The Effect of the Cooperative Integrated Reading and Composition (CIRC) Learning Model on Students' Mathematical Critical Thinking Skills

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Abstract

The research investigates the impact of the Cooperative Integrated Reading and Composition (CIRC) learning model on students' mathematical critical thinking skills. It aims to assess students' mathematical critical thinking abilities before and after implementing the CIRC model and to evaluate the overall influence of the CIRC learning model on these skills. The samples used amounted to 18 students of grade XI science sampling with purposive sampling techniques. Data collection techniques include documentation, test questions, and observations. The data analysis procedure involves normality tests, homogeneity tests, and hypothesis testing. The results indicate a significant effect of the Cooperative Integrated Reading and Composition (CIRC) learning model on students' mathematical critical thinking skills. Specifically, with the student's test scores, if the significance value (sig.) is less than 0.05, then the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. In this study, the sig. value was 0.000, which is less than 0.05, meaning Ho is rejected, confirming the significant impact of the CIRC model.

***Keywords:** CIRC; Thinking; Critical; Mathematics.*

Abstrak

Penelitian ini ditujukan untuk mengkaji pengaruh model pembelajaran Cooperative Integrated Reading and Composition (CIRC) terhadap kemampuan berpikir kritis matematis siswa. Tujuan utamanya adalah untuk mengetahui kemampuan berfikir kritis matematis siswa sebelum dan sesudah diterapkan model CIRC, serta untuk mengevaluasi pengaruh model tersebut secara keseluruhan. Sampel penelitian terdiri dari 18 siswa kelas XI IPA yang dipilih dengan teknik purposive sampling. Teknik pengumpulan data yakni dokumentasi, tes, dan observasi. Prosedur analisis data menggunakan uji normalitas, uji homogenitas, dan uji hipotesis. Hasil penelitian menunjukkan bahwa terdapat pengaruh signifikan model pembelajaran CIRC terhadap kemampuan berpikir kritis matematis siswa. Hal ini ditunjukkan dengan nilai sig. sebesar 0,000 yang lebih kecil dari 0,05, sehingga Ho ditolak dan Ha diterima. Dengan kata lain, terdapat pengaruh yang signifikan antara penggunaan model pembelajaran CIRC dengan kemampuan berfikir kritis matematis siswa.

Kata Kunci: CIRC; Berpikir; Kritis; Matematika.

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INTRODUCTION

Mathematics is a subject that plays an important role in the development of Mathematics is a subject that plays a crucial role in the development of science and technology (Wulandari, Mujib & Putra, 2016). In mathematics learning, it is not just learning about numbers and formulas. Mathematics is a subject that plays an important role in human life, teaching how to think critically and solve problems in everyday life. The ability to think critically is very instrumental in learning mathematics, especially in achieving learning, learning success, and thinking creativity is the core regulator of student actions (Latifah, 2017).

Critical thinking is very important in studying mathematics because critical thinking encompasses the entire process of obtaining, comparing, analyzing, evaluating, and acting beyond science and values. Critical thinking skills are essential thinking skills that every student needs to have so as not to be left behind in the increasingly fierce world competition. Various efforts that can be made to train and improve students' critical thinking skills are widely done through various learning methods and media (Ekawati, 2015). Lukitasari (2013) suggests that critical thinking skills are very important for students thinking patterns to improve students' thinking skills by using both hemispheres of their brains so that they can form rational behavior. In today's world, where challenges abound, the development of critical thinking skills is crucial. However, students at SMAN 5 Kota Sungai Penuh demonstrate relatively low levels of these skills. This conclusion stems from interviews conducted by researchers with a mathematics teacher at SMAN 5 Sungai Penuh City.

The minimum completion criteria for mathematics at SMAN 5 Kota Sungai Penuh is 75. Meanwhile, the daily test results shown by mathematics subject teachers are still below the completeness criteria. The teacher explained that the problem faced by students is students' critical thinking skills where students have difficulty in identifying known elements, asking and the adequacy of the necessary elements, and considering relevant sources and observations from relevant sources. Making conclusions designing and considering deductions and inductions, designing conclusions and evaluating, evaluating definitions and

identifying terms and opinions, and devising strategies and tactics. All of these are indicators of students' critical thinking skills.

Based on pre-research observations that have been conducted on students at SMAN 5 Kota Sungai Penuh Learning currently refers to the 2013 Revised Curriculum. In general, this curriculum emphasizes that learning that takes place in the classroom is student-centered and the role of the teacher is only as a facilitator. Sometimes it also applies group discussion situations to the learning process, but the discussions that occur do not involve all group members. This can be seen from the inactivity of all group members. Therefore, the knowledge obtained by students has not been maximized, so the learning results obtained are also not optimal. The learning process, especially mathematics subjects at the school, is in the teaching and learning process using the lecture method and students have worksheets that help in understanding the material taught. In addition, students can also borrow textbooks in the library as a support in understanding further related to the material taught by the teacher.

The importance of learning models is used, especially learning models that emphasize students to think critically, in this case, teachers design learning activities that develop competencies, both from the cognitive, affective, and psychomotor domains. Learning must also be designed as well as possible so that students are more active and not bored in following the teaching and learning process in class (Nurdyansyah & Fahyuni, 2016; Sumantri, 2015). The learning model is also needed by teachers in conducting learning in the classroom (Sanjaya, 2015). Teachers must be able to choose and apply various existing learning models. When choosing the right model, teachers should pay attention to general principles and factors that influence its determination (Hamdayana, 2014).

One of the cooperative learning methods is the Cooperative Integrated Reading and Composition (CIRC) learning model. This learning model is designed to accommodate how different levels of student abilities, both through heterogeneous groupings and homogeneous groupings (Miftahul, 2016). CIRC-type cooperative learning model is categorized as an integrated learning model that focuses more on group learning, each student has the same responsibility for

the given group tasks and issues certain ideas or thoughts in understanding a concept. The application of this model is very concerned about the success of the group, learners who have higher abilities are responsible for helping their group mates. Through this method, it can cause a motivation for students to follow learning (Dwi, 2013). Therefore, implementing the CIRC learning model is expected to significantly aid students in understanding and developing critical thinking skills while tackling assigned tasks, particularly in upcoming course materials.

Several previous studies on CIRC were done by Dewi et, al (2018); Widyasari (2013), and Ekawati (2013) but not in the mathematics fields. Another prior study about CIRC on critical thinking ability was done by combining CIRC with Group Investigation (Rianto & Lubis, 2023; Christina & Kristin, 2016) and combining CIRC with Mind Mapping (Hidayat & Latifah; 2018). No recent studies conducted about CIRC itself on students' critical thinking ability in mathematics. Based on various research findings in prior studies, we recognize several limitations. Therefore, we want to fulfill the gap research by conducting a study to analyze the effect of CIRC on students' mathematical critical thinking skills. In line with the background, this study is important and has novelty to solve the problem that occurs in SMAN 5 Sungai Penuh.

RESEARCH METHODS

This research is a pre-experimental type. The design of this study was one group pretest-posttest. The pre-experimental group pretest-posttest design was used to determine the level of student ability before treatment and after treatment (Creswell, 2019). The study involves two variables: the independent variable, which is the Cooperative Integrated Reading and Composition (CIRC) Learning Model, and the dependent variable, which is students' mathematical critical thinking ability. The sample comprises 18 students from class XI IPA at SMAN 5 Kota Sungai Penuh. This class will serve as the experimental group where the CIRC learning model will be implemented.

We used documentation, tests, and observations in this study. Documentation is a way to obtain data from various sources or organized archives that can be accessed by respondents or respondents' residences to complete their daily exercises. Test questions are one type of assessment tool to regulate the extent to which learning objectives are achieved. Test questions are a series of questions or practices and other instruments used to measure the ability, scientific information, capacity, or aptitude driven by the person or group of each student. This Test Question is also a series of tasks to be done or some questions that must be answered by students. To be able to measure student capacity, understanding, and authority of topics according to teaching objectives. Observation is an observation made deliberately and systematically about social phenomena with psychic symptoms for later recording. This method is used to obtain data about the learning process, student activities in the class, and the group as a whole.

The critical thinking ability indicators used in this study consist of five indicators according to Fisher (2014); and Nur'asiah, Siahaan & Samsudin (2015). The first is to provide a simple explanation including focusing on the question, analyzing the question, and asking and answering questions about an explanation. The second is to build basic skills including considering relevant sources and observations from relevant sources. The third is to make conclusions, design and consider deductions and inductions, design conclusions, and evaluate. The fourth is to provide further explanations including evaluating definitions and identifying terms and opinions. The last indicator is to develop strategies and tactics including determining the actions to be carried out and interacting with others.

This research stage begins with determining the research problem, in this case, the researcher conducts a preliminary study, namely reading books that are relevant to the research problem, then making initial observations or preliminary studies in the form of pre-research activities to obtain an initial understanding first. The second stage in the study is data collection. In this second stage, research begins by determining data sources, namely relevant sources, and then collecting data in the field. The last stage of this research is the stage of data analysis and assessment, which is analyzing the data that has been obtained in the

field and then reviewing it comprehensively so that in the end conclusions can be drawn.

In the analysis phase of the research, the data were subjected to an average difference test. Before determining the specific type of average difference test, prerequisite tests were conducted, including a Normality test to assess whether the data followed a normal distribution, and a Homogeneity test to determine if the data originated from a homogeneous population.

RESULTS AND DISCUSSION

The data in this study were collected from Table 1, which presents the results of mathematical critical thinking skills tests administered to grade XI IPA students at SMAN 5 Sungai Penuh City. The assessment instruments comprised 5 essay questions, each rigorously analyzed for validity, reliability, discriminative power, and difficulty level. This analysis ensured that the test questions effectively measured students' critical thinking abilities and were suitable for research purposes.

Table 1. Description of Student Critical Thinking Ability Test Results Data

Results	Pretest	Postest
Average	36,66	59,16
Maximum	50,00	90,00
Minimum	15	25
Ideal Maximum Score	100	100

The data on students' mathematical critical thinking skills were derived from test results based on 5 questions administered to a sample of 18 students. Scoring was conducted using rubrics, the frequency distribution is listed in Table 2 below.

Table 2. Description of Research Results

Categories Critical Thinking	Number of Students	Percentage
Very High	4	22,22
High	5	27,78
Average	4	22,22
Low	5	27,78
Very Low	0	0
Sum	18	100

From Table 2 above, approximately 72.22% of students demonstrated moderate to very high levels of mathematical critical thinking skills. In contrast, 27.78% of students showed low critical thinking abilities, totaling 5 students who have not yet developed this skill.

The normality test was conducted on the data concerning the results of students' mathematical critical thinking skills in both the pre-test and post-test, as shown in Figure 1. It can be seen that the Sig. value of the posttest class data is 0.076 and the pretest class is 0.200. Based on the provisions of Sig. > 0.05 then the data is said to be normally distributed, and if Sig. < 0.05 then the data is not normally distributed. Based on the results of Sig. in the table above states that Sig. > 0.05, the data of this study is normally distributed, so the statistical test uses parametric statistics.

Table 3. Tests of Normality

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
results	pretest	,193	18	,076	,922	18	,143
	posttest	,133	18	,200[*]	,958	18	,568

After performing the normality test, the homogeneity test was conducted to determine whether the sample class used in the research had consistent variances. The homogeneity test of the data on students' mathematical critical thinking skills was conducted using SPSS 22.0 for Windows, with a significance level set at 0.05. The results of this homogeneity test are illustrated in Table 4.

Table 4. Test of Homogeneity of Variances

Results			
Levene Statistic	df1	df2	Sig.
7,064	1	34	,012

According to the homogeneity test result above, the experimental class has a significance level of 0.012 > 0.05. Based on the provisions if Sig. > 0.05 then the data is said to be homogeneous variance, and if Sig. < 0.05 then the data is inhomogeneous variance. According to the results of Sig. in the table above states that Sig. > 0.05. This indicates that the data has a homogeneous variance.

The t-test is used to determine the effect of the dependent variable as seen from the comparison of significant values to error values (α). This study used a signification level of 5% or 0.05. It is said to be significant if the probability value is smaller than α = 0.05. Table 5 below is an explanation of the results of the hypothesis test data of students' mathematical critical thinking ability test results using the t-test.

Table 5. t-Test Results

t-test	Hypothesis test
Sig.	0,000
Significant level α)	0.05
Conclusion	H_a accepted

Based on the hypothesis testing criteria, where if sig. > 0.05 Ho is accepted and Ha is rejected, and if sig. < 0.05 then Ho is rejected and Ha is accepted, Table 6 indicates that the significance value (sig.) for the data from the students' mathematical critical thinking ability test is 0.000, which is less than 0.05. Therefore, Ho is rejected, leading to the conclusion that there is a significant influence of using the CIRC learning model on students' mathematical critical thinking skills.

Students' Critical Thinking Skills Before Learning with CIRC

Before implementing the Cooperative Integrated Reading and Composition (CIRC) learning model, student learning was predominantly passive and teacher-centered. Activities primarily involved listening to teacher explanations and completing worksheets (LKS) based on the material presented by the teacher. Research revealed that students exhibited low levels of critical thinking skills before the introduction of the CIRC learning model.

In the first critical thinking indicator, there is one question item that measures this indicator, namely question point No. 1. Question number 1 is to determine the matrix shape of a rectangle which is known in the length and width of the rectangle. The expected thinking of this problem is that students can give simple explanations analyzing the question. On question No. 1, most of the students answered incorrectly.

In the second critical thinking indicator, there is one question item that measures this indicator, namely question point number 2. The number problem is to determine the inverse of the matrix and determine the price of what is known in the problem. Critical thinking expected from this problem is that students can give or determine anything that students can provide relevant observations from the question. Question number 2 most students answer incorrectly.

In the third critical thinking indicator, there is one question item that measures this indicator, namely question point number 3. Question number 3 is to determine how much Dodi will have to pay if he buys 6 pencils and 5 erasers. Critical thinking that is expected from this problem is that students can check what has been stated, considered, studied, and concluded. In question number 3, most of the students answered incorrectly.

In the fourth critical thinking indicator, there is one question item that measures this indicator, namely question point number 4. Question number 4 is to calculate the daily income received by each canteen and the total daily income by presenting the matrix form. The critical thinking expected from this problem is that students can define terms and consider an appropriate definition in solving the problem, complete and correct in doing calculations/explanations. In question number 4, most of the students answered incorrectly.

In the fifth critical thinking indicator, there is one question item that measures this indicator, namely question point number 5. Question number 5 is a matrix equation that corresponds to the problem. Critical thinking expected from this problem is that students can determine the right logical solutions and strategies in solving problems, and complete and correct in doing calculations/explanations. In question number 5, most of the students answered incorrectly.

The study findings indicate that before implementing the CIRC learning model, student learning was ineffective in enhancing critical thinking skills. Specifically, the research data analysis revealed that students' average critical thinking skills score before utilizing the CIRC learning model was 36.66. This

suggests that mathematics learning before the adoption of the CIRC model was insufficient in fostering improvements in students' critical thinking abilities.

The low value of students' critical thinking skills before using the CIRC learning model is due to the learning process that tends not to emphasize students being involved individually, so students are not called to study the material in depth to get maximum results. As for according to Berry and King (2012) who said that conventional methods are methods commonly used by teachers in classroom learning to convey information verbally. One form of conventional method commonly used is the lecture method. The lecture method emphasizes one-way learning from teacher to student because the teacher is more active in delivering learning material, students become passive because learning is still teacher-centered. Thus, it can be concluded that the teaching and learning process using the lecture method is not large enough to improve students' critical thinking skills.

Students' Critical Thinking Skills After Learning with CIRC

The CIRC learning model emphasizes collaborative group learning methods. In CIRC learning, the primary focus is on enabling students to engage in problem-solving activities through specific group activities. These include group representatives reading and predicting problem-solving questions, and collectively interpreting and addressing these challenges.

Following the research, it was found that students' critical thinking skills significantly improved after using the CIRC model. Several factors contribute to this improvement. A crucial factor is the classroom learning process itself. The CIRC model motivates students by actively involving them in group learning activities. Students frequently discuss and pose questions to both their peers and teachers, fostering a collaborative and inquiry-driven learning environment.

The problems incorporated into the CIRC model are real and captivating, designed to provoke students to ask questions from diverse angles. This approach fosters an environment where students become more active and critical in their learning process. They engage in lively discussions, freely debating with peers

and exchanging ideas with both classmates and teachers. These interactions significantly contribute to enhancing students' critical thinking skills.

In the first critical thinking indicator, there is one question item that measures this indicator, namely question point number 1. Question number 1 is to determine the matrix shape of a rectangle which is known in the length and width of the rectangle. The expected thinking of this problem is that students can give simple explanations analyzing the question. On question No. 1, most of the students answered correctly.

In the second critical thinking indicator, there is one question item that measures this indicator, namely question point number 2. The number problem is to determine the inverse of the matrix and determine the price of what is known in the problem. Critical thinking that is expected from this problem is that students can give or determine anything that students can provide relevant observations from the question. In question number 2 most students answer correctly.

In the third critical thinking indicator, there is one question item that measures this indicator, namely question point number 3. Question number 3 is to determine how much Dodi will have to pay if he buys 6 pencils and 5 erasers. Critical thinking that is expected from this problem is that students can check what has been stated, considered, studied, and concluded. On question number 3, most of the students answered correctly.

In the fourth critical thinking indicator, there is one question item that measures this indicator, namely question point number 4. Question number 4 is to calculate the daily income received by each canteen and the total daily income by presenting the matrix form. The critical thinking expected from this problem is that students can define terms and consider an appropriate definition in solving the problem, complete and correct in doing calculations or explanations. On question number 4, most of the students answered correctly.

In the fifth critical thinking indicator, there is one question item that measures this indicator, namely question point number 5. Question number 5 is a matrix equation that corresponds to the problem. Critical thinking expected from this problem is that students can determine the right logical solutions and

strategies in solving problems, and complete and correct in doing calculations/explanations. On question number 5, most of the students answered correctly.

The study results demonstrate that using the CIRC model effectively enhances students' mathematical critical thinking skills. In this model, learning activities center entirely on students, emphasizing their engagement in understanding and grappling with the material. Consequently, learning with the CIRC model encourages students to be more critical and active participants in the learning process. This approach has shown a significant influence in improving students' mathematical critical thinking abilities.

Using the CIRC learning model has proven beneficial in enhancing students' confidence in solving matrix problems and increasing their enthusiasm, thereby improving their mathematical critical thinking skills. This model serves as a viable tool to enhance the quality of classroom learning, aligning with findings from studies by Untari & Astuti (2021) and Febrianto (2018), that highlight the effectiveness of the CIRC model in classroom settings. Beyond matrix subjects, the CIRC model can be adapted for use in various other subjects.

In summary, this study concludes that implementing the CIRC model effectively enhances students' mathematical critical thinking skills. Slavin (2018) said that the main activities in CIRC are solving problem-solving problems including a series of specific joint activities, where one member or several groups read the problem, make predictions, or interpret the content of the problem-polving problem (including writing down what is known, what is asked, and suppose what is asked with a variable), making an overview or solution plan for solving the problem, write down problem-solving solutions in order, and revise and edit each other's work/completion. The findings of this study are consistent with previous research conducted by Jati (2015). Namely in the main activities of the CIRC model, namely, one group member reads reading material and is responded to by other groups, as well as at the concept introduction stage and publication stage, this activity can trigger students to think critically. Based on the analysis of research data, it is evident that students using the CIRC model achieve

higher average scores in mathematical critical thinking skills. The average score for students' mathematical critical thinking skills in this study using the CIRC model was 59.16. Therefore, it can be concluded that the CIRC model significantly enhances students' mathematical critical thinking skills.

The Effect of CIRC on Students' Mathematical Critical Thinking Skills

Based on the comparison of students' mathematical critical thinking skills before and after implementing the CIRC learning model, notable differences in learning processes and student outcomes are evident. Before using the CIRC model, learning was primarily teacher-centered, leading to passive student participation characterized by listening to teacher explanations and completing worksheets (LKS) based on provided material. Research findings indicated that students exhibited low levels of critical thinking skills before the introduction of the CIRC learning model. Meanwhile, in CIRC learning, the focus is that students can solve problem-solving problems including a series of specific joint activities, namely representatives from each group reading questions predicting problem-solving problems and making interpretations related to the problem-solving problems. In line with according to Delviani, Djuanda & Hanifah (2016). this learning model is also applied in the teaching and learning process through the CIRC learning model students are more motivated to explore and interact about existing subject matter, discuss, help each other, and argue and put forward their ideas. After conducting research, it was observed that students' critical thinking skills significantly improved after learning the CIRC model, resulting in higher scores. This indicates that the CIRC model positively impacted students' critical thinking abilities.

These findings align with the results of previous studies conducted by Mudzanatun & Fauziah (2013); and Sari, Hidayat & Harfian (2018), which show that learning using the CIRC model can improve students' mathematical critical thinking skills compared to learning before using the CIRC learning model. In the CIRC learning model, the focus of activities is that students can solve problem-solving problems, including a series of specific joint activities, namely representatives from each group, reading questions predicting problem-solving

problems, and making interpretations related to the problem-solving problems. This is in line with according to Ennis (in Patmawati, 2011). critical thinking is focusing on problems or identifying problems well, finding out what the real problem is, and how to prove it. The results of the research by Widyasari (2013) concluded that the application of the CIRC Model affects students' critical thinking skills.

The CIRC approach fosters greater critical thinking and active participation among students during the learning process. Therefore, implementing the CIRC model significantly enhances students' mathematical critical thinking skills.

CONCLUSION

Based on the data analysis and hypothesis testing conducted, several conclusions can be drawn from this study. First, students' critical thinking skills before using the Cooperative Integrated Reading and Composition (CIRC) Model averaged a score of 36.66, indicating a low level. Second, after implementing the CIRC model, students' critical thinking skills significantly improved, with an average score of 59.16, indicating a high level. Therefore, it can be concluded that the CIRC learning model has a positive influence on students' mathematical critical thinking skills. This study demonstrates that employing the CIRC model can effectively enhance students' mathematical critical thinking abilities.

REFERENCES

Febrianto, S. (2018). *The effect of cooperative integrated reading and composition (CIRC) and self-esteem on students' reading comprehension (a quasi experimental study at the seventh grade students of smp n 3 Ciputat Timur)* (Master's thesis, Jakarta: Fakultas Ilmu Tarbiyah Dan Keguruan Uin Syarif Hidayatullah).

Cahyani, D. (2013). Penerapan Model Pembelajaran Kooperatif Tipe CIRC (Cooperative Integrated Reading and Composition) Berbantuan LKS untuk Meningkatkan Motivasi dan Hasil Belajar Biologi (Siswa Kelas VIII SMP Negeri 14 Jember Tahun Pelajaran 2012/2013).

Christina, L. V., & Kristin, F. (2016). Efektivitas model pembelajaran tipe group investigation (gi) dan cooperative integrated reading and composition (circ) dalam meningkatkan kreativitas berpikir kritis dan hasil belajar

ips siswa kelas 4. *Scholaria: Jurnal Pendidikan dan Kebudayaan*, 6(3), 217-230.

Creswell, J. W. (2019). *Research Desain.* Yogyakarta: Pustaka Belajar.

Delviani, D., Djuanda, D., & Hanifah, N. (2016). Penerapan model kooperatif tipe CIRC (cooperative integrated reading and composition) berbantuan media puzzle kalimat untuk meningkatkan kemampuan membaca anak dalam menentukan pikiran pokok. *Jurnal Pena Ilmiah*, *1*(1), 91-100.

Dewi, R., Ege, B., & Syafruddin, D. (2018). Pengaruh model pembelajaran kooperatif tipe cooperative, integrated, reading, and composition berbasis media peta konsep terhadap kemampuan berpikir kritis siswa pada materi sistem pencernaan manusia. *JPBIO (Jurnal Pendidikan Biologi)*, 3(2), 31-40.

Ekawati, R. (2015). *Peningkatan Hasil Belajar dan Kemampuan Berpikir Kritis Materi Gerak Tumbuhan dengan Model Pembelajaran Kooperatif Tipe Cooperative Integrated Reading and Composition (CIRC) pada Kelas VIII SMPN 2 Randuagung Lumajang* (Doctoral dissertation, University of Muhammadiyah Malang).

Fisher, A. (2014). Critical thinking: Teaching and assessing it. *Inquiry: Critical Thinking Across the Disciplines*, 29(1), 4-16.

Hamdayana, J. (2014). *Model dan Metode Pembelajaran dan Berkarakter*. Bogor: Ghalia Indonesia.

Hidayat, A., & Latifah, R. (2018). Penerapan Model Pembelajaran Cooperatif Integrated Reading and Composition (CIRC) dengan Mind Mapping terhadap kemampuan berpikir kritis siswa kelas XI IPA SMAN 1 Bojongsoang pada materi sistem ekskresi. *Jurnal Bioeduin*, 8(1), 34-42.

Jati, Y. B., Mulyani, S., & Hastuti, B. (2015). Pembelajaran Model Cooperative Integrated Reading and Composition (CIRC) Menggunakan Peta Konsep dan Peta Pikiran Pada Materi Pokok Sistem Koloid Kelas XI Semester Genap SMA N 1 Sragen Tahun Pelajaran 2012/2013. *Jurnal Pendidikan Kimia*, *4*(1), 104-112.

Latifah, R. (2017). *Penerapan Model Pembelajaran Cooperative Integrated Reading and Composition (CIRC) dengan Mind Mapping terhadap Kemampuan Berpikir Kritis Siswa pada Materi Sistem Ekskresi (Penelitian Pre-eksperimen pada Siswa Kelas XI IPA di SMAN 1 Bojongsoang Kab. Bandung)* (Doctoral dissertation, UIN Sunan Gunung Djati Bandung).

Lukitasari, D. R. (2013). Upaya Meningkatkan Kemampuan Berpikir Kritis Siswa melalui Model Pembelajaran Berbasis Masalah dengan Berbantuan Film sebagai Sumber Belajar pada Pokok Bahasan Sikap Pantang Menyerah dan Ulet Kelas X PM SMK N 1 Batang. *Universitas Negeri Semarang, Semarang*.

Miftahul, H. (2016). *Cooperative Learning Methode, dan Penerapan*. Yogyakarta: Pustaka Belajar.

Mudzanatun, M., & Fauziah, I. (2013). Keefektifan model pembelajaran kooperatif tipe CIRC (Cooperative Integrated Reading and Composition) terhadap hasil belajar matematika siswa kelas IV SD Negeri Kedunguter 02 Brebes. *Malih Peddas (Majalah Ilmiah Pendidikan Dasar)*, *3*(1).

Nurdyansyah, N., & Fahyuni, E. F. (2016). Inovasi model pembelajaran sesuai kurikulum 2013.

Nur'asiah, R. R. F., Siahaan, P., & Samsudin, A. (2015). Deskripsi instrumen tes keterampilan berpikir kritis materi alat optik. *Prosiding Simposium Nasional Inovasi dan Pembelajaran Sains 2015*, 497-500.

Patmawati, H. (2011). Analisis Keterampilan Berpikir Kritis Siswa pada Pembelajaran Larutan Elektrolit dan Non-Elektrolit dengan Metode Praktikum.

Rianto, L. A., & Lubis, M. S. (2023). Pengaruh Group Investigation dan Cooperative Integrated Reading and Composition terhadap Kemampuan Berpikir Kritis. *Relevan: Jurnal Pendidikan Matematika*, 3(2), 228-232.

Ruyaliningsih. (2017). *Pengaruh Pembelajaran Cooperative Integrated Reading And Compotition (CIRC) Terhadap Hasil Belajar Matematika*. JKPM (Jurnal Kajian Pendidikan Matematika), Vol 02 (02)

Sanjaya, W. (2015). *Perencanaan dan Desain Sistem Pembelajaran*. Kencana.

Sari, T. A., Hidayat, S., & Harfian, B. A. A. (2018). Analisis Keterampilan Berpikir Kritis Siswa SMA di Kecamatan Kalidoni dan Ilir Timur II. *Bioma: Jurnal Ilmiah Biologi*, *7*(2), 183-195.

Slavin, R. E. (2018). *Educational psychology: Theory and practice*. Pearson.

Sumantri, M. S. (2015). *Strategi Pembelajaran: Teori dan Praktik di Tingkat Pendidikan Dasar*.

Untari, E., & Astuti, I. P. (2021). Efektivitas Model Pembelajaran Kooperatif Tipe Cooperative Integrated Reading and Composition (CIRC), Student Teams Achievement Division (STAD), Dan Jigsaw secara Online terhadap Hasil Belajar Siswa Kelas X Di SMK PGRI 1 Ngawi. *Journal Focus Action of Research Mathematic (Factor M)*, *4*(1), 1-20.

Widyasari, M. (2013). *Pengaruh penerapan model pembelajaran Cooperative Integrated Reading and Composition (CIRC) terhadap kemampuan berpikir kritis siswa pada mata pelajaran geografi SMA* (Doctoral dissertation, Universitas Negeri Malang).

Wulandari, P., Mujib, M., & Putra, F. G. (2016). Pengaruh Model Pembelajaran Investigasi Kelompok Berbantuan Perangkat Lunak MAPLE terhadap Kemampuan Pemecahan Masalah Matematis. *Al-Jabar: Jurnal Pendidikan Matematika*, 7(1), 101-106.