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The Effect of Inside Outside Circle Learning Model on Students' Critical Thinking Skills on Colloid Material

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Abstract: The Effect of Inside Outside Circle Students' Analytical Reasoning Abilities on Colloid Material Using the Learning Model. This research focuses on learning colloids, which is considered difficult due to theory and limited practice. Conventional methods hinder students' critical thinking skills, so the Inside Outside Circle model was implemented to improve these skills in the learning process. The objectives of the study were (1) to examine how the Inner Outer Circle educational method influences students' Analytical Reasoning related to colloid content, and (2) to gather students' opinions on the use of the Inside Outside Circle model in the context of colloid topics. This investigation used a quantitative method through a Quasi-experimental methods, particularly a design using a control group that is not equivalent. The method of sampling utilized was intentional sampling.The subjects of the study consisted of two groups: class XI IPA C functioned as the experimental group, whereas class XI IPA D served as the control group.The instruments utilized included lesson plans, student worksheets, assessment questions, and feedback surveys. Data were obtained through a critical thinking ability test that included 8 multiple-choice questions and 9 essay questions that had gone through validity and reliability testing. Data analysis was carried out using homogeneity and normality tests as prerequisites, and for hypothesis testing, the Mann-Whitney test was applied, followed by the N-Gain test. From the results of the hypothesis testing, it was obtained The Mann-Whitney test results showed that 0,000 < 0. 05. This indicates that there is an influence of the Inside Outside Circle learning model on students' critical thinking abilities.

Keywords: Inside Outside Circle Learning Model, Critical Thinking Skills, Colloid.

Abstrak: Pengaruh Model Pembelajaran Inside Outside Circle terhadap Kemampuan Berpikir Kritis Siswa pada Materi Koloid. *Penelitian ini berfokus pembelajaran koloid yang dianggap sulit karena teori dan minim praktik. Metode konvensional membuat berpikir kritis siswa rendah, sehingga diterapkan model Inside Outside Circle kemampuan tersebut dalam proses belajar. Tujuan penelitian ini adalah (1) Untuk menilai dampak model Inside Outside Circle. terhadap kemampuan berpikir kritis siswa dalam materi koloid, (2) Untuk mengevaluasi respons siswa terkait penggunaan model pembelajaran Inside Outside Circle pada materi koloid. Penelitian ini mengadopsi metode kuantitatif dengan pendekatan Quasi Eksperimen yang menggunakan desain Non-equivalent Control Group Design. Metode pengambilan sampel yang digunakan adalah purposive sampling. Sampel yang diambil terdiri dari dua kelompok yaitu kelas XI IPA C sebagai kelompok eksperimen dan XI IPA D sebagai kelompok kontrol. Instrumen yang digunakan meliputi RPP, LKPD, soal tes, dan angket untuk respons siswa. Data diperoleh melalui tes kemampuan berpikir kritis yang mencakup 8 soal pilihan ganda dan 9 soal*

uraian yang telah melalui pengujian validitas dan reliabilitas. Analisis data dilakukan menggunakan pengujian homogenitas dan normalitas sebagai prasyarat, dan untuk pengujian hipotesis menerapkan uji Mann-Whitney, diikuti dengan uji N-Gain. Dari hasil pengujian hipotesis diperoleh hasil uji Mann-Whitney menunjukkan bahwa 0,000 < 0,05. Ini menunjukkan ada pengaruh dari model pembelajaran Inside Outside Circle terhadap kemampuan berpikir kritis siswa.

Kata kunci: *Model pembelajaran Inside Outside Circle, Kemampuan berpikir kritis, koloid.*

▪ INTRODUCTION

The quick expansion of science and technology demands that students possess have greater cognitive abilities, particularly, critical thinking skills, which enable them to analyze, evaluate, and solve problems systematically. In chemistry education, critical thinking becomes an essential competency because chemistry learning is not limited to memorizing theories but also involves understanding, reasoning, and connecting concepts with real-life phenomena (Andini et al., 2022; Zubaidah, 2019). One of the topics that require strong conceptual understanding is colloids, which include the characteristics of colloidal systems, their properties, and their applications in daily life. Due to its abstract nature, the colloid topic often poses challenges to students when the learning process does not encourage active involvement and scientific discussion (Maimunah, 2022; Mardhiah et al., 2024).

In many schools, chemistry learning is still dominated by traditional lecture-based instruction. Such teacher-centered approaches often result in passive learning, low motivation, and limited students have the chance to improve their critical thinking abilities (Arends, 2012; Manik et al., 2020). Consequently, students' conceptual understanding and analytical abilities, particularly in colloid material, are not developed optimally (Sanjaya, 2019; Yolanda & Juwitaningsih, 2024).

To address this issue, learning models that promote interaction, student engagement, and collaborative thinking are required. One cooperative learning model that has been proven effective in increasing student participation and critical thinking is the Inside Outside Circle model (Dewi et al., 2024; Djafar et al., 2023). The IOC model, developed by Spencer Kagan, organizes students into two concentric circles (inner and outer) in which they interact and exchange information with rotating partners (Kagan, 1994). This structured interaction provides students the opportunity to actively process information, pose questions, give arguments, and enhance the quality of their thinking.

Previous studies have indicated that the IOC model can significantly improve critical thinking skills and conceptual understanding in various subjects. For instance, (Rahmawati & Nurhayati, 2020) reported that IOC implementation resulted in a significant improvement in students' critical thinking skills. Similarly, (Pratama, 2021) found that IOC promotes student engagement, encourages concept elaboration, and enhances learning outcomes in science. Inside Outside Circle learning alsao has the advantage of a learning process that creates a dynamic and collaborative learning atmosphere, this can stimulate students' critical thinking skills (Syamsuriyawati, 2022).

In the context of chemistry learning, especially the colloid topic, the IOC model has great potential to assist pupils in making the connection between theoretical ideas and practical use in the real world. Intensive discussions and idea exchanges encourage students to strengthen their understanding through multiple perspectives. This is

supported by (Slavin, 2011), who states that cooperative learning facilitates better concept acquisition through peer interactions (Ginting & Ginting, 2024).

Based on these considerations, the implementation of the Inside Outside Circle model is viewed as relevant and important in enhancing pupils' critical thinking abilities in colloid learning. Consequently, the aim of this study is to investigate the impact of the Inside Outside Circle teaching approach on students' critical thinking abilities in chemistry.

METHOD

Population and Sample

The population of this study consisted of eleventh-grade science students (Class XI IPA) at MA Ma'arif Udanawu Blitar in the even semester of the 2024/2025 academic year. The population included two courses with a combined total of 84 students, all of whom were involved in this research. With a deliberate sampling strategy, non-probability sampling was the sampling method employed.

Research Variables

According to (Sugiyono, 2020), this study employed a control group design that is not equivalent, as it is categorized as a quasi-experimental design. The independent variable used in this study featured the Inside Outside Circle educational approach. The critical thinking skills of the students abilities were the dependent variable, while the variable under control was the colloid material.

Research Instruments

This study utilized students' pretest and posttest results in chemistry learning in addition to a survey of student responses. The posttest was administered at the conclusion of the educational experience to evaluate students' analytical abilities achievement. The test consisted of ten multiple-choice questions and ten essay questions that had been previously validated. The items were validated by experienced validators and tested in a Grade XII science class. Meanwhile, the survey of students' responses was conducted to the experimental class using a Likert scale, in which students were free to choose a score ranging from 1 to 4 for each statement in the questionnaire.

Data Analysis Techniques

Normality Test

By using the Shapiro-Wilk test, it was determined if the sample data demonstrated a normal distribution. The Shapiro-Wilk test was put into action. The criteria for making decisions in the Shapiro-Wilk test are stated below: The data is considered normally distributed if the Asymp. Sig. (2-tailed) value is greater than or equal to 0. 05, while if the Asymp. Sig. (2-tailed) value is < 0. 05, the data are not normally distributed.

Homogeneity Test

In the homogeneity test, the initial conditions of each sample do not necessarily have to be identical. The purpose of the homogeneity test is to ascertain if the variances across two or more groups are the same (homogeneous). The significance level used in this test was $\alpha = 0.05$.

Hypothesis Testing

This study employed a type of hypothesis assessment that does not rely on parameters, specifically the Mann–Whitney U test. The H_0, which asserts that there is no discernible difference between two populations, is what the Mann–Whitney test is based upon. or actual difference between the two independent groups (Yulita, 2022). The criteria for Mann–Whitney U test's results are as follows: the Sig value is considered to be < 0. 05, so Ha is acknowledged while H_0 is dismissed; the significance value is considered to be > 0. 05, so H0 is acknowledged and Ha is dismissed

RESULT AND DISCUSSION

Based on the research conducted at MA Ma'arif Udanawu Blitar, the researcher collected data using test instruments (pretest and posttest) and obtained the critical thinking skill scores of students in Class XI IPA C and XI IPA D. The pretest and posttest results for both the experimental and control classes are presented in Table 1 below:

Table 1. Results of the Pretest Analysis on Students' Critical Thinking Skills

Category	Class			
	Control		Experiment	
	F	%	F	%
Low	22	48%	21	50%
Very Low	20	52%	21	50%
Quantity	42	100%	42	100%

Table 1 shows the proportion of pupils with strong critical thinking abilities in the pretest for the control class shows that 48% of the students were in the low category, while the trial class had a similar percentage, namely 50% out of a total of 42 students.

The Excel software was used to analyze the posttest results for both the experimental and control groups. Table 2 presents the findings of an examination of students' capacity for critical thought following the therapy.

Table 2. Outcomes of the Analysis After Testing Students' Critical Thinking Abilities

Category	Class			
	Control		Experiment	
	F	%	F	%
Very Low	-	-	-	-
Low	18	43%	16	38%
Medium	8	19%	12	29%
High	16	38%	9	21%
Very High	-	-	5	12%
Quantity	42	100%	42	100%

From Table 2, The outcomes of the posttest regarding critical thinking abilities are evident in the control class fall into three different categories. In the group that was not treated, the peak percentage is in the low category, which is 43%. At the same time, in

the experimental group, the highest rate is 38%, which is considered very low. The findings from analyzing students' critical thinking skills, based on the measured indicators, are shown in Figure 1 below.

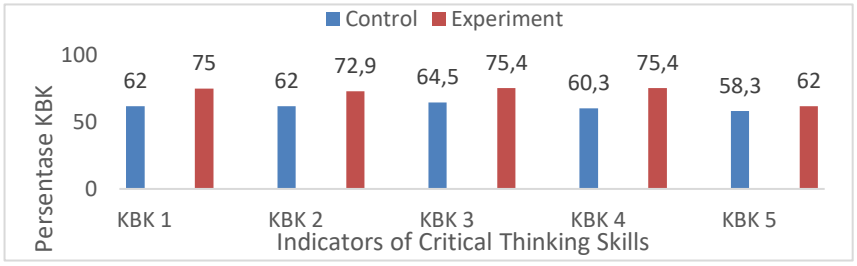

Figure 1. Students' Critical Thinking Skill Scores Across Each Indicator

Figure 1 presents a description of students' critical thinking skills for each indicator based on the posttest results of the experimental and control classes. For the indicator *providing simple explanations*, students in the control class obtained a score of 62, indicating that they were able to answer the given problems and provide logical reasons, although some students were still unable to answer correctly. The experimental class scored 75, meaning that most students were competent to answer the issue given in the questions and provide appropriate and logical reasoning.

For the indicator *building basic skills*, students in the control class scored 62, which shows that a small portion of them were still unable to analyze everyday phenomena related to the questions, particularly in understanding the various properties of colloids. Meanwhile, the experimental class scored 72.9, indicating that students were able to answer well and provide reasons that supported their responses.

For the indicator *drawing conclusions*, students in both classes were able to answer the questions correctly and provide appropriate conclusions that supported their answers. For the indicator *providing further explanations*, students the control class scored 60.3 which shows that they were able to analyze the questions but did not provide accurate reasoning. The experimental class scored 75.4, showing that students were able to identify assumptions by analyzing the statements in the questions and were able to provide supporting reasons as well as relevant examples.

For the final indicator, *creating and integrating thoughts*, the control class obtained a score of 58.3 and the experimental class scored 62. This indicates that some students in both classes were able to provide alternative solutions, but they were still unable to relate them appropriately to the questions asked, resulting in solutions that remained general.

In this study, the group included 84 students. The Shapiro–Wilk test was used to determine whether the data conforms to a normal distribution, and the result was considered significant at the 0.05 level. If the Sig value is higher than α, which is 0.05, then the data is said to conforms a normal distribution. The findings from the normality assessment for this research are presented in Table 3.

Table 3. Normality Test Results

	Shapiro-Wilk		
	Statistic	**Df**	**Sig**
Experiment	0,941	42	0,030

		Shapiro-Wilk		
Critical Thinking Skills	Control	0,892	42	0,001

From Table 3, the intention value for judgmental rational skills in the management group is 0.030, whereas the test group holds an important value of 0.001. Since the significance value is beneath α = 0.05, the homogeneity test outcomes for students' critical thingking abilities in both classes using the Inside Outside Circle educational framework are not normally distributed. To test homogeneity, the Levene test was conducted using SPSS 16, and are reflected in the Table 4 below.

Table 4. Homogeneity Test Findings

		Levene Statistic	**df2**	**df2**	**Sig**
Posttest	Based on Mean	5.414	1	82	0.022

The findings from the homogeneity evaluation concerning the control group's pretest and experimental classes showed a significance value of 0.22. With a significance level of α = 0.05, it can be concluded that both data sets are < α = 0.05, which means that the posttest data from the control and experimental classes are not homogeneous.

After the prerequisite tests were conducted, hypothesis testing was carried out to determine whether the application of the Inside Outside Circle learning model had an effect on students' critical thinking skills. Since the data were not normally distributed, a non-parametric method was employed for hypothesis testing. The test employed was the Mann–Whitney test. The decision criteria for the Mann–Whitney test are as follows: if the Z-value and the Sig. (2-tailed) value are < 0.05, then H_0 is rejected; if the Z-value and the Sig. (2-tailed) value are > 0.05, then H_0 is accepted. The findings of the Mann–Whitney assessment regarding students' critical thinking abilities are shown in Table 5 below.

Table 5. Mann–Whitney U Test Results

Test Statistics[a]	
	Postest
Mann-Whitney	158.000
Wilcoxon W	1061.000
Z	-6.485
Asymp. Sig. (2-tailed)	.000
a. Grouping Variable: Kelas	

Based on the table above, the significance level from the Mann–Whitney U test shows a Z-value of –6.485 and an asymptotic. sig. The two-tailed p-value is 0.000, which is below the significance level of 0.05. So, we reject the H_0, which means there is a noticeable difference or change in the critical thinking scores between the control group and the test group and the experimental class after the test. So, the hypothesis that he inside outside circle approach to education influences the development of critical thinking among students in the colloid topic is accepted. This result matches what was found in a past study by (Nadia, 2017), which also showed that the Inside Outside Circle technique greatly improved learners analytical reasoning abilities. The Inside Outside Circle model also trains students to think critically, because this model

directs students to interact, discuss, and exchange information through a pattern of rotation and exchange of pairs (Sahuleka et al., 2020).

Table 6. N-Gain Test Results

Class	N-gain	Category
Control	0,228	Low
Experiment	0,541	Medium

Based on the N-gain test results, there is an argument that using the Inside Outside Circle model supports learners analytical reasoning abilities in the colloid topic was quite effective. The experimental group showed some improvement with an average increase. N-gain score of 0.541. The knowledge strategy implemented in the class successfully boosted students' capacity for critical analysis. Meanwhile, the control class obtained an N-gain score of 0.228. The result of the analysis use the N-gain category according to Hooke (Shofa et al., 2022).

The information obtained from the student questionnaire the Inside Outside Circle technique and its impact on learners analytical reasoning skills were administered at the end of the lesson for the experimental group, as they received the Inside Outside Circle treatment. Through this analysis, the researcher was able to identify the strengths and weaknesses of the Inside Outside Circle technique in relation to learners analytical reasoning abilities.

Table 5. Descriptive Statistics of Students' Responses

	N	Min	Max	Mean	Std. Deviation
Motivation	42	3	12	8.24	1.650
Collaboration	42	7	12	9.52	1.254
Mastery of the material	42	6	16	11.62	1.925
Questioning	42	4	8	5.69	1.179
Critical thinking ability	42	8	16	11.95	1.766
Discussion presentation	42	6	14	11.40	1.345
Valid N (listwise)	42				

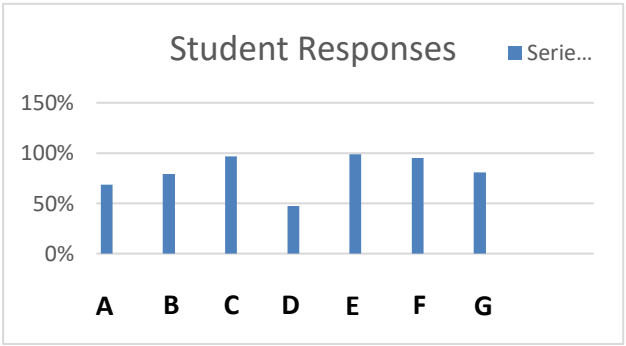

Figure 2. Student Response Rate Analysis

Explanation:

A : Motivation
B : Collaboration
C : Mastery of the material

D : Questioning ability
E : Critical thinking ability
F : Discussion presentation
G : Average

The overall average score obtained from the student response questionnaire administered to the class performance reached 81%, categorizing it as "good" classification. This finding is consistent with previous research showing that when students are fully engaged and attentive during lessons using the Inside Outside Circle treatment., it can foster positive responses and improve student abilities (Sari, 2017).

To begin the study, the research sample was given a pretest consisting of twenty questions that met the required criteria, including item validity, reliability, discrimination power, and difficulty level. The pretest was conducted during one learning session. Both samples showed homogeneous distribution; however, the normality test indicated that both classes had non-normal distributions. The average pretest score of the control class was 35.5, while the experimental class scored 34.3. The findings show that learners in the experimental group had relatively low initial abilities.

CONCLUSION

The study suggests that the Inside Outside Circle method enhanced critical thinking abilities among Grade XI Science students at MA Ma'arif Udanawu Blitar when exploring colloids. The Inside Outside Circle learning model helped improve students' ability to think critically. This conclusion is also backed by the results of the hypothesis test and the differences in critical thinking test scores between the experimental and control groups.

The Mann–Whitney test, which is a type of non-parametric hypothesis test, gave a sig rank of 0.000, which is less than 0.05. This means that the H_0 is not supported and the choice hypothesis is considered true. In other words, the Inside Outside Circle treatment has a big impact on students' ability to think critically.

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