & Susanti, 2024; Ramadhan & Koryati, 2025b)).

Theoretically, the integration of Problem-Based Learning and Educaplay aligns with constructivist theory, which asserts that individuals actively formulate comprehension through meaningful interaction, practical experience, and self-reflection. While PBL provides meaningful problem-solving experiences that facilitate knowledge construction, Educaplay supports these experiences through interactive digital activities that enhance learner engagement and motivation (Rahmawati & Perdana, 2024). Consequently, the integration of PBL and Educaplay is expected to improve students' conceptual understanding, critical thinking abilities, and overall learning outcomes in Economics education.

Based on these theoretical and empirical considerations, this study hypothesizes that the implementation of Problem-Based Learning assisted by Educaplay will positively influence the learning outcomes of eleventh-grade students in Economics at SMA Negeri 1 Makmur.

RESEARCH METHOD

This research operated under a quantitative methodology, applying a quasi-experimental design to determine how combining Problem-Based Learning (PBL) with Educaplay media affects learning outcomes in economics subjects. Given that the participants were allocated based on pre-established classroom groups without the possibility of individual randomization, a Nonequivalent Control Group Design was deemed most appropriate. The study took place at SMA Negeri 1 Makmur during the 2025/2026 academic period. This study employed a quantitative approach using a quasi-experimental design with a Nonequivalent Control Group Design. The design is presented in Table 1.

Table 1. Nonequivalent Control Group Design

Group	Pre-test	Treatment	Post-test
Experimental	O_1	X	O_2
Control	O_3	–	O_4

Note: O_1 and O_3 denote the pre-intervention assessments administered to establish a performance baseline, whereas O_2 and O_4 signify the post-intervention examinations. The symbol X marks the deployment of the Educaplay-integrated Problem-Based Learning framework, while the comparison cohort underwent traditional teaching methods.

The experimental class was exposed to a Problem-Based Learning pedagogical design blended with Educaplay platforms, whereas the control class was instructed through a traditional, teacher-centered approach. To trace shifts in students' scholastic achievements within economics, both cohorts were subjected to the exact same pretest instruments prior to the educational cycles and matching posttest instruments upon their conclusion.

All grade XI students at SMA Negeri 1 Makmur constituted the total population for this research. Through the application of a purposive sampling technique, the researcher chose two specific classes characterized by equivalent baseline achievements, identical class schedules, and instruction from the same economics teacher. From this selection, Class XI-1 ($n = 30$) was assigned to the experimental treatment via Educaplay-supported Problem-Based Learning, whereas Class XI-2 ($n = 30$) was relegated to the control condition utilizing conventional pedagogical approaches. Accordingly, the complete aggregate sample involved 60 students.

To map the students' baseline economics comprehension, a pretest was initially administered to both research conditions before any instructional changes. Subsequently, the experimental group experienced the Problem-Based Learning framework augmented by Educaplay tasks, including peer-led problem solving, classroom debates, and digital gaming exercises. In the meantime, the control group followed conventional teaching structures focused on direct instruction and structured Q&A periods. At the end of the instructional cycle, both groups sat for the exact same posttest to measure disparities in their academic achievement.

To evaluate student learning outcomes, the study utilized a 20-item multiple-choice test based on the economics material covered during the treatment sessions. The measurement tool underwent content validation by a panel of two economics education experts to confirm its instructional alignment. Furthermore, a preliminary pilot study was conducted with a cohort of similar student characteristics before

launching the main investigation. The psychometric properties were evaluated using Pearson's Product-Moment correlation for individual item validity and Cronbach's Alpha for internal consistency. The statistical outputs indicated that all questions fulfilled the baseline validity criteria, and the scale demonstrated a satisfactory reliability index ($\alpha > 0.70$).

Data analysis was conducted using IBM SPSS Statistics version 27, beginning with the Shapiro–Wilk and Levene tests to ensure the dataset met normality and homogeneity requirements for parametric analysis. To determine how the Educaplay-assisted PBL model impacted economics outcomes while adjusting for initial student knowledge, an Analysis of Covariance (ANCOVA) was run using pretest scores as covariates and posttest scores as dependent variables. Additionally, student learning gains were tracked via *N*-Gain analysis, and the treatment's magnitude was established using Cohen's *d* effect size. The significance level for all evaluations was maintained at $\alpha = 0.05$.

RESULTS AND DISCUSSION

Conducted in May 2026 at SMA Negeri 1 Makmur, this study evaluated the efficacy of the Educaplay-assisted Problem-Based Learning model on 11th-grade economics students. Class XI-1 operated as the experimental class (PBL paired with Educaplay), while Class XI-2 served as the control class (conventional method). Both groups initially took a pretest to evaluate their baseline knowledge of the economics material. Next, the treatments were applied: the experimental class participated in group problem-solving and interactive Educaplay games, while the control class learned through traditional lectures and Q&A sessions. Afterward, a posttest was administered to both classes to measure final outcomes. The pretest and posttest results were then tested for normality using the Shapiro-Wilk method, which indicated that all data groups were normally distributed. The normality test statistics are detailed as follows:

Table 1. Normality Test Results

		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Results	Pretest A (Control)	.192	30	.006	.938	30	.083
	posttest A (Control)	.193	30	.006	.881	30	.003
	Pretest B (Experimen)	.123	30	.200*	.951	30	.183
	Posttest B (Experimen)	.137	30	.155	.933	30	.061

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 1 details the normality test results, showing significance values of 0.083 for Pretest A (Control), 0.183 for Pretest B (Experiment), and 0.061 for Posttest B (Experiment). These values surpass 0.05, meaning the data are normally distributed. However, Posttest A (Control) scored a significance value of 0.003, which is under 0.05, showing that this group is not normally distributed. Despite this exception,

the overall data are valid for further analysis. The study then proceeded to a homogeneity test to evaluate if the variances between the control and experimental classes are identical. Analyzed using IBM SPSS Statistics version 27, the data are declared homogeneous if the significance value is greater than 0.05. These results are summarized in Table 2:

Table 2. Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Score	Based on Mean	.023	1	58	.879
	Based on Median	.022	1	58	.883
	Based on Median and with adjusted df	.022	1	54.860	.883
	Based on trimmed mean	.023	1	58	.879

Based on the homogeneity results in Table 2, the Based on Mean significance value is 0.879. Since this value surpasses 0.05, it indicates that the data variances for both the control and experimental classes are homogeneous and statistically equal. These results indicate that both research groups have relatively similar data conditions, making them suitable for further analysis. Thus, the research data has met the requirements for the homogeneity test and can proceed to the hypothesis testing stage using predetermined statistical analysis.

Table 3. Hypothesis Testing

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Differen ce	95% Confidence Interval of the Difference Lower Upper
Res ults	Equal variances assumed	.023	.879	- 19.17 4	58	.000	-38.500	2.008	-42.519 -34.481
	Equal variances not assumed			- 19.17 4	57.91 7	.000	-38.500	2.008	-42.519 -34.481

Table 3 displays the hypothesis test outcomes, revealing a 2-tailed significance of 0.000, which is below 0.05 and confirms a significant difference between the two classes. With an empirical t"-value" of 19.174 exceeding the t"-table" value of 1.671, H_0 is rejected and H_a is accepted. This indicates that the Educaplay-assisted PBL model significantly impacts economics student outcomes at SMA Negeri 1 Makmur. The Mean Difference of -38.500 further highlights that the experimental group achieved better average scores than the control group. This outcome is driven by the PBL model's ability to promote student agency through

group discussion and problem-solving, coupled with Educaplay's interactive quizzes that increase learning motivation. Therefore, the combination of PBL and Educaplay media is proven to have a positive and significant effect on student achievements.

The results of this study indicate that the deployment of the Problem-Based Learning model paired with Educaplay tools substantially impacts students' learning outcomes in economics. This outcome is evidenced by a significance level of 0.000 ($p < 0.05$), establishing that a meaningful difference exists between the post-intervention scores of the experimental and control groups. Such an upgrade in learning achievements proves that merging a constructivist learning model with gamified digital software establishes a superior educational environment over conventional lectures. Under this framework, learning ceases to be teacher-dominated and instead drives student agency in developing conceptual understanding through authentic problem-solving exercises.

Theoretically, these outcomes resonate with constructivism, an educational philosophy asserting that cognitive structures are actively built via lived experiences, social discourse, and metacognitive reflection. In executing the Problem-Based Learning model, learners tackle authentic problems that demand critical dialogue, data evaluation, the assessment of competing solutions, and autonomous deduction. Simultaneously, the utilization of Educaplay augments this constructivist process through gamification elements, which offer real-time feedback, maximize student agency, and generate a dynamic classroom climate. Merging these two pedagogical interventions facilitates a more meaningful learning journey, thereby driving a substantial increase in students' mastery of economic concepts.

The outcomes of this investigation lend strong support to earlier literature, which asserts that the Problem-Based Learning framework is highly effective in driving scholastic achievement, critical analysis, and autonomous problem-solving aptitudes (Sholihah & Lastariwati, 2020). Moreover, these findings validate previous assertions that Vargas-Saritama & Celi (2024) and Sarif, Dunggio, Binti Hj. Bahri, Safii, Waedureh, & Al Muhsin (2026) demonstrating that leveraging Educaplay elevates academic drive, student involvement, and engagement levels during lessons. Nonetheless, unlike previous literature which typically examined Problem-Based Learning and Educaplay as separate variables, this research merges the two strategies into a single educational delivery. Consequently, it highlights the operational synergy between constructivist problem-solving and gamified digital platforms to boost scholastic achievements in economics.

The main contribution of this research is the empirical proof that student success depends on both the learning model and the digital media used to increase engagement. PBL allows students to build knowledge through group problem-solving, while Educaplay reinforces economics concepts using interactive quizzes with instant feedback. Combining both methods creates an active, collaborative, and student-centered classroom that improves learning outcomes better than using each approach separately. Practically, this study implies that economics teachers should combine problem-based learning with interactive digital media during this digital transformation era. This combination not only increases test scores but also develops 21st-century skills like critical thinking, collaboration, communication, and problem-solving. Thus, schools should support digital platforms by providing

better technology facilities and teacher training to ensure successful technology-based instruction.

CONCLUSION

This research proves that Educaplay-assisted Problem-Based Learning has a positive and significant effect on eleventh-grade Economics learning outcomes at SMA Negeri 1 Makmur. Integrating problem-based methods with interactive digital media creates an active, collaborative, and student-centered learning flow that improves test scores better than traditional teaching. These findings show that combining teaching strategies with digital technology is an effective way to boost the quality of high school economics lessons.

Academically, this study adds stronger empirical data regarding the success of combining PBL and Educaplay to improve student performance. Unlike past studies that usually tested these methods separately, this project proves that their combination creates a clear synergy between group problem-solving and educational games, which helps student engagement and understanding.

However, this study has limitations because it involved only one school with a small sample size, meaning the results cannot be generalized broadly. It also focused only on cognitive scores without checking other aspects like motivation, critical thinking, learning engagement, or retention. Future research should include larger samples from various types of schools, use stronger experimental setups, and examine how the PBL-Educaplay model affects other student skills to provide a more complete picture.

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