



Critical & Creative Thinking Ability given the Inquiry Component in Elementary School Science Lessons

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ABSTRAK

Salah satu keterampilan abad ke-21 tersebut yakni keterampilan berpikir kritis (*critical thinking*) dan keterampilan berpikir kreatif (*creativities*). Keterampilan ini diperlukan oleh seseorang agar berhasil menghadapi tantangan, kehidupan yang semakin kompleks dan penuh dengan ketidakpastian, serta agar berhasil dalam hidup dan karir di dunia kerja. Penelitian ini bertujuan untuk menganalisis kemampuan berpikir kritis dan kreatif ditinjau dari komponen inkuiri dalam pembelajaran IPA di sekolah dasar. Sampel penelitian yaitu siswa sekolah dasar dengan jumlah 31 siswa. Teknik pengumpulan data yang digunakan dalam Penelitian ini adalah observasi, tes, wawancara, dan dokumentasi. Metode penelitian eksperimen yang digunakan dalam penelitian ini adalah *quasi experimental*. *Quasi experimental* digunakan agar peneliti dapat menganalisis perbedaan dari kedua perlakuan pada kelas kontrol dan kelas eksperimen. Desain penelitian yang digunakan adalah *non-equivalent control group design*. Hasil analisis keterampilan berpikir kritis dan kreatif terhadap model inkuiri kelas kontrol yaitu 45,3% dan 54,7%, sedangkan untuk kelas eksperimen memperoleh 65,5%. Sehingga pengaruh model inkuiri siswa kelas eksperimen lebih tinggi dengan kelas kontrol. Model Inkuiri terhadap keterampilan berpikir kritis dan kreatif berpengaruh positif, Dengan penelitian ini dapat disimpulkan dengan adanya model inkuiri dapat meningkatkan keterampilan berpikir kritis dan berpikir kreatif siswa kelas V SD pada pembelajaran IPA.

ABSTRACT

The 21st-century skills are critical thinking skills and creative thinking skills. These skills are needed by someone to be successful in facing challenges, an increasingly complex and uncertain life, and to be successful in life and career in the world of work. This study aims to analyze critical and creative thinking skills in terms of the inquiry component in science learning in elementary schools. The research sample is elementary school students, with a total of 31 students. Data collection techniques used in this study were observation, tests, interviews, and documentation. The experimental research method used in this research is *quasi-experimental*. *Quasi-experimental* is used so that researchers can analyze the differences between the two treatments in the control class and the experimental class. The research design used was a *non-equivalent control group design*. The results of the analysis of critical and creative thinking skills for the control class inquiry model were 45.3% and 54.7%. In comparison, the experimental class obtained 65.5%, so the influence of the inquiry model on experimental class students is greater than the control class. The inquiry model has a positive effect on critical and creative thinking skills. With this research, the inquiry model can improve the critical thinking skills and creative thinking of fifth-grade elementary school students in science learning.

1. INTRODUCTION

Changes or developments in education are things that are supposed to happen in line with life changes. Changes in improving education at all levels need to be continuously made in anticipation of future interests (Diputra, 2016; Yasmini, 2022). Education that can support development in the future is education that can develop the potential of students so that those concerned can face and solve the

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problems of life they face (Azhar Juliantri et al., 2017; Saugi, 2020). In the 2013 curriculum, teachers are expected to be able to equip students with 21st-century skills. Skills development to prepare for Indonesia's golden generation. One 21st-century skill is critical thinking and creative thinking (Mitra & Purnawarman, 2019; Pramudyani, 2020). These skills are needed by someone to be successful in facing challenges, an increasingly complex and uncertain life, and success in life and career in the world of work (Rosnaeni, 2021; Sari & Montessori, 2021). However, in reality, teachers still use the lecture method and have not used interesting methods and models for students, so they still tend to be passive, and their level of creativity is low (Neka et al., 2019; Umam & Jiddiyah, 2021). Students find it difficult to express their ideas because they only listen to the teacher's explanation (Rifa Hanifa Mardhiyah et al., 2021; Sari & Montessori, 2021). Students have yet to find other alternatives to solve the problem. Based on the results of early study observations in fifth grade at SDN Gugus Subroto, Pringapus District, Semarang Regency, in the achievement of learning outcomes, many students still need to reach the specified minimum completeness criteria, which is greater than 70. Many factors influence, including strategies and techniques teaching teachers who need to be more right or the facilities/media used, are less varied and not following the conditions of students. There are still many students who need help expressing their ideas. Students still find it difficult to express the difficulties they face in learning. The low awareness of student learning can be seen from students' lack of enthusiasm to learn during learning. Many still talk to themselves, disturb their friends, and do not pay attention to the teacher when explaining. There are still many educators who use conventional methods in a monotonous manner in classroom learning activities so that the learning atmosphere seems stiff and dominated by the teacher. If these problems are immediately resolved, they will impact student learning outcomes to be high.

The solution to overcome these problems is by implementing inquiry learning. The guided inquiry learning model is one of the appropriate learning models for classroom conditions where students' abilities vary. The guided inquiry learning model is learner-centered. Students are also trained to develop thinking skills. Students are trained to think critically. In addition, it can generate enthusiasm for learning in students (Akbar, 2016; Mamun et al., 2022). The inquiry learning model is an activity that includes many activities (Ain & Mitarlis, 2020; Bambang Sri Anggoro, 2016). Teacher inquiry learning provides a problem, so students have curiosity about something to build student motivation (Muliani & Wibawa, 2019). Then students investigate the existing data and assemble the data obtained from each other in their opinion, and they will organize their knowledge. In the inquiry learning process, some activities require critical and creative thinking skills in carrying out assignments (Yasmini, 2022). Inquiry method activities can meet four criteria: clarity, suitability, accuracy, and complexity. Students are placed as learning subjects. The role of the teacher in learning with the inquiry method is as a guide and facilitator (Zani et al., 2018). The teacher's task is to choose a problem that needs to be presented to the class to solve. In this regard, the existence of an inquiry model can improve the critical thinking skills and creative thinking of fifth-grade elementary school students in science learning with the theme Health is Important.

Previous research findings stated that the Guided Inquiry Method improves Fifth Grade Students' Science Learning Outcomes (Yasmini, 2022). We apply the guided inquiry learning model to improve student's learning outcomes and science process skills (Zani et al., 2018). There are differences between problem-based and guided inquiry learning models on students' critical thinking skills (Diani et al., 2016; Kusumasari et al., 2022). Increased understanding of science concepts using guided inquiry learning models in elementary schools (Nurmalena, 2017; Tut Wuri Handayani, 2018). Application of inquiry learning methods to improve civic education learning outcomes (Wairata, 2021). The research activities are guided by the implementation of previous research by comparing previous research results to find the content's relevance. The research content is the topic related to the description of the theory used. The differentiating element found in several previous studies lies in using inquiry models to improve critical and creative thinking skills by carrying out activities to find the truth of the material from the learning resources used. This study aimed to analyze critical and creative thinking skills in terms of the inquiry component in learning science in elementary schools.

2. METHOD

The experimental research method used in this research is Quasi-Experimental. Quasi-Experimental is used because it is difficult to get a control group used for research. Quasi-Experimental is used so that researchers can analyze the differences between the two treatments in the control class and the experimental class. The research design used was a non-equivalent control group design. The population used in this study was the fifth-grade students at SDN Gugus Gatot Subroto, Pringapus, Kab. Semarang. The sampling technique is random sampling. Simple random sampling is the simplest sampling where the sampling is done randomly without regard to strata in the population. Class distribution at SDN

Gugus Gatot Subroto, Pringapus, Kab. Semarang is carried out homogeneously with even distribution of exam results in the previous class. Identify problems with learning science in schools that will be used as research sites for empirical and theoretical data. Empirical data were obtained from various references, while theoretical data were obtained by conducting question-and-answer sessions with fifth-grade teachers at SD Langensari 04. The data obtained were studied to determine the solution to overcome the problems.

Data collection techniques used observation, tests, interviews, and documentation. Research instruments are tools or facilities used by researchers in collecting data so that their work is easier and the results are better, in the sense that they are more accurate, complete, and systematic so that they are easy to process (Agung, 2014). In this study, the instrument used was a test sheet. The form of the test used is a descriptive test. The essay test is a type of question that emphasizes the subjectivity of students. The description test in this study aims to measure the ability to think critically in science. This test is seen not only from the students' answers, right or wrong, but also from the answer indicators that measure critical thinking skills previously checked and validated by experts. The instrument is validated for use after being found valid and reliable. The analysis of this inquiry model is to determine the increase in critical thinking skills and creative thinking skills in the inquiry model compared to conventional models. Testing the hypothesis in analyzing the inquiry model used the N-Gain test to determine the increased understanding of concepts before and after treatment. The t-test was used to see significant differences in understanding concepts in the control and experimental classes. The t-test was used to test the hypothesis of significant differences in increasing understanding of concepts in the control and experimental classes. The hypothesis test in this study was that there was no difference in understanding the concept in the control and experimental classes. There are differences in understanding the concept in the control and experimental classes. Observation sheet on implementing the inquiry learning model that teachers commonly use. This observation sheet measures the increased critical and creative thinking skills in ongoing learning. Observations were used using a rating scale. In this observation, some guidelines are adjusted to the indicators that have been formulated. This observational data is used to strengthen the tests given to students.

3. RESULT AND DISCUSSION

Result

The experimental research method used in this research is Quasi-Experimental. The learning outcomes of students' critical and creative thinking abilities in the control group (traditional classroom learning) and the experimental group (inquiry model) are in Table 1.

Table 1. Description of the Score of Students' Critical Thinking Skills and Creative Thinking Abilities

Acquisition aspect	Control Group		Experiment Group	
	Pretest	Posttest	Pretest	Posttest
Critical thinking skills				
The highest score	75	85	80	95
Lowest score	65	65	70	75
Average score	70.2	72.4	72.1	85.6
Creative thinking ability				
The highest score	80	82	80	96
Lowest score	66	70	70	76
Average score	70.9	73	71.8	86.7

Table 1 shows increased students' scores in the control and experimental groups. However, the range of improvement in student scores in the experimental group was further away, from the lowest score of 70 and the highest score of 96. Meanwhile, in the control group, the range of lowest scores did not differ much from the highest scores. The categories of students' critical and creative thinking skills are presented in Table 2.

Table 2. Categories of Students' Critical Thinking Skills and Creative Thinking Skills

Variable	Category	Control Group				Experiment Group			
		Pretest		Posttest		Pretest		Posttest	
		n	%	n	%	n	%	n	%
Critical	Very high	0	0	4	12.9	2	6.4	30	96.8

Variable	Category	Control Group				Experiment Group			
		Pretest		Posttest		Pretest		Posttest	
		n	%	n	%	n	%	n	%
Thinking Ability	High	31	100	27	87.1	29	93.6	1	3.2
	Moderate	0	0	0	0	0	0	0	0
Creative Thinking Ability	Very high	1	3.2	2	6.4	1	3.2	29	93.6
	High	30	96.8	29	93.6	30	96.8	2	6.4
	Moderate	0	0	0	0	0	0	0	0

The average student score is in the control and experimental groups' high category. The average learning outcomes (post-test) of students in the experimental group is 85.6, and the learning outcomes of students in the control group are 72.4. Judging from these data, it can be concluded that the average score of the experimental group students is higher than the average score of the control group. The results showed a significant increase in scores in the experimental group where learning used the inquiry method. This finding is based on the increase in the average pretest and post-test scores, from 72.1 to 85.6 for critical thinking skills and an average score of 71.8 to 86.7 for creative thinking skills. From the analysis results, the average student in the control group had high critical thinking skills during the pretest and post-test. Whereas in the experimental group, the average student has high critical thinking skills during the pretest, increasing to very high during the post-test. From the results of this analysis, using the inquiry method can improve students' critical thinking skills. The results of the N-Gain analysis are in [Table 3](#).

Table 3. The Results of the n-Gain Test Analysis in The Experimental Group

Group	Kemampuan Berpikir	N-Gain Score	Criteria	N-Gain (%)	Interpretation
control	Critical	0.164	Low	16.4	Ineffective
	Creative	0.139	Low	13.9	Ineffective
Experiment	Critical	0.606	Moderate	60.6	Effective enough
	Creative	0.621	Moderate	62.1	Effective enough

Based on the analysis results, the inquiry model is effective enough to improve students' critical and creative thinking skills in the experimental group with the moderate N-Gain score category. In the control group, the N-Gain score on students' critical and creative thinking skills is in a low category, so it can be concluded that the conventional model (traditional classroom learning) is ineffective in improving student learning outcomes. The N-Gain score for the student's critical thinking skills in the experimental group was 0.606 in the moderate category. From the results of the N-Gain score, the inquiry method is quite effective. In the control group, the N-Gain score on students' critical thinking skills was 0.164 in the low category. Based on the N-Gain score obtained, it can be concluded that the inquiry model approach is better than the conventional model (traditional classroom learning) in improving students' critical thinking skills. The N-Gain score on students' creative thinking ability in the control group was 0.139, while in the experimental group, it was 0.621. The control class experienced an increase in learning outcomes with a low category, while the experimental class experienced a moderate increase in learning outcomes. Based on the N-Gain score, it can be concluded that the inquiry model is quite effective in increasing students' creative thinking abilities compared to the conventional model (traditional classroom learning). In addition, Neka said that the N-Gain score in the group of students who were given the inquiry method learning was higher than those who were not given learning without the inquiry method ([Neka et al., 2019](#)). Differences in students' critical and creative thinking abilities before and after treatment in the control and experimental groups. Analysis of differences in pretest and post-test scores for students in the control group and the experimental group used the Wilcoxon test because the normality test results showed that the data distribution of student scores was not normal, and the data were heterogeneous. The results of the analysis of hypothesis testing using the Wilcoxon test are presented in [Table 4](#).

Based on [Table 4](#), the average score shows differences in students' critical and creative thinking abilities before and after learning in the control group ($\alpha < 0.05$). Therefore, it can be concluded that conventional methods (traditional classroom learning) affect students' critical and creative thinking skills in science learning. The same thing was found: significant differences in students' critical and creative

thinking skills in the experimental group before and after learning using the inquiry method ($\alpha < 0.05$). These results indicate an influence of the inquiry method on students' critical and creative thinking skills in science learning. The difference in the mean post-test scores of the control and experimental groups was analyzed using the Mann-Whitney test because the distribution of the score data was not normal and heterogeneous (not homogeneous). The results of the Mann-Whitney test analysis are presented in Table 5.

Table 4. Results of Wilcoxon Test Analysis

Group	Kemampuan berpikir	Mean Rank	Z	p-score
Control	Critical	7.00	-3.50	0.000
	Creative	10.00	-3.90	0.000
Experiment	Critical	16.00	-4.94	0.000
	Creative	16.00	-4.87	0.000

Table 5. Results of the Mann-Whitney Test Analysis

Variable	Group	Mean Rank	Z	p-score
Critical	Control	17.05	-6.356	0.000
	Experiment	45.42		
Creative	Control	16.53	-6.511	0.000
	Experiment	45.95		

Based on Table 5 shows that the p-score of students' critical thinking skills is 0.000 (< 0.05), so H_0 is rejected, and H_a is accepted. It can be concluded that there is a significant difference in the scores of students' critical thinking abilities between the control group and the experimental group. The p-score of the Mann-Whitney test on the score of creative thinking ability is 0.000 (< 0.05), then H_0 is rejected, and H_a is accepted. So there is a difference in the score of students' creative thinking abilities between the control and experimental groups. Therefore, the inquiry method effectively increases students' critical and creative thinking skills. Multivariate analysis was performed to test the interaction hypothesis between critical and creative thinking abilities. The analysis uses the MANOVA test, and the test statistic is Pillai's Trace. It is due to unfulfilled assumptions, the assumption of the similarity of the variance-covariance matrices, and the assumption of normality. The results of the multivariate analysis are presented in Table 6.

Table 6. Results of the MANOVA Test Analysis

Effect		Score	F	p-score
Intercepts	Pillai's Trace	0.998	17363.947	0.000
Group	Pillai's Trace	0.810	125.460	0.000

Based on Table 6 shows that the significance score is 0.000 (< 0.05), so it can be concluded that there are differences in the ability to think critically and creatively between students in the experimental group and students in the control group.

Discussion

The results of the statistical analysis show differences in the ability to think critically and creatively between groups of students who study using the inquiry method compared to groups who study using conventional methods (traditional classroom learning). It shows that the inquiry method better influences students' critical and creative thinking abilities than the conventional method. Learning using the inquiry method is more efficient for developing students' critical and creative thinking skills than conventional learning methods (Violadini & Mustika, 2021; Wirasti, 2014). The success of the inquiry method is measured through the post-test scores. To find out whether there is a difference in the average learning outcomes of the two groups after being given different treatments, an analysis of the average difference test is carried out using the Mann-Whitney test because the data are not normally distributed and are not homogeneous. The results of the analysis obtained a p-score of 0.000, so it can be seen that there are significant differences in the score of students' critical and creative thinking skills from the control class and the experimental class. Using conventional methods (traditional classroom learning) positively impacts students' critical and creative thinking skills. Although the average pretest and post-

test scores are not much different, there are still differences. It can happen because of the delivery of material by the teacher so that students who do not understand the concept of the material before learning begins (pretest) become more understanding of the concept of the material. The inquiry method is proven to affect students' critical and creative thinking skills in science learning. By using the inquiry method, students are directly involved in each lesson. The direct involvement of students in each stage of learning helps train students' critical and creative thinking skills because they have learned independently to find proof of truth in a concept. The inquiry approach can improve student achievement results (Fatwa, 2019; Surya, 2017; Wirasti, 2014; Yatmi, 2016). The application of the inquiry model is proven to improve science learning outcomes for elementary school students. This target can be achieved because the inquiry method emphasizes critical and analytical thinking processes to solve the problems in question (Umami et al., 2015). This finding is reinforced by the findings of previous studies, which stated that the Guided Inquiry method was used to improve students' science learning outcomes (Yasmini, 2022) applying the guided inquiry learning model to improve student's learning outcomes and science process skills (Zani et al., 2018). There are differences between problem-based and guided inquiry learning models on students' critical thinking skills (Diani et al., 2016; Kusumasari et al., 2022). Increased understanding of science concepts using guided inquiry learning models in elementary schools (Nurmalena, 2017; Tut Wuri Handayani, 2018). Application of inquiry learning methods to improve civic education learning outcomes (Wairata, 2021). The inquiry learning model can be applied to the learning process from previous research findings. This research implies that teachers are expected to be able to apply the inquiry learning model to improve critical and creative thinking skills.

4. CONCLUSION

The results showed that the ability to think critically and creatively increased in elementary school's inquiry component of learning science. There are differences in the post-test scores for creative thinking skills between students who are given traditional classroom learning and those who are given inquiry learning. It is recommended that teachers can use interesting learning models so that students are enthusiastic and excited about participating in learning. In addition, teachers can use models that are appropriate and not monotonous.

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