JOURNAL OF WORLD SCIENCE
https://jws.rivierapublishing.id/index.php/jws
Volume 4 No. 3. March 2025
P-ISSN: 2828-8726
E-ISSN: 2828-9307

EFFECTIVENESS OF RICOSRE LEARNING MODEL USING AUDIOVISUAL MEDIA ON STUDENTS' CRITICAL THINKING ABILITIES AND LEARNING OUTCOMES ON BLOOD CIRCULATORY SYSTEM MATERIAL

Siti Rifaatul Mahmudah*, Agung Wijaya Subiantoro
Universitas Negeri Yogyakarta, Indonesia

sitirifaatul.2021@student.uny.ac.id * agung_wijaya@uny.ac.id

ABSTRACT
This study aims to evaluate the effectiveness of the RICOSRE learning model, enhanced by audiovisual media, in improving critical thinking skills and learning outcomes related to the circulatory system, compared to conventional methods. This study employs a quasi-experimental design comparing two groups of students at Al Kahfi Somalangu Islamic High School during the even semester of the 2023/2024 academic year. The sample in this study consisted of 62 students, who were randomly selected and divided into two groups: control and experimental classes. The experimental class had a better learning outcome than the control class. A descriptive analysis of the learning outcomes of students in both the experimental and control classes was conducted utilizing the SPSS 22 for Windows software application. The analysis results show that the use of a learning model supplemented with audio visual media provides better results than conventional methods. The results of the descriptive statistical analysis indicated that students highly supported the application of the model. The study concludes that the ROC curves of the experimental class have a significant difference between the pre-test and post-test results.

Keyword: audiovisual media; critical thinking skills; circulatory system; learning outcomes; RICOSRE

INTRODUCTION

Education in the era of globalization is experiencing increasingly complex challenges, especially in the industrial revolution 4.0 which requires human resources to have critical, creative, communicative, and collaborative (4C) thinking skills (Khoerunnisa & Illahi, 2023; Odewole et al., 2023; Zhang & Zhao, 2018). One important aspect in today's education world is the development of students' critical thinking skills, especially in science subjects, such as Biology. Critical thinking skills are needed to understand abstract concepts, such as the circulatory system, which are highly complex and require in-depth understanding (Hakim & Darojat, 2023; Hasanah et al., 2023; Makhene, 2022). However, various studies show that students still have difficulty understanding biology material, especially the circulatory system, due to learning methods that are less innovative and do not actively involve students (Salsabila et al., 2022). Therefore, innovation in learning models is needed to improve students' understanding and learning outcomes.

Various factors influence the low critical thinking skills and learning outcomes of students in Biology education. One major factor is the continued reliance on traditional teaching methods by educators in schools, particularly in Islamic boarding schools like SMA Islam Al-Kahfi Somalangu Kebumen (Dewi, 2019). The prevalent approach is lecture-based, which results in students being less engaged in critical thinking and lacking sufficient opportunities to explore biological concepts thoroughly. Additionally, the limited use of

innovative teaching media poses a challenge to enhancing students' motivation and comprehension of the subject matter (Zhang & Zhao, 2018). Another contributing factor is the restricted access to technology in the learning environment, hindering students' ability to access more interactive and engaging learning resources.

The effect of employing this uniform learning method is substantial on the quality of Biology education. One result is the minimal engagement of students in the learning process, resulting in a superficial grasp of concepts and poor academic performance (Mahanal & Siti Zubaidah, 2017). Without opportunities to think critically and delve into concepts through active learning, students tend to resort to memorization rather than grasping the underlying essence. Furthermore, inadequate critical thinking abilities affect students' preparedness to confront academic challenges and the increasingly competitive job market (Paat et al., 2022). Consequently, a learning strategy is required to foster critical thinking and enhance student learning outcomes.

To improve the effectiveness of Biology learning, especially in the circulatory system material, the RICOSRE learning model is one solution that can be applied. The RICOSRE learning model (Reading, Identifying the Problem, Constructing the Solution, Solving the Problem, Reviewing the Problem Solving, and Extending the Problem Solving) is a learning model developed to improve students' critical thinking skills through systematic learning syntax (Diah et al., 2023). This model allows students to actively learn through reading, identifying problems, building solutions, solving problems, reviewing solutions made, and expanding problem solving in various contexts. The advantage of this model lies in the involvement of students as a whole in the process of critical thinking and problem solving (Syam & Kurniasih, 2023).

In addition to the use of the RICOSRE model, audiovisual learning media also plays an important role in improving students' understanding of Biology material (Sunaryo et al., 2023). Audiovisual media allows students to connect abstract concepts with more concrete visualizations, making it easier to understand the circulatory system. The use of this media is also based on the characteristics of students in the digital era who are more interested in technology-based learning. The combination of the RICOSRE learning model with audiovisual media is expected to create a more interactive and effective learning environment in improving learning outcomes and critical thinking skills of students (Khasanah et al., 2022).

This study aims to evaluate the effectiveness of the RICOSRE learning model, enhanced by audiovisual media, in improving critical thinking skills and student learning outcomes related to the circulatory system, compared to conventional methods. Audiovisual media facilitates students' understanding by connecting abstract concepts to concrete visualizations, catering to the preferences of digital-era learners (Rahmah & Fitriyana, 2024). The combination of these approaches is anticipated to foster a more interactive and effective learning environment. Given the limited research on the specific application of the RICOSRE model in biology education, this study aims to fill that gap and

provide empirical evidence supporting its effectiveness. The findings are intended to benefit various stakeholders, including school principals, biology teachers, and future researchers, by promoting innovative teaching models that enhance student engagement and learning quality in the digital age.

The current research presents several novel contributions, including the integration of the RICOSRE learning model with audiovisual media, which enhances student engagement in biology education, particularly regarding the complex circulatory system (Khasanah et al., 2022; Sunaryo et al., 2023). It emphasizes the development of critical thinking skills, a focus that has not been extensively documented in previous studies (Hakim & Darojat, 2023; Salsabila et al., 2022). Employing a robust quasi-experimental design with comprehensive data analysis enhances the reliability of the findings, while the research context within an Islamic boarding school provides unique insights into the educational challenges faced in such environments (Dewi, 2019). Finally, the study incorporates student feedback to assess engagement and understanding, adding valuable qualitative dimensions often overlooked in prior research (Istiqomah et al., 2023).

METHOD

This research employs a quasi-experimental design comparing two groups of students at Al Kahfi Somalangu Islamic High School. The control group utilizes traditional teaching methods, while the experimental group engages in learning through the RICOSRE model, supported by audiovisual media. Following the Pretest Posttest Control Group Design, both groups undergo a pretest to evaluate their initial conditions and identify differences in performance.

Conducted from January to June 2024, the study focuses on eleventh-grade IPA students during the even semester of the 2023/2024 academic year. The sample was selected through simple random sampling, ensuring every student had an equal chance of participation. The research examines critical thinking skills and learning outcomes, with controlled variables including teachers, subject matter, and the learning period.

Data collection involved several techniques, including tests (pretest and posttest), observations of critical thinking skills, questionnaires to gauge student responses, and documentation of research activities. All instruments were validated for content and construct validity, and reliability was assessed to ensure consistent results. Statistical analyses included normality and homogeneity tests, followed by an Independent Sample T-Test to determine significant differences between the experimental and control groups before and after treatment.

RESULTS AND DISCUSSION

Results

This research was conducted at SMA Islam Al Kahfi Somalangu Kebumen in the period from January to May 2024. The main objective of this study was to determine the

effectiveness of the RICOSRE learning model assisted by audiovisual media on critical thinking skills and learning outcomes of class XI students.

The sample in this study consisted of 62 students, who were randomly selected and divided into two groups:

1) Experimental class: 29 students, received learning with the RICOSRE model assisted by audiovisual media.
2) Control class: 32 students who followed conventional methods of learning.

Each group was given a pretest before treatment to measure students' initial abilities and a posttest after treatment to measure learning outcomes. During the study, 6 meetings were held in each class, with a duration of 90 minutes per meeting. This study measures two main variables:

1) Critical Thinking Skills: Measured through observation sheets used during learning.
2) Learning Outcomes: Measured through pretest and posttest with 40 multiple-choice questions.

In addition, to determine the effectiveness of the learning model, an analysis of student responses was conducted using a Likert-based questionnaire.

Instrument Test

This test is used to obtain valid and reliable results. The instruments in this study have gone through instrument validity testing, namely content validity and construct validity.

1) The results of the question validity test using construct validity with the product moment formula with the help of the SPSS for Windows version 22 program. This question validity test is tested at a higher level.
2) Test results, the reliability test can be seen from the Cronbach Alpha value. The reliability test results obtained with a total of 40 questions are 0.687 with high criteria.

Prerequisite Test

Normality and homogeneity are prerequisite tests before conducting inferential analysis of student learning outcomes. Normality testing is carried out using the Kormogorov-Smirnov test, then for homogeneity using the Levene's test with the help of the SPSS 22 for Windows application. Data from the normality and homogeneity test results of the distribution on the critical thinking observation sheet of students from the control class and the experimental class, Table 1. Results of the Normality and Homogeneity Test of the Distribution of the Critical Thinking Ability Observation Sheet**.**

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of the distribution on the critical thinking observation sheet of students from the control and experimental classes.

Table 1. Results of the Normality and Homogeneity Test of the Distribution of the Critical Thinking Ability Observation Sheet

No	Intervention	Kolmogorov-Smirnova			Description (@5%)
		df	*Statistic*	*Sig*	
1	Control Class	32	0,945	0,200	Normally Distributed
2	Experimental Class	29	0,937	0,112	Normally Distributed
3	Levene's test		0,218		Homogeneous

The table shows both classes are normally distributed. Levene's test yields a significance of 0.218, which exceeds 0.05. This indicates normality and homogeneity in student learning outcomes for both control and experimental classes.

Table 2. Results of the Normality Test of the Distribution of Student Learning Outcomes

No	Intervention	Kolmogorov-Smirnova			Description (@5%)
		df	*Statistic*	*Sig*	
1	Control Class	32	0,148	0,072	Normally Distributed
2	Experimental Class	29	0,134	0,194	Normally Distributed
3	Levene's test		0,377		Homogeneous

Both classes show normal distribution. Levene's test results indicate a significance of 0.876, exceeding 0.05, which signifies homogeneity of variance between the control and experimental classes. Hypothesis proof can proceed with inferential analysis. This data comes from the Normality and Homogeneity Tests of Learning Outcomes in the Pretest and Posttest of the Experimental Class.

The results pertaining to the normality and homogeneity tests of the distribution of pretest and posttest scores for the students in the experimental class were acquired utilizing the Kolmogorov-Smirnov test. Subsequently, the homogeneity was assessed employing Levene's test, facilitated by SPSS for Windows version 22.

Table 3. Results of the Normality and Homogeneity Test for the Distribution of Pretest and Posttest Value Data

No	Intervention	Kolmogorov-Smirnov$_a$			Description (@5%)
		df	*Statistic*	*Sig*	
1	Pretest Score Data	29	0,945	0,169	Normally Distributed
2	Posttest Score Data	29	0,937	0,194	Normally Distributed
3	Levene's test		0,866		Homogeneous

The data from both the pretest and posttest are normally distributed. The Levene's test analysis shows a significance value of 0.866, which, compared to the decision-making guidelines, is greater than 0.05. This indicates that the variance of the data is homogeneous.

Hypothesis Testing

Critical Thinking Skills

Inferential proof of the hypothesis is provided using parametric statistics, specifically an independent sample t-test. This t-test determines whether there is a significant difference between the control and experimental classes. Data on the average value of the observation sheet assessing students' critical thinking skills is gathered from the control class.

Table 4. Data on the Average Value of Critical Thinking Skills in the Control Class and Experimental Class

No	Type	Critical Thinking Skills Value	
		Control Class	***Experimental Class***
1	Mean	22,28	24,17
2	Maximum Value	-0,979	-0,987
3	Minimum Value	-2,804	-2,796
4	Standard Deviation	1,922	1,605

Descriptive analysis for the observation sheet of critical thinking skills of the control and experimental classes was carried out with the help of the SPSS 22 for Windows software application. The average results (mean) between the control class and the different experimental class, where the experimental class has a higher average critical thinking ability of 24.17. The difference in critical thinking skills between the control and experimental classes is 1.89. This value can be concluded descriptively statistically that there is a difference in average critical thinking skills between the control and experimental classes.

Table 5. Data from the Results of the Analysis of Critical Thinking Skills in the Control Class and Experimental Class

t-test	df	Sig.(2-tailed)
-4,148	59	0,000

Decision-making can be done in two ways: by comparing the calculated t with the t table and by looking at the sig. value (2-tailed). The data in Table 7 above shows that the calculated t value is -4.148. The calculated t value is negative because the critical thinking ability of the control class is lower than the critical thinking ability value in the experimental class.

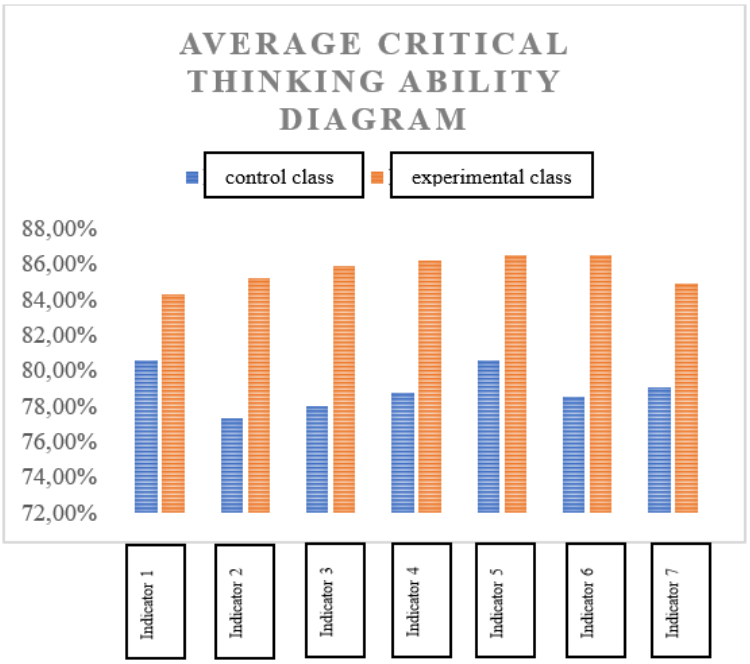

Figure 1. Average Critical Thinking Ability Diagram

The diagram illustrates that the learning model affecting critical thinking skills is the RICOSRE model, utilized in the experimental class with the help of audiovisual media. Additionally, the appendix highlights the percentage of observation results for critical thinking skills in both the control and experimental classes.

Student Learning Outcomes

Analysis of student learning outcomes from the control and experimental classes using the Independent Samples T-test.

Table 6. Data on Average Learning Outcome Values of the Control Class and Experimental Class

No	Type	Student Learning Outcome Value	
		Control Class	***Experimental Class***
1	Mean	76,41	81,55
2	Maximum Value	-1,569	-1,541
3	Minimum Value	-8,722	-8,750
4	Standard Deviation	6,505	7,453

A descriptive analysis of the learning outcomes of students in both the control and experimental classes was conducted utilizing the SPSS 22 for Windows software application. The average results (mean) reveal that the experimental class achieved a higher mean learning outcome of 81.55 compared to the control class. The observed difference in learning outcomes between the control and experimental classes is 5.09. This value permits

a statistical conclusion that there exists a significant difference in the average learning outcomes of students between the control and experimental classes.

Table 7. Data from the Results of Analysis of Learning Outcomes of Students in the Control Class and Experimental Class

t-test	df	Sig.(2-tailed)
-2,879	59	0,006

Decision-making can be conducted through two methodologies: juxtaposing the calculated t-value with the t-table, and examining the significance (2-tailed) value. The calculated t-value is -2.879. This negative t-value indicates that the learning outcomes for students in the control group are inferior to those of students in the experimental group.

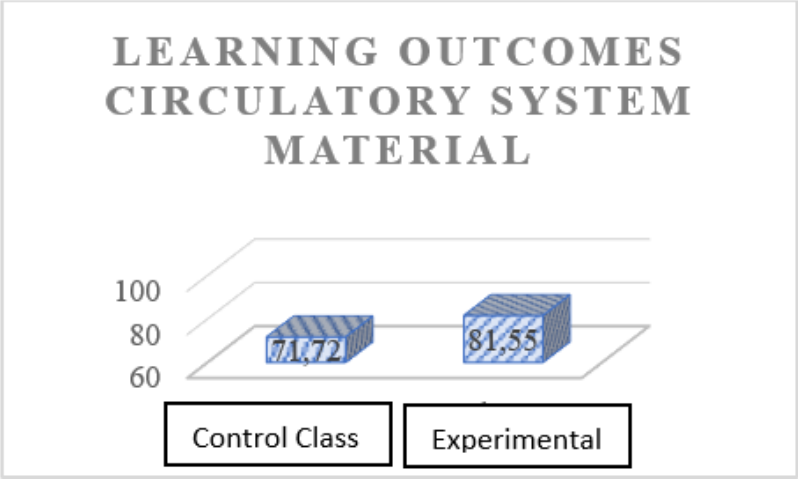

Figure 2. Average Learning Outcome Diagram

The learning model that affects biology outcomes is the RICOSRE model used in the experimental class, supported by audiovisual media. For a summary of the percentage of biology learning outcomes in both the control and experimental classes, refer to the appendix.

Comparison Test of Learning Outcomes Pre-test and Post-test Experimental Class

The paired sample T-test analyzes the pretest and post-test results of the experimental class. Its goal is to identify differences between two related or paired samples.

Table 8. Data on Average Pre-test and Post-test Values of the Experimental Class

No	Type	Student Learning Outcome Score	
		Pre-test Score	***Post-test Score***
1	Mean	71,72	81,55
2	N	29	29
3	Standard Deviation	7,937	7,453

The average learning outcomes of the Experimental class in the Pre-test and Post-test are 71.72 and 81.55, respectively. This indicates a descriptive difference in average learning outcomes between the Pre-Test and Post-Test. Furthermore, to determine if the difference is statistically significant, it is necessary to interpret the results of the Paired Samples T-test.

Table 9. Results of the Correlation Test of the Pre-Test and Post-Test of the Experimental Class

N	Correlation	Sig.
29	0,149	0,439

The correlation between the pre-test variables and the post-test variables shows a correlation coefficient of 0.149, with a significance value of 0.439. Since the significance value of 0.439 exceeds the probability threshold of 0.05, it can be concluded that there is no relationship between the pre-test variables and the post-test variables.

Table 10. Data on the Influence of Learning Outcomes on Pre-Test and Post-Test Experimental Classes

Mean	-9,828
Std.Deviation	10,043
Std.Error	1,865
t	-5,270
df	28
Sig. (2-tailed)	0,000

The Sig. (2-tailed) value is 0.000 <0.05, so H0 is rejected and Ha is accepted. It can be concluded that there is an average difference between the learning outcomes of the pre-test and post-test, which means that the use of the RICOSRE learning model assisted by audiovisual media influences student learning outcomes.

Analysis of Student Responses

The analysis uses a Likert measurement scale, with the highest number 4 and the lowest 1, and a description of the answer ranging from "strongly disagree" to "strongly agree."

Table 11. Class Interval Calculation

Variable	Indicator	Formula (Highest Score – Lowest Score / Number of Classes)	Class Interval
The RICOSRE Learning Model is assisted by audiovisual media	A	4 – 1 / 20	0,4
	B	4 – 1 / 20	
	C	4 – 1 / 20	
	…	…	

	T	4 – 1 / 20

Table 12. Class Range Calculation

Variable	Class Interval	Class Scale Range	Description	Results
The RICOSRE Learning Model is assisted by audiovisual media	0,4	1-1,4	Disagree	2,5
		1,41-1,8	Less agree	
		1,81-2,2	Agree	
		2,21-2,6	Strongly agree	

The overall result obtained was 2.5, which falls within the scale range of 2.21 to 2.6. This indicates that students strongly agree that the RICOSRE learning model, supported by audiovisual media, should be applied to the learning process.

Discussion

SMA Islam Al Kahfi Somalangu is situated in the Al Kahfi Somalangu Islamic Boarding School in Kebumen. This school operates on a boarding model, allowing students to reside in dorms while participating in a curriculum that integrates formal and religious instruction. The RICOSRE learning model enhances critical thinking skills and improves educational results. It utilizes interactive audiovisual resources such as E-LKPD Liveworksheet and the e-teaching Module, all conveniently accessible through the Android app "BIOGANZA."

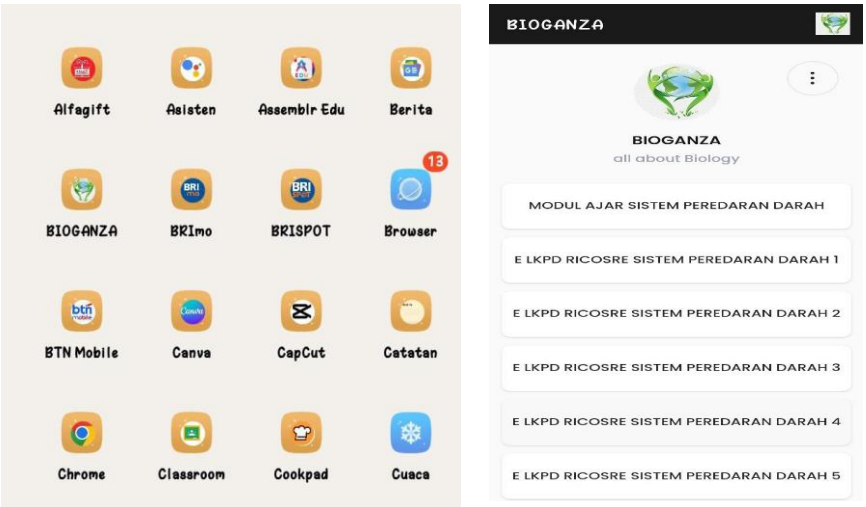

Figure 3. Android Application View and Application Front Page View

Some of the design and visual communication platforms used in this E-LKPD live worksheet include Canva, YouTube videos, and Augmented Reality. Teachers and researchers also utilize Artificial intelligence and barcodes as learning media. The learner

activities in this E-LKPD live worksheet are arranged according to the syntax in the RICOSRE learning model.

Figure 4. Front Page View and Contents of E-LKPD

Use of E-Modules. This E-Module, in its creation, utilizes the Canva design platform, and the downloaded results are linked to the PubHTML flip book maker. PubHTML flip book maker is an open-source software, where this application can convert PDF files into interactive digital books.

Figure 5. Front cover view of flipbook

The analysis results show that using the RICOSRE model assisted by audiovisual media provides better results than conventional methods. The main differences are seen in:

1) The critical thinking skills of students in the experimental class are higher than those in the control class.
2) The learning outcomes of students in the experimental class are better than those in the control class

This study's findings align with earlier research asserting that technology-based learning models enhance student learning outcomes. A descriptive statistical analysis was performed on student feedback to assess acceptance of the learning model. Results indicated that students highly supported the use of the RICOSRE model supplemented with audiovisual media. The students' feedback revealed that:

1) They were more enthusiastic in learning.
2) More confident in expressing opinions.
3) Curiosity increased.

The students' feedback indicated that: a. Their enthusiasm for learning improved. b. They gained confidence in voicing their opinions. c. Their curiosity grew. This demonstrates that technology-based learning positively influences students. However, there are some limitations identified in this study:

1) Limited literature on similar research.
2) Limited time and energy cause the research to be less than optimal.
3) Limited use of learning tools and media, where the use of smartphones in groups is still limited.

CONCLUSION

The study concludes that the RICOSRE learning model, enhanced by audiovisual media, is more effective than conventional methods in improving critical thinking skills and student outcomes, with students demonstrating better understanding, deeper thinking, and increased motivation. However, limitations such as restricted research time, unequal access to technology, and the study being conducted in a single school hinder the generalizability of the results. Future research should expand the application of the RICOSRE model across diverse educational settings to assess its broader effectiveness and explore the integration of interactive media to further enhance learning outcomes. Additionally, developing adaptive technology applications is crucial to ensure equitable access to digital resources for all students, maximizing the benefits of the RICOSRE model regardless of their technological backgrounds.

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