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The Influence of the Inquiry Learning Model on Critical Thinking in Science Learning in Grade V Elementary School

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ABSTRAK

Masih rendahnya kemampuan berpikir kritis siswa khususnya pada pelajaran IPA. Penelitian ini bertujuan untuk menganalisis pengaruh Model Pembelajaran Inkuiri terhadap kemampuan berpikir kritis siswa mata pelajaran IPA siswa kelas V SD. Jenis penelitian quasy experiment dengan rancangan Nonequivalent Control Group Design. Populasi penelitian ini adalah seluruh siswa kelas V SD sebanyak 160 siswa dengan sampel kelompok eksperimen sebanyak 34 siswa dan sebanyak 29 siswa sebagai kelompok kontrol yang ditentukan menggunakan Teknik Cluster Random Sampling. Pengumpulan data penelitian menggunakan metode tes uraian terdiri dari 9 butir soal valid. Data hasil penelitian dianalisis menggunakan teknik analisis statistik deskriptif dan teknik analisis statistik inferensial kemudian dianalisis menggunakan uji-t (rumus polled varians). Hasil penelitian menunjukkan thitung 3,923 dan ttabel 1,999 pada taraf signifikansi 5% (α sama dengan 0,05) dengan derajat kebebasan (dk) sama dengan 61 sehingga Ho ditolak. Disimpulkan bahwa terdapat pengaruh yang signifikan dari penerapan model pembelajaran Inkuiri terhadap kemampuan berpikir kritis dalam pelajaran IPA siswa kelas V SD. Penelitian ini memberikan kontribusi yang baru dalam memahami efektivitas model pembelajaran inkuiri dalam meningkatkan berpikir kritis pada siswa kelas V.

ABSTRACT

Students' critical thinking skills are still low, especially in science lessons. This study aims to analyze the effect of the Inquiry Learning Model on the critical thinking skills of students in science subjects in fifth grade elementary school students. This type of research is a quasy experiment with the Nonequivalent Control Group Design. The population of this study were all 160 students of fifth grade elementary school with a sample of 34 students in the experimental group and 29 students as the control group which was determined using the Cluster Random Sampling Technique. Collecting research data using the description test method consisting of 9 valid questions. Research data were analyzed using descriptive statistical analysis techniques and inferential statistical analysis techniques and then analyzed using the t-test (polled variance formula). The results showed that t-count was 3.923 and ttable was 1.999 at a significance level of 5% (α equal to 0.05) with degrees of freedom (dk) equal to 61 so that Ho was rejected. It was concluded that there was a significant influence from the application of the Inquiry learning model on critical thinking skills in science lessons for fifth grade elementary school students. This research makes a new contribution in understanding the effectiveness of the inquiry learning model in increasing critical thinking in fifth grade students.

1. INTRODUCTION

21st century learning is learning that integrates literacy skills, knowledge skills, skills and attitudes, as well as mastery of technology. This 21st century learning focuses on designing a learning process so that students are able to keep up with very rapid technological developments. (Ningtyas & Sihombing, 2023; Siregar et al., 2023). 21st century learning has the main goal of building students' learning abilities and supporting their development into active, independent lifelong learning. (Alhayat et al., 2023; Muthmainnah et al., 2023). So that 21st century learning requires schools to have creative thinking skills, critical thinking and problem solving, communication, and collaboration or what is commonly referred to as 4C. (Bellaera et al., 2021; Taufiqurrahman, 2023; Wardani & Budiadnyana, 2023). Of these four skills will help in cultivating

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the character of students in the ability to develop, implement and convey new ideas to others, besides that students will be able to produce innovative new discoveries. (Aziz et al., 2022; Satyawan et al., 2021; Shaleh & Jamal, 2022). One of the 21st century skills that students must have is critical thinking and problem solving (critical thinking and problem solving). Critical thinking skills are high-level thinking skills that can improve students' analytical skills in thinking critically. (Afni, 2020; Bağ & Gürsoy, 2021; Mudita et al., 2019). Therefore improving student learning outcomes can be done through the development of students' critical thinking skills in learning.

However, in reality, students' critical thinking skills in some educational institutions in Indonesia are still categorized as low (Diva & Purwaningrum, 2023; Nuryanti et al., 2021). The lack of teacher abilities and skills in choosing and developing media according to the needs of students amid the current conditions that demand the learning process to run (Atminingsih et al., 2019; Sukarini & Manuaba, 2021). Science learning is still low, such as lack of student interest in learning, students tend to be passive, only accept what the teacher says without being able to express opinions, ask questions, and answer questions (Dewi et al., 2021). This is because students feel bored with science learning which is presented by copying and lectures, the provision of visual aids in elementary schools is also a source of limitations in the learning process. In line with this research, according to the results of interviews and observations conducted, it is known that students lack enthusiasm in participating in the learning process, low levels of student confidence in learning activities, and low critical thinking skills of students, especially in science lessons. In addition, students are still less enthusiastic in participating in the learning process which results in a lack of students' active role in the learning process. Besides that, students also have low self-confidence, this causes students to tend to be passive and only become listeners or spectators when the teacher conveys learning, then the last is that students' critical thinking skills are still low, especially in science lessons. This has a huge impact on student learning activities in the classroom. Natural Sciences (IPA) is a subject in schools that can provide roles and experiences for students. In science lessons, there are lots of learning materials related to daily activities. Natural Sciences (IPA) is a subject in schools that can provide roles and experiences for students. In science lessons, there are lots of learning materials related to daily activities. Natural Sciences (IPA) is a subject in schools that can provide roles and experiences for students. In science lessons, there are lots of learning materials related to daily activities.

The solution to overcome the problem is with innovative lessons that are able to invite students to be actively involved in learning, namely by applying an inquiry learning model (Juwitasari, 2023; Zaenab, 2023). One learning model tsassahat is able to improve students' critical thinking skills is the inquiry learning model. The inquiry learning model is a learning model developed so that students find and use various sources of information and ideas to increase their understanding of a particular problem, topic or issue. (Hulu et al., 2023; Putri Pratiwi & Muharam, 2022). The inquiry learning model helps students to be able to develop intellectual disciplines and thinking skills by asking questions and getting answers to their curiosity. (Nababan, Lumbantobing, et al., 2023; Nababan, Sihombing, et al., 2023). The advantage in applying this inquiry learning model is being able to improve students' skills in solving problems in new and different situations that they might find at other (future) times, besides that students are also more motivated and students are able to improve their skills, especially in solve a problem. One lesson that is suitable to be applied to the inquiry learning model is natural science (IPA).(Bone & Lio, 2023; Wahyuni & Witarsa, 2022).

The findings of previous research stated that the application of the guided inquiry learning model could increase students' learning motivation and students' critical thinking skills (Wartini, 2021). The inquiry model emphasizes maximum student activity to seek and find (Suryantari et al., 2019). The inquiry learning model influences learning outcomes with the help of video media (Uliani & Wibawa, 2019). The inquiry learning model with scaffolding techniques influences scientific literacy skills and science learning achievement (Erna Muliastrini et al., 2019). Research related to the application of the inquiry learning mode has been carried out a lot. However, in this study applying the inquiry model with experimental research methods.This research has a novelty because it focuses on the effect of the inquiry learning model on critical thinking in science lessons for fifth grade elementary school students in Cluster V, Tabanan District in the 2022/2023 academic year. Until now, there has been no research specifically exploring the effect of inquiry learning models on critical thinking at that level and in the same educational context.The purpose of this study was to analyze the inquiry learning model for critical thinking in science lessons for Class V SD Cluster V, Tabanan District, Academic Year 2022/2023. It is hoped that students will be able to improve students' critical thinking skills, especially in science lessons and be able to increase their confidence in expressing an opinion on existing problems. The application of this inquiry learning model can change learning activities to become more interesting and able to increase students' interest in learning to carry out learning activities.

2. METHOD

The type of research conducted is quantitative research, namely using a quasi-experimental design. This is because not all the variables that arise in the experiment can be regulated and controlled strictly. The research design uses two classes, namely the experimental class and the control class. The experimental class is a class that gets special treatment using the inquiry learning model and the control class does not use the inquiry learning model. The population of this study were all fifth grade students at SD Cluster V, Tabanan District. The total population of 160 students with an experimental group sample of 34 fifth grade students at SDN 1 Delod Peken and 29 fifth grade students at SDN 5 Delod Peken as the control group was determined using the Cluster Random Sampling Technique. Collecting research data using the description test method consisting of 9 valid questions. The research design used was "Nonequivalent control group design". The instruments used in the research will pass several research instrument tests which will produce valid instruments. The grid of test questions on critical thinking in science lessons presented in Table 1.

Table 1. Grids of Research Instrument Trial Questions

Basic Competencies	Indicators of Competence Achievement	Indicator Question	Cognitive Aspect	Question Form	Number of Questions	Question Number
3.7 Analyze the effect of heat on changes in temperature and the shape of objects in everyday life	3.7.1 Analyze changes in the shape of objects	Presented a question, students can compare solid, liquid and gas objects and give examples of each object	C4	Essays	1	1
		Presented a question, students can conclude events change the form of objects	C5	Essays	1	5
		Presented a picture and a question, students can analyze events in everyday life about changes in the form of objects	C4	Essays	4	2,3,7,10
	3.7.2 Create a schematic drawing of changes in the shape of objects	Presented a question, students can make a scheme of changing the shape of an object to evaporate, melt, freeze, condense, sublimate and crystallize	C6	essay	1	4
	3.7.3 Analyzing differences in physical and chemical forms of matter	Presented a question, students can compare changes in the shape of objects physically and chemically	C4	Essays	1	6
	3.7.4 Analyzing the differences in the forms that receive heat	Presented a question, students can describe changes in state that receive heat	C4	Essays	2	8,9
Amount						**10**

The design in this study involved 2 class groups, namely the experimental class group and the control class group. The data collection method used in this study is the test method while the data analysis techniques used in this study are descriptive statistics and inferential statistics. Descriptive statistics are used to analyze data by describing or illustrating the data that has been collected and then looking for the data's mean, median, mode, and standard deviation values. The calculated results of the average score are

related to student scores, then an analysis is carried out and converted in the form of a Benchmark Reference Assessment (PAP) category with a scale of 5 which is presented inTable 2.

Table 2. Benchmark Reference Assessment Category (PAP) With A Scale Of 5

Value Range	Score	Letter Value	Criteria
90 – 100	4	A	Very High
80 – 89	3	B	Tall
65 – 79	2	C	Currently
40–64	1	D	Low
0 – 39	0	E	Very Low

(Agung & Jampel, 2022)

Based on the results of data analysis on a part of the population called the sample. The analysis technique used is hypothesis testing using the t test. Before testing the hypothesis, there are two tests that must be fulfilled, namely the normality test of data distribution and the homogeneity of variance test. The normality test for the distribution of this data is calculated using the Chi-Square formula. The criterion in the test is if the price of X^2count < X^2table with a significance level of 5% then the dsaata is stated to be normally distributed otherwise if X^2count ≥ X^2table then the data is not normally distributed with degrees of freedom = number of rows – 1 (dk = k - 1). After the normality test was carried out, it was then continued with the homogeneity of variance test using Fisher's test (F). The test criteria in this test are, if Ho is accepted if the price of F-count ≤ the price of Ftable which can be interpreted that the data is homogeneous, but if F-count > the price of F-table, then the data is declared not normally distributed with a level of 5% (α = 0.05) with degrees of freedom for the quantifier k-1 and the degrees of freedom for the denominator nk. The value of k is the number of data groups being measured while n is the number of samples being measured. Data that has fulfilled the prerequisites for the normality test and homogeneity test, then analyzed using the research hypothesis, namely the t-test. The t-test uses the polled variance formula. The value of k is the number of data groups being measured while n is the number of samples being measured. Data that has fulfilled the prerequisites for the normality test and homogeneity test, then analyzed using the research hypothesis, namely the t-test. The t-test uses the polled variance formula. The value of k is the number of data groups being measured while n is the number of samples being measured. Data that has fulfilled the prerequisites for the normality test and homogeneity test, then analyzed using the research hypothesis, namely the t-test. The t-test uses the polled variance formula.

3. RESULT AND DISCUSSION

Result

The data collected in this study are data from critical thinking skills in science lessons for fifth grade students at SD Cluster V, Tabanan District, Academic Year 2022/2023. The data that has been collected is analyzed according to a predetermined analytical technique. To find out the data from the results of descriptive statistical analysis, a table of the frequency distribution of post-test scores for critical thinking skills in science lessons is presented Table 3.

Table 3. Frequency Distribution of Post-Test Data for Experimental Groups

No.	Intervals	xi	f	fk	f. xi	xi-$\bar{x}$	(xi-$\bar{x}$)2	F(xi-$\bar{x}$)2
1	67-71	69	5	5	345	-10.88	118374	591.87
2	72-76	74	9	14	666	-5.88	341574	311.17
3	77-81	79	5	19	395	-0.88	01774	3.87
4	82-86	84	7	26	588	412	161974	118.82
5	87-91	89	6	32	534	912	831174	499.05
6	92-96	94	2	34	188	1412	1991374	398.75
Amount			**34**		**2716**			**1923.53**

Then, to find out the tendency of the value of critical thinking skills in science lessons in the experimental class, it is presented in Figure 1

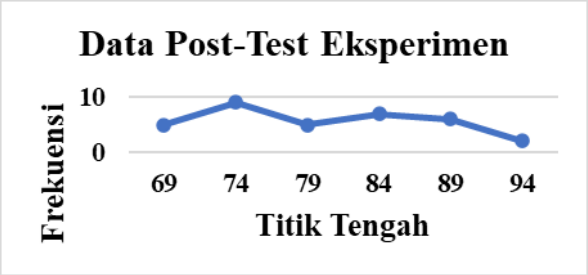

Figure 1. Post-Test Data Polygon Graph of Critical Thinking Skills in Lessons Science in the Experimental Class

Based on Figure 1, the mode is smaller than the median and the median is smaller than the mean (Mo < Me < M), indicating that most values tend to be low. Then from these calculations the post-test average value of critical thinking skills in science lessons in the experimental class was converted into the five-scale PAP calculation category to determine the high or low quality of students' critical thinking skills in science lessons. Based on the results of calculating the average student scores, it was found that the average post-test score for students' critical thinking skills in science lessons in the experimental class was 79.88 so that it lies in the 65-79 score range with the Enough category. The post-test results of the experimental group are presented inTable 4.

Table 4. Results of the Experimental Group PAP Post-Test Scale

Value Range	Category	Predicate
90 – 100	Very good	A
80 – 89	Good	B
65 – 79	Enough	C
40–64	Not enough	D
0 – 39	Very less	E

In addition to knowing the trend of the value of critical thinking skills in science lessons in the experimental class, the data is also presentedTable 5.

Table 5. Frequency Distribution of Control Group Post-Test Data

No.	Intervals	xi	f	fk	f. xi	xi-$\bar{x}$	(xi-$\bar{x}$)2	F(xi-$\bar{x}$)2
1	56-61	58.5	7	7	410	-13.25	175,563	1228.94
2	62-67	64.5	3	10	194	-7.25	52,563	157.69
3	68-73	70.5	6	16	423	-1.25	1,563	9.38
4	74-79	76.5	4	20	306	4.75	22,563	90.25
5	80-85	82.5	8	28	660	10.75	115,563	924.50
6	85-91	88.5	1	29	89	16.75	280,563	280.56
Amount			**29**		**2081**			**2691.31**

Then, to find out the tendency of the value of critical thinking skills in science lessons in the experimental class, it is presented in Figure 2.

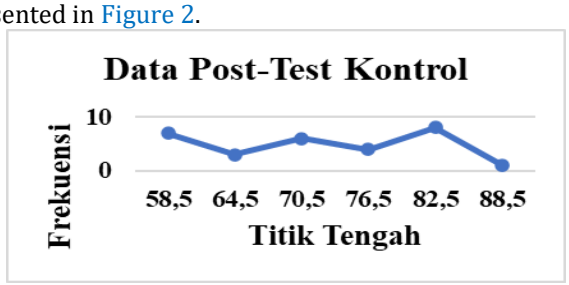

Figure 2. Post-Test Data Polygon Graph of Critical Thinking Skills in Lessons IPA in the Control Class

Based on Figure 2, the mode is greater than the median and the median is greater than the mean (Mo > Me > M), indicating that most values tend to be low. Then from these calculations the average value

of the post-test of critical thinking skills in science lessons in the control class is converted into the five-scale PAP calculation category to determine the high or low quality of critical thinking skills in students' science lessons, based on these calculations it is obtained that, average -The average post-test score for critical thinking skills in science subjects in the control class is 71.75 so that it lies in the 65-79 score range with the Enough category. The post test results of the control group are presented inTable 6.

Table 6. Control Group Post-Test PAP Scale Results

Value Range	Category	Predicate
90 – 100	Very good	A
80 – 89	Good	B
65 – 79	Enough	C
40–64	Not enough	D
0 – 39	Very less	E

The normality test used is the Chi-Square Test$(X^2)$with the criteria of normally distributed data if X^2count ≤X^2table with a significance level of 5% then Ho is accepted, which means that the data is normally distributed and ifX^2count >X^2then the data is not normally distributed with a significance level of 5% then Ho is rejected. The data distribution normality test was carried out to obtain the results of the post-test of critical thinking skills in science lessons of students in the experimental group and the control group which are presented inTable 7.

Table 7. Recapitulation of Data Normality Test Results for Critical Thinking Ability

No.	Data Group	X2count	X2table	Conclusion
1	Experiment Group	8.286	11.070	Normal
2	Control Group	4.423	11.070	Normal

Based on the results of the data distribution normality test using the Chi-Square formula with resultsX^2count ≤X^2table at a significance level of 5%, it is obtained that data from the experimental group and the control group are declared normally distributed. The prerequisite test that has been carried out in a normally distributed study. Then proceed with the calculation using the variance homogeneity test. In this study, the homogeneity test was carried out on the experimental group and the control group. The homogeneity test used is Fisher's Test. Then the criterion in this test is if Fcount ≤ Ftable at a significance level of 5% with df numerator = k – 1 and df denominator = n – k then the two data groups are declared homogeneous. Conversely, if F-count > F-table, the two data groups are said to be heterogeneous. Based on the results of the data analysis that has been done,Table 8.

Table 8. Post-Test Test Results of Homogeneity of Variance of Students' Critical Thinking Ability

No.	Sample	S2	et al	Fcount	Ftable	Conclusion
1	Experiment Group	58.22	34	1.649	4.00	Homogeneous
2	Control Group	96.04	29			

Based on Table 8, it is obtained that the F-count of post-test data results for students' critical thinking skills in science lessons in the experimental group and the control group is 1.649 at a significance level of 5%, df numerator = k – 1 = 2 – 1 = 1 and df denominator = n – k = 63 – 2 = 61 so that F-table is 4.00. So, Fcount (1.649) ≤ F-table (4.00) then the variance of the post-test data on students' critical thinking skills in science lessons in the experimental group and the control group is declared homogeneous. Based on the results of testing the assumptions or testing the prerequisites, it is known that the results of the prerequisite test with the results of the normality of the data distribution are normally distributed and the homogeneity of the variance is declared homogeneous, then the hypothesis is tested using the t-test. Then the t-test analysis was carried out using the polled variance formula and a significance level of 5%. The provisions are that if t-count ≤ t-table then Ho is accepted, whereas if t-count > t-table then Ho is rejected. The results of the polled variance t-test analysis results are presented in Tabel 9.

Table 9. T-test Calculation Results Recapitulation

Group	Multiple Subjects	Average Score ($\bar{X}$)	Variance	et al	tcount	Ttable (ts5%)
Experiment	34	58.22	58.22	61	3.923	1999
Control	29	71.13	101.00			

Based on Table 9, it is found that tcount = 3.923 and ttable = 1.999 at a significance level of 5% (α = 0.05) with degrees of freedom (dk)= $n_1 + n_2 - 2$ = (34 + 29 – 2 = 61). So, it was found that tcount = 3.923 > ttable = 1.999 so that Ho was rejected. So it can be concluded that there is a significant difference in the ability to think critically in science lessons for students who are taught using the inquiry learning model and students who are not taught using the inquiry learning model in class V SD Cluster V, Tabanan District, Academic Year 2022/2023.

Discussion

The results of the study showed that there was a significant influence of students who were taught using the inquiry learning model on critical thinking in science lessons for fifth grade students at SD Cluster V, Tabanan District, Academic Year 2022/2023. The application of the inquiry learning model in the learning process in the classroom has steps for learning activities, learning activities begin with the teacher explaining the learning activities then giving some stories or readings related to learning and the teacher asks students to form groups consisting of 4-5 students, then students are asked to find out what problems will be studied as well as determine the method they will choose when researching the problem (Achmad Dicky Santoso et al., 2023; Firdaus & Sujatmiko, 2023). The second step is for students to learn to formulate hypotheses or temporary answers to the problems they have proposed (Khalid et al., 2023; Yenni, 2023). The third step is for students to plan and carry out research or student experiments to record the entire process and results of research conducted in groups. The fourth step students process and analyze various data obtained in research or experimental activities. The fifth step students test the hypothesis that has been proposed and if the hypothesis is proven students must be able to explain in detail the reasons for the acceptability of the hypothesis and vice versa students must provide scientific arguments if the hypothesis is not proven. The sixth step students formulate general or final conclusions on the results of the inquiry activities that have been carried out where these conclusions should be able to answer the formulation of the problem that was previously proposed. In the seventh step, representatives from each group present the results of their work. The presentation was followed by a class discussion moderated and facilitated by the teacher. The last step is the teacher discusses the problem again and alternative solutions that can be used to solve the problem. In the process the teacher compares between one solution and another solution the results of students' thinking or also compared with existing theoretical solutions. (Asyhar, 2023; Rosidi, 2023).

The existence of significant differences in critical thinking in science lessons in the experimental group and the control group was known based on the treatment given to the experimental group which was taught using the inquiry learning model. The inquiry learning model is a learning model that can create more enjoyable learning activities and ultimately affect the understanding of the concepts found (Azizah & Rosdian, 2022; Suindhia, 2023). Students can learn to work together and respect each other in giving income during group work. From these learning activities students and teachers have meaningful learning experiences so that this can improve students' critical thinking skills (Rahmadani et al., 2023; Sarifah & Nurita, 2023). In contrast to learning in the experimental class, in the learning activities that were applied to the control group, students followed a learning process that was not the same as in the experimental class. Where the learning given to the control class is not taught by the inquiry learning model. In addition, the learning activities in the control class are only the teacher who plays more roles such as delivering learning material, so that the role of students to participate in learning activities is very less (Harahap & Julyanti, 2023; Susanti, 2023).

This finding is reinforced by previous research which states that students' critical thinking skills using inquiry learning models are higher than conventional learning models (Ramdhani et al., 2023). There are differences in critical thinking skills between the experimental class and the control class because the experimental class uses the inquiry learning model. This is because the inquiry learning model in its implementation provides opportunities for students to think in solving problems found in the learning process, so that students can develop their thinking skills through problem solving activities independently. (Bone & Lio, 2023; Sari & Lutfi, 2023). In addition, the level of understanding obtained by students is deeper because students are directly involved in the process of finding answers to existing problems and directly practicing them. (Pratiwi & Mawardi, 2020). There is a significant difference between learning using the inquiry learning model on critical thinking skills. This shows that learning using the inquiry model can foster higher critical thinking skills. This is because the treatment of the inquiry learning model in the learning process students are required to use high-level thinking skills, be active in finding a problem and solving problems. (Azisah et al., 2023; Ummu et al., 2023). Based on the results of the analysis and presentation, it can be concluded that there is a significant influence of the inquiry learning model on the critical thinking skills of science grade V SD Cluster V, Tabanan District. This research has a novelty because it focuses on the effect of the inquiry learning model on critical thinking in science lessons for fifth grade elementary

school students in Cluster V, Tabanan District in the 2022/2023 academic year. Until now, there has been no research specifically exploring the effect of inquiry learning models on critical thinking at that level and in the same educational context. Thus, this research makes a new contribution in understanding the effectiveness of the inquiry learning model in increasing critical thinking in class V SD Cluster V, Tabanan District, Academic Year 2022/2023.

4. CONCLUSION

Critical thinking skills in science lessons in experimental groups that have been studied with the inquiry learning model has increased significantly. So it can be concluded that the use of the inquiry learning model has a significant effect on critical thinking skills in science and has a positive impact on learning activities in class V SD Cluster V, Tabanan District. This research can be used as relevance for teachers to choose the right learning model in teaching, so that students are more confident in learning activities, one of which is by applying the inquiry learning model in learning at school.

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