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The Influence of the Learning Cycle 7E Model on Critical Thinking Skills and Learning Outcomes in Grade XII Biology at SMAN 4 Blitar City

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Abstract
The increasingly rapid development of science and technology (IPTEKS) is a security that can improve people's welfare. Therefore, new education is a directed at increasing the nation's competitiveness so that it is able to compete in global competition. This can be achieved if education in schools is directed not solely at mastering and understanding scientific concepts, but also at improving student's thinking abilities and skills, especially critical thinking skills and learning outcomes is the 7E Learning Cycle model. This research aims to determine the effect of the 7E Learning Cycle model on critical thinking skills and learninf outcomes of class XII science students at SMAN 4 Blitar city. The sample used was 33 students as the control class and 35 stundets as the experimental class. The data analysis technique used is the prerequisite test for normality and homogeneity and the ANCOVA hypothesis test. The research result show that using the learning cycle 7E model has a positive influence on improving critical thinking skills and students learninf outcomes compared to using the conventional learnig model. In the learning cycle 7E model, the average corrected score for critical thinking skills is 7,9% higher and learning outcomes are 6,8% conventional learning.

Keywords: *Critical thinking skills, learning cycle 7E, learning outcomes*

1. INTRODUCTION

The rapid advancement in Science, Technology, and Innovation (STI) represents progress that can enhance societal well-being. However, these developments also pose challenges in global competition. In this situation, the quality of human resources (HR) must be improved, which means the quality of education needs enhancement. Generally, the quality of a nation's HR can be seen through the quality of its education system (Kunandar & KTSP, 2007). Therefore, education should focus on enhancing the nation's competitiveness to be able to Compete globally. This can be achieved if education in

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schools is not only directed towards mastering and understanding scientific concepts but also towards developing students' abilities and skills in critical thinking, especially critical thinking skills (Sadia, 2008).

Critical thinking is thinking that makes sense and focused reflection to decide what should be believed or done. It means thoughtful reasoning and focused reflection aimed at determining what should be believed or done (Ennis, 1987). The opinion can be interpreted as stating that essentially, when people think, they are exercising their intellectual abilities. During the process of thinking, various alternatives and solutions to the problems at hand emerge, enabling individuals to determine the necessary actions to take. This decision-making process is a part of critical thinking. Critical thinking skills are crucial in the study of Biology. Biology is a science closely related to everyday life. However, in schools, students' critical thinking skills remain low because the focus of learning is more on remembering and understanding. According to research, 21% of students have high critical thinking skills, 15% have moderate skills, and 64% have very low skills (Andini & Retno, 2022).

The research conducted by Aryani Novianti, Meiry Fadilah Noor, and Baiq Hana Susanti (2014) on the topic of the Human Digestive System resulted in a learning cycle model aimed at improving students' critical thinking skills, with a confidence level of 0.95. The study found that the highest achievement indicator was the application of principles at 74.78%, and the percentage of critical thinking skills developed among students was 84.45% (Adnyani, Pujani, & Juniartina, 2018). The study conducted by Romy Faisal Mustofa (2018) on the application of the 7E learning cycle model in the topics of Bryophyta and Pteridophyta showed significant influence. Students using the 7E learning cycle model obtained a score of 86.58%, whereas students in the conventional learning group scored 77.95%. This reflects a difference of 8.63% (Mustofa, 2019). The research conducted by Mitarayani, Saleh Hidayat, and Naintyn Novitasari (2018) on the topic of Biodiversity showed a significant impact of applying the Learning cycle model on student learning outcomes. Using PowerPoint and worksheets (LKS), there was a significant difference in learning outcomes between those using the 5E Learning cycle model and those in the conventional learning group (Mitrayani, Hidayat, Novitasari, 2018).

Based on observations and interviews with Biology teachers of grade XI at SMAN 4 Kota Blitar on December 5, 2022, it was found that 79% of grade XI science students scored below the minimum passing grade (KKM) of 75. The low scores are attributed to the current learning models that do not adequately support critical thinking skills, as evidenced by students' passivity when asked to present ideas or arguments. Passive learning hinders the development of critical thinking, which is crucial for academic achievement.

Changing the learning model to a more active approach could be a solution to this issue, such as implementing the 7E Learning Cycle Model. The 7E Learning Cycle Model is a systematic approach that allows students to actively engage in each stage, thereby enabling them to master the material effectively. This active participation helps students understand concepts better and retain them in long-term memory (Purwoko, 2017). This model enables teachers to conduct meaningful activities for students and helps them develop critical thinking skills (Balta & Sarac, 2016).

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Based on the description, it shows that learning with the 7E Learning Cycle Model can enhance critical thinking skills and learning outcomes. Therefore, further research is needed to investigate this "The Influence of the Learning Cycle 7E Model on Critical Thinking Skills and Learning Outcomes in Grade XII Biology at SMAN 4 Blitar City."

2. LITERATURE REVIEW

2.1. Learning Cycle 7E Model

The success of the learning process heavily relies on teachers' ability to develop learning models that focus on effectively engaging students throughout the learning process. Learning models encompass a broader meaning compared to strategies, methods, or procedures in teaching. A learning model can be defined as a way or technique used in instructional activities with systematically designed procedures to achieve the objectives of learning.

In 2003, Arthur Einskraft expanded the Learning Cycle Model into seven stages, known as the 7E Learning Cycle. Research on the learning process and curriculum development indicated the need to expand the 5E Learning Cycle model into the 7E Learning Cycle model. In the 5E Learning Cycle model, the engage phase was expanded into two parts: elicit and engage. Similarly, the elaborate and evaluate phases were expanded into three parts: elaborate, evaluate, and extend (Eisenkraft, 2003). The primary role of the teacher in the Learning Cycle 7E process is as a facilitator, mediator, and motivator. The seven stages or syntax in the Learning Cycle 7E learning model developed by Arthur Einskraft are elicit, engage, explore, explain, elaborate, evaluate, and extend. The Learning Cycle 7E model begins with the teacher posing questions to assess students' prior knowledge (Elicit). In the engagement phase, students are encouraged to make predictions about the phenomena to be discussed. During exploration, students work together in small groups to test their predictions. In the explanation phase, students present their exploration results in a classroom discussion (Eisenkraft, 2003).

In the elaboration phase, students engage in discussions while the teacher helps correct misconceptions towards scientific understanding. During the evaluation phase, effectiveness assessments are conducted on previous stages as well as on students' knowledge and understanding of concepts. The extend phase provides students with opportunities to develop and apply mastered scientific concepts to related topics. The Learning Cycle 7E model offers several advantages. Teachers can select more effective learning strategies based on students' prior knowledge (elicit). Students are stimulated to recall previous material, become more active and curious through engagement, experience discovery learning in exploration which makes concepts more meaningful and enduring, and accommodate students' critical and creative thinking abilities. However, the model also has its drawbacks. It requires teachers to have a thorough grasp of the subject matter and its steps for effective implementation, demands dedication and creativity from teachers, and necessitates more time and effort to plan and execute lessons (Darsana, Sadia, Tika, 2014).

2.2. Critical Thinking Skills

Thinking is a highly complex series of processes that occur within the human brain. The process of thinking is essential for processing information effectively. According to Tawil and Liliasari, "Thinking is a cognitive process, a mental activity to acquire knowledge." This process involves activities such as remembering, analyzing,

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understanding, reasoning, and using language to acquire knowledge (Tawil, 2013). Butterworth and Geoff Thwaites suggest that "Activities such as analysis, evaluation, problem-solving, and decision-making pose higher levels of challenge than merely knowing, remembering, or understanding facts. What sets thinking apart is that a thinker applies knowledge and adapts it to specific purposes." This highlights the active and purposeful nature of thinking beyond mere acquisition of information (Butterworth & Thwaites, 2005). From the statement, it can be concluded that thinking is a mental activity involving brain functions such as analyzing, evaluating, seeking solutions, in order to receive new information for problem-solving, developing ideas, and making decisions.

Critical thinking is one aspect of complex thinking. According to Ennis, "Critical thinking is the ability to give reasoned and reflective consideration to what is believed and done" (Purwoko, 2017). According to Scriven and Paul, critical thinking is a disciplined process of intellectually active and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action (Tawil, 2013). From these various perspectives, it can be concluded that critical thinking is a process of clear and rational thinking that actively and skillfully conceptualizes, analyzes, synthesizes, and/or evaluates incoming information to enhance the quality of one's thinking. Developing critical thinking skills can assist individuals in drawing conclusions by considering real-world data and facts.

2.3. The Essence of Learning Outcomes

According to constructivist theory, learning is not just about memorization but rather the process of constructing knowledge through experiences. One of the pioneers of constructivism, as explained by Jean Piaget, suggests that knowledge formation involves cognitive processes to achieve equilibrium, resulting in the formation of new schemas (Haryanto, 2020). As stated by Sadia, "Learning is not simply adding new information, but involves the interaction between new knowledge in relation to prior knowledge." This emphasizes the importance of integrating new information with existing knowledge as a fundamental aspect of the learning process (Darsana et al., 2014). This can be interpreted as in the acquisition of knowledge, individuals construct their own understanding. From the various opinions mentioned above, it can be concluded that learning involves active engagement where learners integrate and connect experiences or materials learned with their existing understanding, thereby expanding their knowledge.

In constructivist theory, understanding of learning emphasizes the process rather than the outcome. During the learning process, learning outcomes, learning methods, and learning strategies influence the development of learners' thinking patterns and schemas. Learning outcomes are influenced by learners' experiences with the physical world and their environment. The outcomes of learning depend on what learners already know, including concepts, goals, and motivations that affect their interaction with the material being studied. Learning outcomes can be assessed through an evaluation process aimed at collecting data to show the extent to which learners achieve learning objectives. Thus, learning outcomes reflect learners' abilities after they have undergone the learning process. These abilities encompass cognitive, affective, and psychomotor aspects. In this research, learning outcomes in biology are evaluated based on the cognitive domain, namely remembering (C1), understanding (C2), applying (C3), analyzing (C4), and evaluating (C5). The instrument used to measure these learning outcomes is the testing technique.

Include the current knowledge including substantive findings, as well as theoretical and methodological contributions to your topic. A literature review surveys books, scholarly articles, and any other sources relevant to a particular issue, area of research, or theory, and by so doing, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated.

3. METHODS

This research employs a quantitative approach with an experimental design. The experimental design used is a Quasi-Experimental Design with a Pretest-Posttest Control Group Design. Respondents are divided into two groups: the first group serves as the experimental class using the Learning Cycle 7E model, while the second group serves as the control class using conventional teaching methods such as lectures and assignments. The structure of the research design can be seen in the following Table 1.

Table 1. Research Design

Subject Design	Pretest	Treatment	Posttest
Experiment	P1	X	P2
Control	P1	-	P2

Explanation:
P1 : Pretest questions on critical thinking skills and learning outcomes.
P2 : Final test (posttest) on critical thinking skills and learning outcomes.
X : Learning Cycle 7E
(-) : Using the conventional method of lectures and assignments

The population in this study consists of the 12th-grade students of SMA Negeri 4 Kota Blitar, which includes class XII MIPA 1 (9 males, 26 females), XII MIPA 2 (12 males, 21 females), XII MIPA 3 (12 males, 22 females), and XII MIPA 4 (13 males, 22 females). The sample for this study totals 68 students, with XII MIPA 1 as the experimental class (35 students) and XII MIPA 2 as the control class (33 students). The sampling technique used is purposive sampling, which involves selecting samples based on specific criteria. These criteria include a difference in the number of students not exceeding 10% and equivalent average scores for the odd semester exams. This study has three variables: the independent variable, the dependent variable, and the control variable. The independent variable is the Learning Cycle 7E model. The dependent variables are critical thinking skills and student learning outcomes. Control variables include the teacher, students, learning resources, learning media, class level, and learning time.

The research instruments used in this study are tests for critical thinking skills and student learning outcomes. The instrument for the critical thinking skills test consists of essay tests, where each question includes indicators of critical thinking skills, while the learning outcomes test uses multiple-choice questions. Additionally, an observation sheet is used as an instrument to evaluate the implementation of the learning process according to the Learning Cycle 7E design or plan. This sheet contains a list of all activities based on the Learning Cycle 7E syntax performed by both the teacher and students during the learning process.

The stages of this study include three phases: the pre-field phase, the fieldwork phase, and the analytical phase. The pre-field phase consists of several steps. First, the

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conceptual stage, which includes formulating and identifying problems, reviewing relevant literature, defining the theoretical framework, and formulating hypotheses. Second, the design and planning stage, which involves selecting the research design, identifying the population under study, determining methods to measure research variables, designing the sampling plan, and preparing research instruments. Third, selecting the research site that aligns with the research objectives. Fourth, obtaining permissions to conduct research at the chosen location. Fifth, gathering and utilizing information from homeroom teachers or subject teachers regarding the sample to be studied. Sixth, preparing research tools to facilitate the research process.

The fieldwork phase includes three main steps. First, conducting initial orientation or observation to gather information about the number of students, learning conditions, and determining the research subjects, consisting of the experimental and control classes based on learning evaluations and recommendations from the biology teacher after normality and homogeneity tests. Second, the implementation of the learning process begins with a pretest in both classes, followed by Learning Cycle 7E-based learning in the experimental class and conventional learning in the control class. Third, after the learning process is completed, a posttest is conducted to measure critical thinking skills and learning outcomes. The final phase is the analytical phase, where the activities include processing and analyzing the research data. The data collected from the field are processed and analyzed to draw conclusions, including the results of hypothesis testing.

Hypothesis testing in this study employs ANCOVA to analyze whether the difference in students' posttest scores between the experimental and control groups is caused by the treatment, with the pretest serving as a covariate. ANCOVA is conducted to identify the effect of treatment on response changes while controlling for other quantitative variables, using SPSS for analysis. Prior to hypothesis testing, normality and homogeneity of data are assessed. Normality is tested using the Kolmogorov-Smirnov test in SPSS with a significance level of 5%. The data tested include both the experimental and control classes. Homogeneity of data is tested using Levene's Test Equality of Variances in SPSS with a significance level of 5%.

4. RESULTS AND DISCUSSION

4.1. The Results of The Normality Test of The Data

The normality test results for critical thinking skills and learning outcomes from the pretest and posttest data can be seen in Table 2. The normality test was conducted to determine whether the data on critical thinking skills followed a normal distribution. Based on the Kolmogorov-Smirnov test results presented in Table 2, all significance values for both the experimental and control classes in the pretest and posttest assessments were greater than 0.05. Specifically, the pretest results for the experimental class had a significance value of 0.079, while the control class had a value of 0.101. Similarly, the posttest results showed significance values of 0.890 for the experimental class and 0.079 for the control class.

These findings indicate that the data for critical thinking skills in both groups adhere to the assumption of normality. A normally distributed dataset is essential for conducting further parametric statistical analyses, such as ANCOVA, which rely on this assumption to ensure valid and reliable results.

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Table 2. Summary of Normality Test for Critical Thinking Skills Data

	Model_Learning_Cycle 7E	Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Critical Thinking Pretest	Experiment Class	0.913	35	0.079
	Control Class	0.837	33	0.101
Critical Thinking Postest	Experiment Class	0.954	35	0.890
	Control Class	0.756	33	0.079

A normality test was conducted to determine whether the learning outcomes data followed a normal distribution. As presented in Table 3, the results of the Kolmogorov-Smirnov test indicate that all significance values for both the experimental and control classes in the pretest and posttest assessments are greater than 0.05. Specifically, the pretest significance values were 0.574 for the experimental class and 0.705 for the control class. Similarly, the posttest results showed significance values of 0.832 for the experimental class and 0.789 for the control class. These findings confirm that the learning outcomes data in both the experimental and control groups meet the assumption of normality. Ensuring that data are normally distributed is crucial for conducting further parametric statistical analyses, such as ANCOVA, which require normality to produce valid and reliable conclusions.

Table 3. Summary of Normality Test for Learning Outcomes Data

	Model_Learning_Cycle7E	Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Learning Outcomes Pretest	Experiment Class	0.910	35	0.574
	Control Class	0.912	33	0.705
Learning Outcomes Postest	Experiment Class	0.939	35	0.832
	Control Class	0.934	33	0.789

4.2 Homogeneity Test Results

After testing for normality, the next prerequisite test is the homogeneity test of the data. The research data subjected to homogeneity testing includes scores of critical thinking skills and learning outcomes from pretest and posttest. The results of the homogeneity test for critical thinking skills and learning outcomes can be seen in Table 4.

Table 4. Homogeneity Test of Critical Thinking Skills and Learning Outcomes Data

	Levene Statistic	df1	df2	Sig.
Critical Thinking Pretest	16.327	1	66	.007
Critical Thinking Postest	.004	1	66	.949
Learning Outcomes Pretest	.060	1	66	.807
Learning Outcomes Postest	.035	1	66	.852

In Table 4, it is observed that the homogeneity test results for critical thinking skills and learning outcomes in both the experimental and control classes show significance levels greater than 0.05. This indicates that the sample data comes from populations that have homogeneous variances.

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4.3 Hypothesis Testing Results

Based on the results of the ANCOVA test, the effect of the treatment on critical thinking skills shows that the hypothesis test on the learning model yields a value of 0.957 > 0.005. This means that H0 is rejected, and the research hypothesis is accepted, indicating that the Learning Cycle 7E model has an impact on critical thinking skills. The analysis results show that the average score of critical thinking skills in conventional learning is 50.00, while in the Learning Cycle 7E model, it is 59.37. Therefore, the corrected average score of critical thinking skills in the Learning Cycle 7E model is 9.37% higher than in conventional learning. This indicates that the Learning Cycle 7E model has the potential to improve students' critical thinking skills more than conventional learning. The results of the ANCOVA statistical analysis for the dependent variable of students' critical thinking skills are briefly presented in Table 5.

Tabel 5. Hypothesis Test of Critical Thinking Skills

		Sum of Squares	Df	Mean Square	F	Sig.
Critical Thinking Pretest	BetweenGroups	7129.932	1	7129.932	44.402	0.561
	WithinGroups	10598.068	66	160.577		
	Total	17728.000	67			
Critical Thinking Postest	BetweenGroups	1491.711	1	1491.711	9.017	0.957
	WithinGroups	10918.171	66	165.427		
	Total	12409.882	67			

The results of the ANCOVA test on the effect of the treatment on learning outcomes show that the hypothesis test on the learning model yields a value of 0.008 > 0.005. This means that H0 is rejected, and the research hypothesis is accepted, indicating that the Learning Cycle 7E model has an impact on learning outcomes. The analysis results show that the average score of learning outcomes in conventional learning is 55.75, while in the Learning Cycle 7E model, it is 64.57. Therefore, the corrected average score of learning outcomes in the Learning Cycle 7E model is 8.82% higher than in conventional learning. This indicates that the Learning Cycle 7E model has the potential to improve students' learning outcomes more than conventional learning. Furthermore, the results of the ANCOVA statistical analysis for the dependent variable of learning outcomes are briefly presented in Table 6.

Tabel 6. Hypothesis Test of Learning Outcomes

		Sum of Squares	Df	Mean Square	F	Sig.
Learning Outcomes Pretest	Between Groups	788.603	1	788.603	2.517	.117
	WithinGroups	20674.632	66	313.252		
	Total	21463.235	67			
Learning Outcomes Postest	Between Groups	1319.486	1	1319.486	8.476	.008
	WithinGroups	10274.632	66	155.676		
	Total	11594.118	67			

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4.4 Discussion

Based on the above analysis, the Learning Cycle 7E model affects critical thinking skills. There is a significant difference between students learning with the Learning Cycle 7E model and conventional learning. Students using the Learning Cycle 7E model experience a 43.19% increase in critical thinking skills, while conventional learning only increases by 9.67%. The average final score of critical thinking skills in the Learning Cycle 7E model class is 8.3% higher than in conventional learning, indicating that this learning model is more effective in improving students' critical thinking skills. This research is in line with the study by Romy Faisal M (2018), which shows that the Learning Cycle 7E model enhances critical thinking skills more than conventional learning (Mustofa, 2019). Mitarayani (2018) also found that the Learning Cycle 5E model can improve critical thinking skills (Mitrayani et al., 2018). Learning activities that involve orienting students to problems and group discussions in the Learning Cycle 7E model can help develop critical thinking aspects. Critical thinking skills are essential in learning, as they help students understand complex problems, synthesize information, and find solutions from various perspectives (Agustina, 2019). These skills also equip students to face the demands of the times, which require effective and efficient skills (Setyaningtyas, 2019).

6. CONCLUSION

The conclusion of this study, there is an influence of the Learning Cycle 7E on critical thinking skills and learning outcomes in Grade XII Biology at Senior High School. Students learning with the Learning Cycle 7E model have a corrected average score of Critical Thinking Skills that is 43.19% higher than students in conventional classes, who have an average score of 9.67%. Students learning with the Learning Cycle 7E have a corrected average score of Learning Outcomes that is 54.16% higher than students in conventional classes, who have an average score of 35.21%. Based on the research conducted, the researcher has several recommendations, including: 1) learning with the Learning Cycle 7E model requires a considerable amount of time, thus meticulous planning is essential to ensure optimal learning outcomes; 2) Teachers can integrate the Learning Cycle 7E model into their teaching activities to prevent student boredom and encourage active participation throughout the learning process.

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