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The Effect Of The Scramble Learning Model On The Critical Thinking Abilities Of Grade 2 Students In The Science Subject At Donggobolo Elementary School

Ayu selvitriana [1], Sri Suryaningsi [2], Jessy Parmawati Atmaja[3]
STKIP Harapan Bima[123]

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Abstract
The background of this research stems from the importance of mastering critical thinking skills from an early age in elementary school, especially in facing the rapid development of science and technology. The purpose of this study was to determine the effect of the Scramble learning model on the critical thinking abilities of second-grade students in the IPAS subject at SDN Donggobolo. This research employed a quantitative approach using a quasi-experimental design in the form of a nonequivalent control group design. The research subjects consisted of all second-grade students at SDN Donggobolo, totaling 33 students, comprising 16 students in the experimental class and 17 students in the control class. The instrument used was an essay test designed to measure students' critical thinking skills. The data analysis technique was carried out through several stages, namely prerequisite tests including normality and homogeneity tests, followed by hypothesis testing using an independent sample t-test. The results of the analysis indicated that the significance value (2-tailed) was 0.001 < 0.05, thus rejecting the null hypothesis (H_o) and accepting the alternative hypothesis (H_a). Therefore, it can be concluded that the use of the Scramble learning model has a significant effect on improving the critical thinking skills of second-grade students. These findings suggest that the implementation of the Scramble learning model can serve as an innovative instructional strategy to enhance the quality of the teaching and learning process, particularly in IPAS learning at the elementary school level.

Corresponding Author:
Ayu selvitriana
STKIP Harapan Bima

1. INTRODUCTION

In the elementary school curriculum, science plays a crucial role in fostering curiosity, critical thinking skills, and building character and social awareness through project-based learning and real-world experiences (Helzi et al., 2024). Critical thinking is a key competency needed by students in this modern era to analyze information, evaluate arguments, and formulate innovative solutions.

complex problems. This ability is the foundation for individuals to effectively process and understand information from various sources, make informed decisions, and solve problems rationally (Nugrahani & Hardini, 2021; Sasmita et al., 2023; Rahmawati et al., 2023). Amidst the rapid pace of information change, critical thinking equips students with the capacity to not only receive information but also question, analyze, and form their own views in a logical and structured manner (Fajari, 2021; Estuhono & Efendi, 2024).

The Natural Sciences (IPAS) subject provides a platform for students to develop their critical thinking skills. It is designed to help students understand basic scientific concepts and social issues, encouraging them to think critically and solve problems related to everyday life (Kurniasih, 2021; Yohamintin & Huliatunisa, 2023). The integration of science and social studies materials into one subject aims to enable students to see the relationship between natural and social phenomena and develop holistic problem-solving skills, making it highly relevant to students' cognitive development (Riadi et al., 2023; Jumanto & Mustofa, 2023).

Although the importance of critical thinking skills has been widely recognized, the reality on the ground shows that the level of critical thinking skills of elementary school students, including initial observations at SDN Donggobolo, still tends to be low (Rahmawati et al., 2023; Sasmita et al., 2023; Yuliani et al., 2022). Low critical thinking skills in students can also hinder students from understanding the subject matter in depth, difficulty in solving problems, and a lack of initiative to ask reflective questions (Fajari, 2021; Komalasari et al., 2021). Students' low critical thinking skills are often caused by a learning model that is still teacher-centered and a lack of learning activities that require students to think actively. These challenges often stem from learning methods that are still conventional, less interactive, and tend to be teacher-centered, thus limiting students' opportunities to discuss, analyze, or evaluate information independently (Nugrahani & Hardini,

2021), (N & Taufina, 2020). Therefore, learning innovations are needed that can encourage active student involvement in the learning process.

In science learning at Donggobolo Elementary School, teachers and students often face various challenges that affect the effectiveness of the teaching and learning process. Teachers often experience difficulties in integrating science and social science materials in a balanced manner due to limited understanding of science concepts, a lack of supporting facilities, and a dense curriculum that limits learning time (Agus Syahputra et al., 2022). Furthermore, the science material presented is often not contextualized to students' daily lives, making it difficult for students to understand the concepts and less motivated to actively participate in learning. Other obstacles that arise are the minimal use of interesting and interactive learning media, as well as limited school infrastructure, which impacts students' low interest and understanding of science material (Marisol Solis-Foranda et al., 2021).

The scramble learning model, as an innovative learning model, offers a different approach to the learning process. This learning model involves students in the activity of shuffling and rearranging information or concepts they have learned. (Hasan et al., 2023). The Scramble model is an active learning strategy that involves students in rearranging pieces of information into meaningful forms, thus encouraging them to think logically and analytically (Lestari et al., 2021; Hasriani & Masruddin, 2020). This model is very suitable for elementary school students because of its interactive and game-based nature, making the learning process more enjoyable and participatory, and training students' cognitive abilities through information restructuring (Alfaris, 2021; Heinrich et al., 2024).

Several studies have demonstrated the effectiveness of the scramble model in improving learning outcomes and critical thinking skills. Research by Surya (2024) demonstrated a significant increase in critical thinking skills in science students after implementing the scramble model. Similarly, Lestari et al. (2023) found that implementing scramble improved students' activeness and critical thinking to a good level.

In line with the problem formulation, this study has several objectives. First, to analyze the effect of the scramble learning model on students' critical thinking skills in science. Second, to determine the extent to which students' critical thinking skills improve after implementing the scramble learning model in science.

2. MATERIALS AND METHODS

A. Materi

Theoretical Study

- Science Subject for Grade 2 Elementary School

  Natural and Social Sciences is a curriculum innovation at the elementary school level that integrates science and social studies into a single unit. This integration is based on the understanding that elementary school-aged students, particularly in the early grades, such as second grade, have a holistic perspective and do not yet rigidly separate natural and social phenomena. Science learning is designed to equip students with relevant knowledge, skills, and attitudes to understand their natural and social environments.

Social Sciences (IPAS) learning for second-grade elementary school students focuses on understanding basic human needs and how to maintain a healthy and clean environment. Basic human needs include nutritious food, appropriate clothing, comfortable housing, and health-promoting activities such as exercise, adequate rest, and handwashing. In addition, children are introduced to the importance of maintaining a clean environment, disposing of waste properly, and maintaining water and air quality. This aligns with findings (Halimah, Hardiyanto, and Rusdinal, 2023), which emphasize differentiated learning as a form of implementing the independent curriculum, allowing teachers to adapt methods and materials to students' abilities and interests to make learning more effective and enjoyable.

The scramble learning model is an active learning strategy that involves students in randomizing and rearranging information or concepts that have been learned. The syntax of this model consists of six stages: (1) conveying objectives and preparing students, (2) presenting information, (3) forming groups, (4) arranging concept cards randomly, (5) rearranging information, and (6) presenting results. This approach encourages students to think logically, analytically, and creatively, as well as increasing activeness and cooperation among students.

In implementing the inquiry-based learning model, Hayati and Utomo (2020) stated that students are more active and engaged in the learning process through observation, simple experiments, and critical questioning. For second-grade elementary school students, this approach can be implemented through environmental observation activities, comparing hands before and after washing, or observing the difference between a clean and dirty environment. In this way, students not only passively receive information but also experience direct learning, making the concepts of health, hygiene, and basic human needs easier to understand and apply in everyday life.

The importance of innovation in science learning, including the use of interactive media, images, cartoons, and educational games, as well as field activities to observe the real environment. For grade 2 elementary school, teachers can use visual media such as posters, illustrations of nutritious food, or role-playing games to maintain cleanliness (Meylovia and Julianto, 2023). This innovative approach helps students understand concepts concretely, increases learning interest, and makes learning more interesting and relevant to their experiences. It also highlights the opportunities and challenges of implementing the independent curriculum, which provides flexibility for teachers in adapting learning methods to student characteristics, but requires creativity and good classroom management skills. In practice, grade 2 elementary school teachers can design real-life activities such as making cleanliness posters, role-playing environmental protection, or mini-classroom cleaning projects (Ragil Nazar, Nasir, Bagea, and Abubakar, 2024). This strategy allows students to apply science knowledge directly in everyday life, while fostering a caring attitude towards health and cleanliness.

Yanti et al. (2024) emphasized the importance of comprehensive learning evaluation in the era of the Industrial Revolution 4.0, including the use of digital media and practical activity-based assessments. For second-grade elementary school students, evaluation can be conducted through direct observation, assignments to create posters or drawings related to cleanliness, and group discussions on how to maintain health and the environment. This activity-based evaluation assesses not only conceptual understanding but also students' attitudes and practical skills, allowing teachers to adapt learning strategies to achieve the goals of the independent curriculum.

Research by Istiqomah et al. (2025), Isro'Hidayatullah et al. (2025), Ilham et al. (2024), and Muslimin et al. (2025) shows that students often have difficulty understanding the concept of science and science due to its abstract nature and lack of visual media.

Therefore, material for grade 2 elementary school must be presented simply, concretely, and contextually with everyday experiences, through demonstrations, direct observation, visual media, and simple practices. With this active, innovative, and differentiated approach, students can understand basic human needs, the importance of maintaining cleanliness and health, and foster a caring attitude towards themselves and the surrounding environment, in accordance with the principles of the independent curriculum.

B. Research Methods

This study uses a quantitative approach with a quasi-experimental research design. Nonequivalent control group design, namely a design that involves two randomly selected groups, but both are given a pretest and a posttest. The experimental group will be given treatment in the form of a scrambled learning model, while the control group will use conventional methods that are usually applied by teachers in the classroom. The following is the research design in Table 1:

Table 1. Research Design

No	Class	Treatment	Measurement
1	AND	X	THE
2	K	–	THE

The population in this study was 2nd-grade students of SDN DONGGOBOLO in the 2024/2025 academic year. Sampling used (purposive sampling) consisted of 33 students, which was a design that included 2 groups being observed, namely one class divided into an experimental group and a control group, each of which consisted of around 16-17 students. Class selection was based on practical considerations, taking into account the similarity of characteristics between the two groups in terms of initial abilities, number of students, and learning background.

The instrument used in this study was a descriptive test that was assessed for its discriminatory power, difficulty level, validity, and reliability. This test was used in the pretest (before treatment) and posttest (after treatment) to measure changes in critical thinking skills.

The data collection technique was carried out by administering a pretest and a posttest to two groups. The pretest was conducted before the treatment was given to determine students' initial abilities, while the posttest was conducted after learning to determine student changes after the treatment. The data analysis technique used the t-test (independent sample t-test) with SPSS at a significance level of 5% to see the effect of the scramble model on students' critical thinking abilities in the experimental and control classes.

Research Implementation Stage

The first stage was research planning, which began with observations at the school to identify the initial conditions of science learning and the students' critical thinking skills. Next, the researchers developed learning materials consisting of teaching modules, worksheets (LKK), and descriptive test instruments.

The second stage is the implementation of the research, which was carried out in four meetings.

- In the first meeting, the researcher gave a pretest to both classes to determine students' initial critical thinking abilities.
- In the second and third meetings, the treatment was carried out. In the experimental class, the teacher implemented the Scramble learning model with the steps specified in the teaching module, such as randomizing and rearranging pieces of information to form meaningful concepts. Meanwhile, the control class learned using simple lecture and discussion methods based on the students' textbook.

- In the fourth meeting, both classes were given a posttest to measure the increase in critical thinking skills after the treatment was carried out.

The data processing process was carried out using a descriptive and inferential statistical approach using SPSS software version 26. Descriptive analysis includes calculating the average (mean), standard deviation (standard deviation), minimum, and maximum values.

$$g = \frac{\textbf{Shoes posttest} - \textbf{Shoes pretest}}{\textbf{Shoes maximum} - \textbf{Shoes Prettest}}$$

The analysis requirements examination involves a normality test applied with a significance criterion greater than 0.5 to declare the data normally distributed, while the homogeneity test is performed using Levene's Test (data is considered homogeneous if the significance > 0.05). If these requirements are met, hypothesis testing is continued with an Independent Sample t-test, where the null hypothesis (H_0) is rejected if the significance is < 0.05.

3. RESULTS

This study shows that the application of the learning model Scramble had a positive influence on improving students' critical thinking skills in science subjects in grade 2 of SDN Donggobolo. Students in the experimental class showed better development compared to the class using the conventional learning model. This was evident in the students' increased activeness in the learning process, their ability to analyze problems, and their courage in expressing opinions.

Before the lesson began, students were given a descriptive pretest to assess their initial abilities. This test aimed to determine the extent of students' understanding before being given treatment using the Scramble learning model. The test consisted of eight descriptive questions that students had to answer in writing. The following presents the pretest results for the experimental and control classes. Students' critical thinking skills based on the pretest and posttest can be seen in Table 2:

Table 2. Pretest and Posttest Results of Experimental and Control Classes

Class / Data Type	Experiment		Control	
	Pretest	*Posttest*	*posttest*	*Pretest*
Shoes Minimum	42	40	35	62
Maximum Score	65	63	38	65
Rate-rate (Mean ± SD)	52,3 ± 6,2	78,5 ± 5,8	82,3 ± 6,4	48,7 ± 7,3
	61,2 ± 7,1	51,8 ± 6,5	63,5 ± 8,2	49,2 ± 7,8
Number of Students	16	17	16	17
Number of Questions	8	8	8	8

During the treatment, students in the experimental and control classes studied the material in two sessions. The experimental class used the Scramble learning model, while the control class studied without it. In the fourth session, students were given a posttest consisting of eight essay questions to measure their progress. The results showed that the experimental class experienced greater progress than the control class, confirming the effectiveness of the Scramble learning model in improving second-grade students' understanding.

Based on the table above, after the experimental class was given treatment using the Scramble learning model, the average posttest score was 78.5. Meanwhile, in the control class, the average posttest score was 82.3. These results indicate an increase in student learning abilities after the implementation of the Scramble learning model treatment.

Next, data hypothesis testing was conducted to determine whether the data distribution was normally distributed. Data were analyzed using normality tests, homogeneity tests, and independent t-tests. The testing criteria used were: if the sig value > 0.05, then the data is normally distributed, and if the sig value < 0.05, then the data is not normally distributed. The results of the data calculations obtained can be seen in the following table:

Table 3. Results of the Normality Test (Kolmogorov–Smirnov Test)

Questionnaire Results	**Class**	**Kolmogorov–Smirnov**			**Data Distribution**
		Statistic	df	Say	
Pretest	Experimental Class	0.167	16	0.061	Normally distributed data
	Control Class	0.142	16	0.057	Normally distributed data
Posttest	Experimental Class	0.176	17	0.200	Normally distributed data
	Control Class	0.158	17	0.182	Normally distributed data

Based on the results of the normality test presented in Table 3, the significance value obtained for the pretest data of the experimental class was 0.061, and the pretest of the control class was 0.057. Both values are greater than 0.05, so it can be stated that the pretest data in both classes are normally distributed. Furthermore, the posttest data for the experimental class obtained a significance value of 0.200, and for the control class was 0.182. Both values are also > 0.05, so the posttest data in each class are declared normally distributed. The complete results of the homogeneity test calculation are presented in the following table:

Table 4. Results of the Homogeneity of Variance Test (Levene Test)

Variables	**Levene Statistic**	**df1**	**df2**	**Mr. (p)**	
Experiment (Posttest)	0,842	1	31	0,367	Homogen
Control (Pretest)	1,125	1	31	0,298	Homogen

Based on the results of the homogeneity test carried out using Levene's Test, the significance value (Sig.) obtained for the experimental class posttest data was 0.367, and in the pretest data of the control class amounted to 0.298. This value is greater than the significance level used, namely σ = 0.05, so that **0,367 > 0,05** and **0,298 > 0,05**.

Thus, it can be concluded that the data in the experimental and control classes have the same variance or are homogeneous. This indicates that the distribution of student grades between the two groups is at a balanced level of uniformity, so that the data meets the requirements for a t-test to determine the differences in learning outcomes between the two classes after being given the learning model treatment of *Scramble*. The complete results of the t-test calculation (independent sample T-test) are presented in the following table:

Table 5. Results of the Independent Sample T-Test: Pretest and Posttest

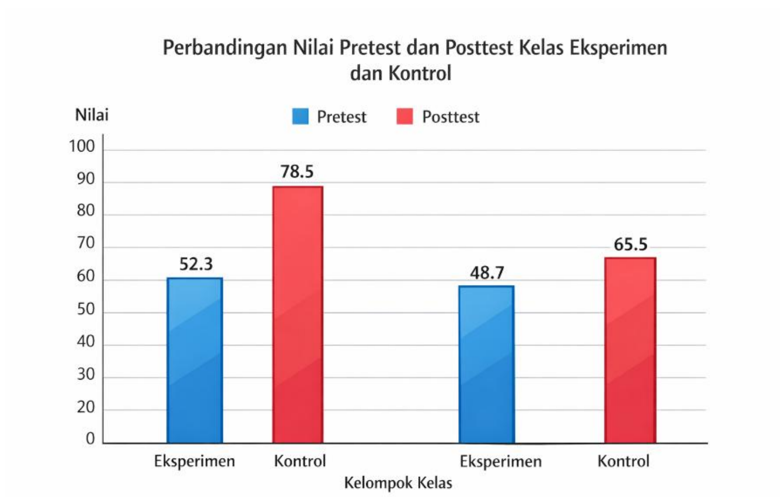
Variables	t - Count	df	Sig.(2-tailed)	Information
Experiment-Control (Pretest)	1,142	31	0,262	Significant
Experiment-Control (Posttest)	3,957	31	0,001	Significant

The independent t-test revealed a highly significant difference between the experimental and control groups in both variables. Based on the results of the Independent Sample T-Test calculations, the values obtained were t-count **= 2.136**with significance value Sig**. (2-tailed) = 0,039 < 0,05**This indicates a significant difference between the learning outcomes of students in the experimental and control classes during the posttest. Therefore, it can be concluded that the learning model applied to the experimental class has a better effect on students' critical thinking skills than the control class. The complete results of the N.gain calculation are presented in the following table:

Table 6. Distribution of N-gain in Both Groups

Group	Currently	Low	Rate-rate N gain	Category
Experiment-Control (Pretest)	52,3	48,7	55% (Pretest-Posstest)	Currently Low
Experiment-Control (Posttest)	78,5	65,5	33%(Pretest-Posstest)	Currently Low

The results of the N-gain analysis showed that the experimental group achieved an average N-gain of 0.55 (medium category), while the control group only achieved 0.33 (low category). The data revealed a striking difference in the posttest distribution of the two groups. In the experimental group, the majority of students rose to the high category (78.5%), and the medium category (65.5%), with the low category dropping to 33%. Conversely, in the control group, the majority of students remained predominantly low (55%) in the pretest, with only minimal increases. This variation in distribution further confirms the finding that the experimental intervention was more effective.



The table and graph above explain the higher increase in critical thinking skills of second-grade students at Donggobolo Elementary School in the experimental class compared to the control class, indicating the effectiveness of active learning methods. This method encourages students to actively participate in discussions and problem-solving, thereby significantly improving their analytical and evaluation skills. Research by Rabina Fajra et al. (2023) shows that active learning is more effective than conventional methods in improving critical thinking skills in elementary school students. In addition, Eka Tusyana (2025) emphasizes the importance of the teacher's role as a facilitator and a learning environment that supports the success of this method. Adireza et al. (2024) also prove a significant increase in critical thinking skills through the gradual implementation of active learning methods.

The significant difference in learning outcomes between the experimental and control classes indicates that the scramble model is more effective in developing critical thinking skills in second-grade students (Aristanti & Fatayan, 2024). Conventional learning, which tends to be passive, does not sufficiently encourage maximum student engagement and thinking activity (Bhardwaj et al., 2025; Siew & Rahman, 2022). The scramble model provides a challenging and collaborative learning environment that strongly supports the development of these thinking skills (Loyens et al., 2023).

These fun and challenging learning activities are believed to increase student motivation and active participation in the learning process (Bungati, 2024), thus accelerating conceptual understanding and developing critical thinking skills. Conversely, conventional, more passive learning fails to encourage students to think deeply and actively.

Statistically and practically, data show that implementing the scramble learning model can be a solution for improving elementary school students' critical thinking skills, particularly in science subjects, which require a comprehensive and integrative understanding of concepts (Kumala et al., 2020). This model is also able to address learning challenges often faced by teachers, such as limited media and student motivation.

The significant improvement in grades in the experimental class demonstrates that the Scramble learning model is capable of creating an active, interactive, and collaborative learning environment. During the learning process, students not only passively receive information but are also required to think critically in reconstructing the scrambled concepts. This activity trains students to analyze, evaluate, and synthesize information, thus optimally developing their critical thinking skills.

These results align with the findings of Lestari et al. (2023) and Surya (2024), who stated that implementing the Scramble model can improve students' critical thinking skills and learning engagement. The fun, game-based learning environment encourages students to be more enthusiastic and confident in expressing their opinions. The Scramble model also addresses the tendency toward monotony and teacher-centered conventional learning.

4. CONCLUSION

The results of the study indicate that the implementation of the Scramble learning model has a significant effect on the critical thinking skills of 2nd-grade students of SDN Donggobolo. The posttest results showed a significant increase in the experimental class (mean 78.5 ± 5.8) compared to the control class (mean 65.5 ± 6.5), supported by an independent t-test (Sig. $0.001 < 0.05$), normality test ($p > 0.05$), and homogeneity ($p > 0.05$). These findings confirm that the activities of randomizing, restructuring concepts, and presentations in the Scramble model effectively stimulate students' abilities to analyze, evaluate, and synthesize information. This study recommends that teachers adopt the Scramble model as an innovative strategy in science learning. This model not only improves conceptual understanding but also fosters a culture of discussion, analytical thinking, and group collaboration, in line with the critical thinking dimensions of the Pancasila Student Profile. However, this study has several limitations, such as the relatively short treatment duration (4 meetings) and limited sample size (33 students), so the results cannot be widely generalized. Therefore, further research is recommended to explore the application of the Scramble model to other science subjects or different classes.

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