

THE EFFECTIVENESS OF THE STEM APPROACH USING ECOMINI ON THE ECONOMIC LITERACY OF FIFTH-GRADE STUDENTS IN ECONOMIC ACTIVITIES

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Abstract

The low level of economic literacy among elementary school students regarding economic activities indicates that instruction has not yet fully provided a learning experience that is contextual, active, and relevant to students' daily lives. This study aims to analyze the improvement in students' economic literacy through the application of the STEM approach using Ecomini (Economy Mini) a mini-scale simulation of economic activities designed to provide real-world learning experiences in the classroom and to compare its effectiveness with conventional teaching methods. This study employed a quasi-experimental method with a non-equivalent control group design, involving 62 students from two elementary schools in Conggeang Subdistrict: 32 students from SDN Cibubuan II as the experimental group and 30 students from SDN Narimbang I as the control group. Data were collected through pretests, posttests, and observations, then analyzed using descriptive and nonparametric statistics via the Wilcoxon, Mann-Whitney, N-Gain, and effect size tests. The results showed that the average pretest score of the experimental class increased from 51.50 to 88.84 on the posttest, while the control class increased from 51.97 to 68.27. The results of the Wilcoxon test for both classes showed a significance value of $0.000 < 0.05$, while the Mann-Whitney test indicated a significant difference between the two classes with a significance value of $0.000 < 0.05$. The N-Gain score for the experimental class was 77.16%, placing it in the effective category, while the control class scored 33.98%, placing it in the ineffective category. Furthermore, the effect size of 0.84 falls into the large category, indicating a strong impact of implementing STEM through Ecomini on students' economic literacy. These findings confirm that the STEM approach via Ecomini is more effective than conventional instruction because it fosters more active, contextual, participatory, and meaningful economic learning for elementary school students.

Keywords: STEM; Ecomini; Economic Literacy; Social Studies Education; Economic Activities

Abstrak

Rendahnya literasi ekonomi siswa sekolah dasar pada materi aktivitas ekonomi menunjukkan bahwa pembelajaran belum sepenuhnya memberikan pengalaman belajar yang kontekstual, aktif, dan dekat dengan kehidupan sehari-hari siswa. Penelitian ini bertujuan menganalisis peningkatan literasi ekonomi siswa melalui penerapan pendekatan STEM dengan Ecomini (Economy Mini), yaitu simulasi kegiatan ekonomi dalam skala mini yang dirancang untuk menghadirkan pengalaman belajar nyata di kelas, serta membandingkan efektivitasnya dengan pembelajaran konvensional. Penelitian menggunakan metode kuasi eksperimen dengan desain Nonequivalent Control Group yang melibatkan 62 siswa dari dua sekolah dasar di Kecamatan Conggeang, yaitu 32 siswa SDN Cibubuan II sebagai kelas eksperimen dan 30 siswa SDN Narimbang I sebagai kelas kontrol. Data dikumpulkan melalui pretest, posttest, dan observasi, kemudian dianalisis menggunakan statistik deskriptif dan nonparametrik melalui uji Wilcoxon, Mann-Whitney, N-Gain, dan effect size. Hasil penelitian menunjukkan bahwa rata-rata pretest kelas eksperimen meningkat dari 51,50 menjadi 88,84 pada posttest, sedangkan kelas kontrol meningkat dari 51,97 menjadi 68,27. Hasil uji Wilcoxon pada kedua kelas menunjukkan nilai signifikansi $0,000 < 0,05$, sedangkan uji Mann-Whitney menunjukkan adanya perbedaan signifikan antara kedua kelas dengan nilai signifikansi $0,000 < 0,05$. Nilai N-Gain kelas eksperimen sebesar 77,16% berada pada kategori efektif, sedangkan kelas kontrol sebesar 33,98% berada pada kategori tidak efektif. Selain itu, hasil effect size sebesar 0,84 termasuk kategori besar yang menunjukkan pengaruh kuat penerapan STEM melalui Ecomini terhadap literasi ekonomi siswa. Temuan ini menegaskan bahwa pendekatan STEM melalui Ecomini lebih efektif dibandingkan pembelajaran konvensional karena mampu menciptakan pembelajaran ekonomi yang lebih aktif, kontekstual, partisipatif, dan bermakna bagi siswa sekolah dasar.

Kata Kunci: STEM; Ecomini; Literasi Ekonomi; Pembelajaran IPS; Aktivitas Ekonomi

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Introduction

Social Studies instruction in elementary school, particularly regarding economic activities, requires students not only to understand the concepts of production, distribution, and consumption in theory but also to be able to relate them to daily life. This ability is linked to economic literacy that is, students' ability to understand simple economic issues and make appropriate decisions in specific situations (Ladiku et al., 2025). Economic literacy is defined as an individual's ability to understand basic economic concepts, interpret economic information, and apply that knowledge in making rational decisions in daily life. Instilling economic literacy starting in elementary school is crucial because it helps students act rationally, frugally, and responsibly when using available resources (Agustin et al., 2025; Maritim et al., 2024). Furthermore, the rapid advancement of science and technology demands that students possess adaptive 21st-century competencies, including the ability to understand and address real-world economic issues (Ali et al., 2025).

In this study, economic literacy is measured based on indicators developed by Ladiku et al. (2025), namely scarcity, decision-making, resource allocation, economic incentives, and supply and demand. These five indicators not only emphasize the theoretical mastery of economic concepts but also students' ability to apply these concepts in the context of daily life. Therefore, economics instruction in elementary school needs to be designed in a contextual and meaningful way so that students can connect abstract concepts with real-life experiences in their surrounding environment. In line with this, research by Nugraha et al. (2022) shows that the use of ecoliteracy-based learning modules can improve elementary school students' literacy skills through contextual and active learning experiences. This module-based learning helps students understand real-world issues in their surrounding environment and increases student engagement during the learning process. These findings suggest that contextual learning involving hands-on experiences can provide a more meaningful understanding compared to conventional learning.

Empirically, various international studies indicate that students' economic literacy skills have not yet developed optimally. Happ & Pilz (2022) explain that economic knowledge is becoming increasingly important for students to understand and adapt to modern economic life. In the context of 21st-century education, students need not only conceptual understanding but also the ability to think critically, make decisions, collaborate, and solve economic problems in their daily lives. However, various studies indicate that students still struggle to apply basic economic concepts to real-world situations. This situation suggests that economics education should not merely focus on memorizing concepts but must provide authentic, participatory, and contextual learning experiences.

In reality, the social studies learning process in elementary schools still tends to be teacher-centered. Economic concepts are generally conveyed through lectures, question-and-answer sessions, and practice exercises, so students primarily receive information rather than building understanding through direct experience. Safitri et al. (2024) found that students still struggle to understand the relationships between economic activities because learning tends to be theoretical and lacks context. Preliminary interviews with students also indicate that they still

struggle to distinguish between the concepts of needs and wants. Additionally, students reported that learning is primarily conducted through memorizing material and solving practice problems without connecting them to real-life experiences in daily life. Interviews with classroom teachers revealed that the limited use of media and interactive learning models results in students being less actively engaged during lessons. These conditions highlight the urgent need to implement Social Studies instruction that is more contextual, participatory, and capable of providing students with direct experiences in understanding economic activities.

One approach considered relevant to addressing these needs is STEM (Science, Technology, Engineering, and Mathematics). The STEM approach integrates various disciplines to help students solve problems in a contextual and meaningful way (Angela & Rahayu, 2022). Research by Chen & Lin (2026) indicates that STEM learning can enhance student engagement through collaborative activities and real-world problem-solving. Margot & Kettler (2019) also explain that integrated STEM learning can foster active participation, collaboration, and interdisciplinary problem-solving skills during the learning process. Furthermore research by Wu et al. (2021) demonstrates that STEM learning based on authentic inquiry experiences can enhance student engagement and foster a more meaningful conceptual understanding, as students are directly involved in contextual problem-solving activities grounded in real-world experiences. This approach aligns with the constructivist theories of Piaget (1972), Vygotsky (1978), as well as Kolb (1984) experiential learning theory, which emphasize that knowledge is more meaningful when constructed through direct experience and social interaction.

Various international studies have also shown that simulation-based learning can enhance student engagement and conceptual understanding. Chernikova et al. (2020), through a meta-analysis of various empirical studies, found that simulation-based learning has a positive impact on the learning process because students are directly engaged in authentic and contextual learning situations. In the field of economics education, Kalmi & Rahko (2022) explain that game-based and interactive simulation-based economics learning can help students understand economic concepts and decision-making processes more actively. Additionally, Fu et al. (2022) found that economic simulations can improve students' understanding of dynamic economic interactions, particularly regarding decision-making and resource allocation. Beranic & Hericko (2022) also explain that simulation-based learning and serious games can increase student engagement and help them understand economic concepts in a more interactive and practical way.

Nevertheless, previous studies still have several limitations. Most STEM research has been applied primarily to the fields of science and mathematics, whereas its application in social studies education particularly regarding economic activities in elementary schools remains relatively limited. Research on simulation-based learning in economics education is also generally conducted at the secondary and higher education levels and focuses more on improving general skills such as critical thinking, collaboration, and learning outcomes. Thus, the development of learning that specifically integrates STEM with structured economic activity simulations to improve the economic literacy of elementary school students has not yet been widely undertaken.

In the context of economic activities, the STEM approach can be integrated with Ecomini (Economy Mini), a small-scale simulation of economic activities designed specifically for elementary school students. Through this activity, students take on the roles of producers, distributors, and consumers by engaging in buying and selling, managing goods, calculating transactions, and making economic decisions firsthand. Learning not only focuses on

conceptual understanding but also provides students with authentic experiences to observe economic processes as they occur in their surrounding environment. Research by Murthi et al. (2022) indicates that a context-based STEM approach can enhance students' financial literacy, while Aura et al. (2023) found that role-playing instruction can increase student engagement and learning outcomes compared to traditional teaching methods.

Based on the above discussion, a research gap can be identified in previous studies, namely the limited number of studies that integrate STEM learning with structured economic simulations to improve elementary school students' economic literacy in social studies. Previous studies generally examined STEM and simulation-based learning separately and did not specifically prioritize economic literacy as the primary learning outcome. Furthermore, research that develops authentic, contextual, and student-centered economic learning experiences for elementary school students remains limited. This situation highlights the need for educational innovations that not only integrate STEM and economic simulations but also effectively foster students' economic literacy through participatory and meaningful learning experiences.

This study offers novelty by integrating STEM learning with structured economic simulations (Ecomini) specifically to improve elementary school students' economic literacy in Social Studies learning. Unlike previous studies, this research not only emphasizes mastery of economic concepts but also provides authentic learning experiences through economic simulation activities involving direct decision-making, resource allocation, collaboration, and problem-solving. Thus, this study is expected to make a scientific contribution to the development of Social Studies instruction that is more contextual, participatory, and experience-based in an effort to improve elementary school students' economic literacy. Therefore, this study aims to examine the effectiveness of STEM-based Ecomini learning in improving elementary school students' economic literacy compared to conventional instruction.

Research Methods

This study employs a quantitative approach using a quasi-experimental method to determine the effectiveness of the STEM approach through Ecomini on elementary school students' economic literacy regarding economic activities. A quantitative approach was chosen because the research data consists of numerical data obtained from students' pretest and posttest results. Meanwhile, the quasi-experimental method was chosen because the research was conducted in naturally formed classroom settings at the school, making full subject randomization impractical. The design used is the Nonequivalent Control Group Design, which involves two groups, namely the experimental class and the control class, both of which were given pretests and posttests but with different learning treatments. This design is considered relevant for educational research because it allows researchers to compare changes in learning outcomes between the two groups in real learning situations without disrupting the existing class structure. The research design adapted from (Sugiyono, 2013) is presented in Table 1.

Table 1. Research Design

Group	Pretest	Treatment	Posttest
Experimental Class	O ₁	X	O ₂
Control Class	O ₃	-	O ₄

Description:

O₁ : Pretest in the experimental class

O₂ : Posttest in the experimental class

O3 : Pretest in the control class

O4 : Posttest in the control class

X : Treatment provided to students using a STEM approach through Ecomini

The study was conducted during the second semester of the 2025/2026 academic year, specifically from February to April 2026, at two public elementary schools in Conggeang Subdistrict, Sumedang Regency. SDN Cibubuan II was designated as the experimental class, while SDN Narimbang I served as the control class. The selection of locations was done purposively by considering the similarity of school characteristics, namely that both schools use the Merdeka Curriculum, have B accreditation, are at the same grade level, and had not yet received instruction on economic activities prior to the study. These similarities were important to ensure that the initial conditions of the two groups were relatively equivalent. The research subjects consisted of 62 fifth-grade students, comprising 32 students in the experimental class and 30 students in the control class. All students participated in the entire research process, from the pretest, through the implementation of instruction, to the posttest.

In the experimental class, instruction was conducted using a STEM approach integrated with Ecomini (Economy Mini), a simulation of economic activities in the form of a mini-market. In this activity, students act as producers, distributors, and consumers who conduct simple transactions, calculate prices, record income and expenses, and make economic decisions based on the given situations. Meanwhile, the control class uses conventional learning in the form of material explanations, question-and-answer sessions, and practice problems without simulation activities. Data collection was conducted through tests and observations. The test instrument served as the primary data source to measure students' economic literacy before and after the intervention. The instrument consisted of 20 items: 15 multiple-choice questions and 5 short-answer questions, designed based on five indicators of economic literacy scarcity, decision-making, resource allocation, economic incentives, and supply and demand.

The validity of the instrument was tested using Pearson's product-moment correlation to examine the relationship between item scores and total scores. An item was deemed valid if its significance value met the established statistical criteria. The reliability of the instrument was tested using Cronbach's Alpha with the assistance of IBM SPSS Statistics 25. The test results showed that the reliability of the multiple-choice questions was 0.734 and that of the essay questions was 0.732; both fall into the high reliability category, so the instrument was deemed consistent and suitable for use in the study. Additionally, an item analysis was conducted to assess difficulty levels and discriminative power to ensure the quality of each item. All test items were found to meet the validity criteria and can therefore be used to measure students' economic literacy skills.

Observation data were collected using teacher observation sheets and student observation sheets. The teacher observation sheet included five indicators: (1) implementation of learning activities, (2) application of the STEM approach, (3) implementation of the Ecomini simulation, (4) classroom management, and (5) closing activities. The student observation sheet also consists of five indicators, namely: (1) student engagement, (2) cooperation among students, (3) economic calculation skills, (4) utilization of learning tools and media, and (5) environmental awareness during the learning process. Observations were conducted by the classroom teacher as the single observer to record students' learning activities during the instructional process. Permission to conduct the study was obtained from the school administration, and all students participated with the approval of the school and classroom teachers. Student identities were kept confidential, and all data were used solely for academic purposes.

Data analysis was performed using IBM SPSS Statistics 25 with descriptive and inferential statistical techniques. Descriptive statistics were used to examine the general characteristics of the data through the mean, minimum, maximum, and standard deviation. Prerequisite tests were conducted using the Shapiro–Wilk normality test and Levene's homogeneity test. Based on the results of the prerequisite tests, the data did not fully meet the assumptions of normality and homogeneity; therefore, the analysis proceeded using nonparametric statistics. The Wilcoxon Signed-Rank test was used to determine differences in pretest and posttest results within each group. The Mann–Whitney U test was used to determine differences in posttest results between the experimental and control classes. Additionally, improvements in student performance were analyzed using N-Gain, while the magnitude of the treatment effect was analyzed using effect size. The use of these various analytical techniques aimed to strengthen the research rigor so that the effectiveness of the STEM approach through Ecomini could be tested more comprehensively, objectively, and scientifically accountable.

Results and Discussion

This study was conducted at two elementary schools in Conggeang Subdistrict: SDN Cibubuan II as the experimental class and SDN Narimbang I as the control class. These two schools were selected based on the similarity of student characteristics, classroom conditions, and the use of the same curriculum, so that the research results could be compared more fairly. The study was conducted in three stages: a pretest, the implementation of the instruction, and a posttest. The pretest was administered to assess students' initial economic literacy skills before the intervention was implemented.

The learning phase was conducted over two sessions. In the experimental class, students participated in STEM-based learning using Ecomini, a simple simulation of economic activities on a miniature scale. During the first session, students were introduced to economic concepts and role assignments, then began drafting simple buying and selling plans. In the second session, students conducted a simulation by taking on the roles of producers, consumers, and distributors. During this activity, students carried out transactions, calculated capital and profits, and made simple economic decisions. Meanwhile, the control class followed conventional learning through teacher explanations, question-and-answer sessions, and assignments without simulation activities. After the entire learning sequence was completed, a posttest was administered to assess changes in students' economic literacy skills following the different interventions. A comparison of pretest and posttest results is presented in Table 2.

Table 2. Statistical Data of Pretest and Posttest Results

	N	Min	Max	Mean	Std. Dev
Pretest Experimental Class	32	34	66	51.50	8.397
Posttest Experimental Class	32	80	97	88.84	3.699
Pretest Control Class	30	23	71	51.97	13.850
Posttest Control Class	30	43	86	68.27	13.020

Source: Research data analysis (2026)

Based on Table 2, the average pretest scores for the experimental and control classes were relatively similar. This indicates that the students' initial economic literacy skills in both classes were at comparable levels. After the instruction took place, both classes showed improvement. However, the improvement in the experimental class was greater than that in the control class. In addition, the lower standard deviation in the experimental class suggests that

student learning outcomes tended to be more consistent. Before hypothesis testing was conducted, the data was first analyzed using normality and homogeneity tests, as presented in Table 3.

Table 3. Tests for Normality and Homogeneity

Test	Data	Sig.	Notes
Shapiro-Wilk	Experimental Pretest	0,037	Non-normal
Shapiro-Wilk	Experimental Posttest	0,005	Non-normal
Shapiro-Wilk	Control Pretest	0,081	Normal
Shapiro-Wilk	Control Posttest	0,021	Non-normal
Levene Test	Overall data	0,000	Non-homogeneous

Source: Research data analysis (2026)

The results of the analysis indicate that the data do not fully meet the assumptions of a parametric test, so a nonparametric test was used. The Wilcoxon test was used to examine changes in scores within each class, while the Mann-Whitney test was used to compare posttest scores between the two groups.

Table 4. Wilcoxon Test

Class	Z	Sig. (2-tailed)
Experimental	-4,946	0,000
Control	-4,551	0,000

Source: Research data analysis (2026)

The results of the Wilcoxon test in Table 4 show a significant improvement in both the experimental and control classes after instruction. However, the improvement in the experimental class was greater, as evidenced by the higher posttest mean. The difference in learning outcomes between the experimental and control classes was further analyzed using the Mann-Whitney U Test on the posttest scores.

Table 5. Mann-Whitney Posttest

Test	Value	Z	Sig.
Mann-Whitney U	13,000	-6,628	0,000

Source: Research data analysis (2026)

The analysis revealed a statistically significant difference between the experimental and control groups. These findings indicate that students who participated in Ecomini-based STEM learning demonstrated better economic literacy outcomes than those who received conventional instruction. The magnitude of improvement in each class was then analyzed using the N-Gain calculation.

Table 6. N-Gain Results

Class	Mean N-Gain (%)	Category
Experimental	77,16	Effective
Control	33,98	Ineffective

Source: Research data analysis (2026)

Based on Table 6, the experimental class achieved an average N-Gain of 77.16%, which falls into the “effective” category, while the control class achieved an average of 33.98%, which falls into the “ineffective” category. The strength of the treatment effect was further examined using the effect size formula $r = Z/\sqrt{N}$, which produced a value of 0.84 and was categorized as a large effect. This means that the use of Ecomini-based STEM has a strong impact on improving students’ economic literacy. These quantitative findings are further supported by the

results of observations of teacher and student activities during the learning process, as presented in Table 7.

Table 7. Learning Activities

Aspect	Class	Session I	Session II	Average
Teacher	Experimental	95%	100%	97,5%
Teacher	Control	100%	100%	100%
Students	Experimental	93%	97%	95%
Students	Control	91%	93%	92%

Source: Research observations (2026)

Based on Table 7, student engagement in the experimental class was slightly higher than in the control class. During the simulation, students were more active in discussing, collaborating, and making decisions related to economic transactions. The learning activities were also more dynamic because students were directly involved in the learning experience.

The results of this study are consistent with the research by Rozak & Sumadi (2025), which showed that the role-playing method can improve students' learning outcomes in economic studies. Fauziyah & Attalina (2024) also found that role-playing helps students better understand social studies concepts. The similarity lies in the use of role-playing activities that encourage student engagement during learning. However, this study differs in that it combines role-playing with a STEM approach through Ecomini. Students not only play roles in simulations but are also involved in calculating transactions, solving simple problems, and making economic decisions directly. This combination makes the learning experience more concrete and has a stronger impact on improving economic literacy.

The findings of this study are also consistent with those of Murthi et al. (2022), who state that STEM-based learning can improve students' financial literacy. Syahmani et al. (2021) also demonstrate that STEM can develop critical thinking skills through problem-solving activities. The difference is that previous studies have largely discussed STEM in general, whereas this study specifically applies it through the Ecomini simulation in economic literacy instruction at the elementary school level. These results indicate that integrating STEM with simulations can help students understand economic concepts more tangibly while simultaneously developing their numeracy and decision-making skills.

Theoretically, the results of this study can be explained through constructivism, which emphasizes that students construct their understanding through direct experience. In the Ecomini activity, students not only receive material from the teacher but also experience firsthand the process of transactions and the division of roles, making economic concepts easier to understand. These results are also consistent with experiential learning theory, as students learn through direct practice and then understand and apply those experiences in subsequent activities. Furthermore, social interaction theory also supports these findings, as during buying and selling activities, students actively communicate, discuss, and negotiate with their peers. Such interactions help students strengthen their understanding through collaboration and the exchange of ideas.

In terms of student engagement, these findings align with those of Aura et al. (2023), who state that role-playing enhances 21st-century skills such as communication and decision-making. Meanwhile, Dewi et al. (2023) also found that role-playing improved student engagement in economics learning, even without integrating STEM. Nindialisma et al. (2025) confirm that role-playing improves student cooperation and communication, while Kalkautsar et al. (2024) demonstrate improved communication skills in social studies learning. Zalsa et al.

(2025) through a literature review, also confirm that the STEM approach is effective in enhancing critical thinking skills among elementary school students. These findings indicate that integrating STEM and role-playing through Ecomini can foster a more active, contextual, and effective approach to economic learning, thereby helping elementary school students develop their economic literacy more effectively.

This study has several limitations that should be considered when interpreting the findings. First, the sample was limited to two elementary schools in Conggeang Subdistrict. As a result, the findings may not fully represent the implementation of Ecomini-based STEM learning in elementary schools with different characteristics or learning contexts. Second, the intervention was conducted in only two learning sessions, which limited the opportunity to observe the longer-term development of students' economic literacy. These limitations suggest that further studies are needed with a broader sample and a longer implementation period in order to strengthen the findings and provide a more comprehensive understanding of the effectiveness of Ecomini-based STEM learning in elementary school economic literacy instruction.

Conclusion

Based on the results of the study, STEM learning through Ecomini has been shown to contribute positively to improving economic literacy among elementary school students. Learning activities that involve role-playing, analyzing simple transactions, and making economic decisions ensure that students not only receive material from teachers but are also directly involved in the learning process, making their understanding of economic concepts more concrete and easier to grasp. The main contribution of this study lies in the application of Ecomini as a learning medium integrated with the STEM approach to support economic literacy in elementary schools. These findings also highlight a distinction from previous studies, which typically addressed the STEM approach or role-playing methods separately; in contrast, this study integrates both into a single contextual learning activity closely aligned with students' daily experiences. Nevertheless, this study has limitations regarding the relatively small sample size and the short duration of the intervention. Therefore, future research is recommended to involve a larger sample and be conducted over a longer period to provide a more comprehensive picture of the effectiveness of Ecomini-based STEM learning in various educational contexts.

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