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LCI Learning Model: A Solution to Improve Critical Thinking Skills for Pre-Servide Elementary School Teacher Students

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ABSTRACT

Critical thinking skills are essential for every student because they help build knowledge, train logical thinking, and include the characteristics of one's intelligence in dealing with a problem. However, learning carried out in Indonesia does not empower critical thinking skills, especially for pre-service elementary school teaching students in remote areas of Malang. This study aims to determine the improvement of critical thinking skills of pre-service elementary school teacher students through the LCI learning model so that learning is more focused on training students' critical thinking skills. The research design used in this study was quasi-experimental. The subjects of this study were pre-service elementary school teacher students at Raden Rahmat Islamic University, Malang. They are divided into four classes using the LCI model, learning cycle, inquiry, and conventional, with a total sample of 82 students. ANCOVA and LSD analysis tested data. The results showed that the significance of 0.000 means that the LCI learning model significantly affects students' critical thinking skills. The LSD test results show that the LCI learning model is significantly different from other models, with a corrected mean value of 84.39. The main implication of this research is that the LCI model can be used as a model that can improve and empower students' critical thinking skills.

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1. INTRODUCTION

The 21st-century challenge today faces is the increasing global competition between countries in overcoming increasingly complex life problems (Scott, 2015). The main focus of each country is the fulfillment of superior human resources that can increase the country's competitiveness so that it does not lag behind other countries. In this regard, education in Indonesia must facilitate the development

of various skills that support life in the 21st century. However, the learning patterns in most universities have not supported learning that empowers the development of 21st-century skills. Several studies' learning patterns in universities have not empowered 21st-century thinking skills, one of which is critical thinking skills.

Critical thinking is a process of thinking at a complex level using an analysis process and an evaluation process of the information obtained (Wilson, 2016; Muhlisin *et al*. 2016). Critical thinking skills are the essential basic skills to adapt to the demands of 21st-century education. Critical thinking skills are considered necessary in 21st-century learning because they are higher-order thinking skills that are useful for building knowledge (Kalelioğlu & Gülbahar, 2014).

Several facts were found that several senior high schools in Banjarmasin had never measured critical thinking skills (Ramdiah & Corebima, 2014). High school educators in Banjarmasin emphasize cognitive learning outcomes with the tendency to learn to use lectures and discussions. The research results by Yanti et al. (2019) showed that students' critical thinking skills at Raden Rahmat Islamic University Malang (UNIRA) were in a low category, with a percentage of 38.7%. Empowerment of higher-order thinking, including critical thinking, has never been done by most teachers in the Ternate archipelago (Hasan, et al, 2013). Students' low critical thinking skills can be seen from students' arguments that are not appropriate when conveying reasons, giving assumptions that are not following reason, not conveying an assessment of a fact-based problem that occurs. studies have shown that elementary school to college students lack critical thinking skills (McVey, 2012; Carlgren, 2013; Dewaelsche, 2015). Critical thinking skills need to be developed and empowered in learning so that students are accustomed to facing increasingly complex global challenges.

Based on the description that has been explained, it is known that critical thinking skills are aspects that are still not maximally empowered in learning. These aspects have an essential role in student success. Critical thinking skills in solving problems can prepare students to live their careers and real-life(Ramdani & Badriah, 2018). According to Colley et al., (2012) critical thinking should focus on higher education to provide academic training for students. Students need to have skills that will facilitate success in life in the 21st century. Therefore, lecturers have an essential role in developing critical thinking as a provision in their future lives.

Critical thinking skills can be improved through specific learning models. Several research findings indicate that the application of specific learning models can improve critical thinking skills. Hidayah, et al. (2019) shows that the learning cycle model positively influences students' critical thinking. Empowerment of critical thinking skills in research conducted by Hidayah et al., (2019); Mustofa, (2018); Runisah, et al. (2017) reported that the learning cycle model was able to train students' critical thinking skills. In addition to the learning cycle model, inquiry can also improve critical thinking skills.Pursitasari et al. (2020) reported that inquiry could improve students' thinking skills through active involvement in the learning process. The inquiry model can improve students' thinking skills by reflecting on their ideas to explain the studied phenomena (Prayogi et al., 2018).

Based on the problems that have been described in the learning that occurs in tertiary institutions, a learning model is needed that can improve critical thinking skills to the maximum. Some of the learning models used as studies are LC (learning cycle) and inquiry.

Inquiry is a learning system that supports the development of problem-solving and critical thinking skills. Students learn how to ask questions, find answers, and learn what questions are essential to ask (Maxwell et al., 2015). Teaching using inquiry is one approach that can help encourage students to be more interested in learning and improve each student's performance. This approach has been proven to be able to develop the potential of every student, in terms of physical, emotional, spiritual and intellectual, through hands-on and mind-on in each group activity and increase interest in learning which leads to a more positive attitude towards the learning system. (Kitot et al., 2010). If all students only memorize facts, it is guaranteed that they will not be able to develop skills in solving a problem, but when students engage in conducting an investigation, giving reasons, and organizing

knowledge, then students are felt to be able to incorporate the knowledge they just know into their own knowledge into their understanding.

The inquiry learning system also has a drawback: students do not have the opportunity to elaborate and evaluate their learning outcomes, so they cannot expand, strengthen, and assess how much knowledge they have acquired. The inquiry model requires quite a long time to implement, and students need different mental processes to maximize each stage (Putra, 2013). Inquiry learning is less effective if applied to students with low academic abilities (Solihin, 2019) because low-ability students lack experience and knowledge that can be used to adjust to the situation they face. This lack of experience and knowledge causes students to be unable to grow and use their thinking skills in finding problems, formulating hypotheses, conducting tests, and making decisions on the topics they face. This is because the cognitive equilibrium process of students has not been achieved optimally, wherein in the assimilation process, they have been able to accept and incorporate new knowledge into their cognitive structure. However, students have not been able to change their cognitive structure optimally in the accommodation process. The inquiry learning model needs to be combined with other learning models to complement these deficiencies. The learning model that can complement inquiry learning is the learning cycle.

The learning cycle model is a teaching model that can be useful for teachers in designing curriculum materials and learning strategies in science (Madu & Amaechi, 2012). Learning cycles can motivate students through several stages of learning, explore subjects, have definitions for learning experiences, get more detailed information about student learning and evaluate them. Learning using a learning cycle is an active cognitive process in which students experience various learning experiences that allow exploring knowledge into a skill. Students are also involved in mental activities indicated by the reorganization and rearrangement of learning materials (Jack, 2017). The learning cycle allows students to explore the concept of achieving balance, the teacher as a facilitator plays a role in achieving that balance in a fun way of teaching (Shuaibu & Ishak, 2020).

The learning cycle also has shortcomings, including the lack of planned and organized class management because the activities carried out by students are less specific, and the learning activities are general. Learning cycle learning also requires the creativity and sincerity of lecturers in designing and implementing the learning process. According to Usmiatin (2014), cooperation between students in groups does not occur. Students with high initial knowledge tend to be indifferent to students with low initial knowledge. Active communication between students in groups does not occur because of learning alone that occurs in LC 5E learning. It results in a gap in cognitive learning outcomes between students with low and high initial knowledge. A more structured inquiry learning model can complement weaknesses in the learning cycle model.

Based on the studies that have been presented on the two models, it is necessary to combine the two models, namely the Learning Cycle and Inquiry (LCI), so that it is hoped that the model will be more effective in improving critical thinking skills. This study aims to integrate the two learning cycle and inquiry learning models, which are expected to improve critical thinking for pre-service elementary school teacher students.

2. METHODS

The research design used in this study is quasi-experimental because the treatment given to the independent variables is intended to determine their effect on the dependent variable. However, the influential external variables cannot be tightly controlled. The research design used is the Pretest-Posttest Nonequivalent Control Group. To further clarify, it is in the Table. 1.

Table 1. Research Design

Group	Pre-test	Treatment	Post-test
A	A_1	X_1	A_2
B	B_1	X_2	B_2
C	C_1	X_3	C_2
D	D_1	X_4	D_2

Description:

A = experiment group;
B = Control group positif (LC);
C = Control group positif (*Inquiry*);
D = Control Group;
A_1 = *pre-test* scores of experiment class;
A_2 = *post-test* scores of experiment class;
B_1 = *pre-test* scores of treatment class LC;
B_2 = *post-test* scores of treatment class LC;
C_1 = *pre-test* scores of treatment class *inquiry*;
C_2 = *post-test* scores of treatment class *inquiry*;
D_1 = *pre-test* scores of treatment class control;
D_2 = *post-test* scores of treatment class control.

Objects related to this research are all students of Universitas Islam Raden Rahmat (UNIRA) Malang. While the subjects used in this study were students of the elementary school teacher education study program at UNIRA Malang, in this case, they were divided into four classes, each class numbering between 18-23 students. The total number of students was 82 students. Determination of the sample is done by random sampling technique, which is based on the average test scores, which are almost the same. The research instrument is used to measure the success of the learning carried out and the variables measured in a study. The variables measured in this study were critical thinking skills. The instruments used in this study included observation sheets and test questions tested.

The data obtained from the study results were tested first with prerequisite tests, namely normality and homogeneity. Normality test used the One-Sample Kolmogorov-Smirnov test. Homogeneity test using Levene's Test of Equality of Error Variances. The data was then tested by statistical inferential analysis of covariance (ANCOVA) at a significance level of 0.05%, with the pretest value as a covariate. If the results of ANCOVA are significant, then proceed with the BNT test.

Normality test is a preliminary test conducted to see the data to be used comes from a normally distributed population. A population is said to be normally distributed if the significance value is > 0.05. The normality test used the One-Sample Kolmogorov-Smirnov test. The data normality test was carried out on both groups of dependent variable data, namely critical thinking skills, implemented using the LCI model. A summary of the results of the data normality test can be seen in Table 2.

Table 2. Summary of Data Normality Test Results

Dependent Variable		*Kolmogorov-Smirnov*		Score *Alpha*	Desc.
		Statistics	Sig.		
Critical Thinking Skills	Pre-test	0,087	0,188	0,05	Normal
	Post-test	0,062	0,200	0,05	Normal

Based on the test results, it is known that the tested samples are normally distributed. This can be seen from the analysis results, which show the significant value of all dependent variables is greater than the alpha value used, which is 0.05, then H0 is accepted. This means that there is no deviation from the data of each independent variable so that the dependent variable data is usually distributed.

The homogeneity test aims to see the sample data group comes from a population with the same variance. The homogeneity test was carried out on the corrected data, including the average critical thinking skills score. Homogeneity test using Levene's Test of Equality of Error Variances. The summary results of the homogeneity test can be seen in Table 3.

Table 3. Summary Results of Homogeneity Test

Dependent Variable		*Levene Statistic*	df1	df2	Sig.	Description
Critical Thinking Skills	Pre-test	0,753	3	7	0,524	Homogeneous
		1,798	3	8	0,154	
	Post-test			7		Homogeneous
				8		

The criteria for testing the data homogeneity is that if the significance value is greater than the alpha value of 0.05, then H0 is accepted. This means that there is no difference in variance between groups of dependent variable data so that the variance is declared homogeneous. The results of all dependent variable data were declared homogeneous because they showed that the dependent variable data was more significant than the alpha value of 0.05.

The hypothesis test used to see the effect of the learning model on critical thinking skills was tested by the statistical inferential test of covariance analysis (ANACOVA). If the results of anacova are significant, then proceed with the BNT test.

3. FINDINGS AND DISCUSSION

Based on the results of the Anacova calculations that have been carried out regarding the effect of the learning model on each critical thinking skill contained in Table 4, it shows that the F arithmetic model is 15.816 with a sig value of 0.000 so that H1 is accepted and H0 is rejected, it can be concluded that the application of the learning model used affects skills. Critical thinking of every student. The analysis results showed a significant effect, so it is necessary to carry out further tests (BNT/LSD) to find out which learning model is the most influential in improving each critical thinking skill. The results of the LSD test of the effect of the learning model on critical thinking skills can be seen in Table 5, which is available.

Table 4. Anakova Test Results from The Effect of Learning Models on Critical Thinking Skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1836.556[a]	4	459.139	21.800	.000
Intercept	3405.320	1	3405.320	161.683	.000
Pretest-CT	44.513	1	44.513	2.113	.150
Class	999.350	3	333.117	15.816	.000
Error	1621.754	77	21.062		
Total	500258.100	82			
Corrected Total	3458.310	81			

a. R Squared = .531 (Adjusted R Squared = .507)

Tabel 5. LSD Test Results of Learning Models with Critical Thinking Skills

Lerning Model	Pre-test	Post-test	Difference	Corrected	Nonation
Convensional	30,3	74,4	44,2	75,858	a
Learning Cycle	31,2	75,9	44,9	76,774	a
Inquiry	32,0	80,5	46,9	80,922	b
Learning Cycle + Inquiry (LCI)	36,5	86,6	49,4	84,391	c

Based on the LSD test analysis results, it is explained that the four learning models affect students' critical thinking skills. The highest corrected mean value indicates this in the LCI learning model, which is 84.39. The average corrected for the inquiry learning model is 80.92, the average corrected for the learning cycle learning model is 76.77, and the lowest corrected for the conventional learning model is 75.86.

The difference in the notation above shows that the conventional learning model is not significantly different from the LC model used. The LCI and inquiry learning models are located in a notation that is significantly different from the conventional and LC 5E models in their effect on the critical thinking skills of each student.

The results of the analysis that have been carried out show that there is a very significant influence on the LCI learning model on the critical thinking ability of each student with a sig value of 0.000. Based on the LSD/BNT test that has been done, it shows that the LCI learning model is significantly different from the other three learning models.The LC and conventional learning models are not significantly different. The inquiry model is significantly different from the LC and conventional models and the LCI model. The LSD test shows that the conventional and LC learning models are significantly different from the other two learning models.

Conventional learning models are considered the lowest in improving critical thinking skills because these learning models cannot train higher-order thinking skills in their learning activities. This is because classes taught using conventional learning models cannot provide real experiences such as constructivism-based learning (Khalid & Azeem, 2012). Conventional learning models do not empower students in analyzing, evaluating, arguing, and self-regulating. Students are not entirely involved in learning activities, some students are always active in presentation discussion activities, but many ignore the activities carried out in class. Students master the material only when they get an assignment to present a paper in front of the class.

The LC learning model is considered to improve each student's critical thinking skills than the conventional learning model, even though the two are not significantly different. In the LC learning model, this learning model consists of phases that allow students to act actively in LC learning, and students are challenged to solve problems related to concepts through group discussions.(Solihin, 2019). In contrast to conventional methods, learning using the LC 5E learning model will make students actively involved in building concepts with the help of lecturers. The LC learning model developed based on Piaget's theory of development, such as assimilation, accommodation, and organization following the exploration, explanation, and expansion phases, provide opportunities for students to train their intelligent system so that they can improve their critical thinking skills (Budprom et al., 2010).

The inquiry learning model improves critical thinking skills better than the LC and conventional learning models. In the inquiry model, students actively participate in learning, can make connections between the evidence found and a concept, and can develop information through scientific activities(Ananda et al., 2021). The inquiry learning model positively contributes to improving critical thinking skills (Ramdani & Badriah, 2018). The finding in the application of the inquiry model is that students who are taught with the open inquiry learning model can determine problems and plan investigations, and make decisions on the results of their investigations. The problem formulation stage in the open inquiry learning model provides opportunities for students to develop their scientific

abilities in viewing a topic. This stage is the stage that most determines the success of the learning process using the open inquiry learning model (Solihin, 2019). Lecturers as facilitators have an essential role in this stage so that students can formulate problems based on the topics studied to achieve learning objectives.

Based on the findings, the LCI learning model is more effective in improving critical thinking skills than other learning models. This finding follows the findings of Sen & Oskay (2017), Ong et al. (2020), Yacob et al. (2020), and Ong et al., (2020), Yacob et al. (2020), dan Ong et al., (2021) in terms of the effect of the LCI learning model even though the context, the variables measured and the students involved are different. The LCI learning model, increasing students' critical thinking scores, is supported by the steps in the LCI learning model. In general, the steps of the LCI learning model that support the empowerment of critical thinking include formulating problems, analyzing, evaluating, submitting opinions, and reflecting. LCI learning can stimulate higher-order thinking through every stage carried out by students.

At the exploration stage, where students are asked to formulate problems and make hypotheses from the phenomena encountered, this activity tests students' abilities to analyze an event and predict the results obtained from their investigations. The exploration stage stimulates students' curiosity to try their ideas on a phenomenon. This follows the way a scientist explores new ideas or phenomena before conducting research (Yacob et al., 2020).

At the explanation stage, the activities carried out by students are conducting investigations or experiments, analyzing and interpreting data, and drawing conclusions. These activities can support students' critical thinking skills because students can design experiments according to their ideas, analyze and translate the results of their findings to find answers to the problems they encounter. Thus, students are actively involved in learning and can build their knowledge based on the investigations carried out. This stage also supports students' higher-order thinking skills because of a well-organized mental process. In the early stages of the LCI model, students are asked to identify unique phenomena and formulate problems encountered and conduct investigations. These stages reflect a person's critical thinking stages. Muhlisin et al. (2016) argues that if students who have critical thinking skills will tend to be more sensitive to the problems around them, be able to access every problem around them and be able to identify the elements that cause these problems, make decisions, be able to find solutions to problems, and being able to communicate. The following stages that can stimulate students to think critically are the stage of analyzing and interpreting the data that has been collected. This affects a person in finding solutions by analyzing and interpreting data in scientific inquiry activities.(Lin, 2014).

Critical thinking is a process of thinking at a complex level using an analysis process and an evaluation process of the information obtained (Wilson, 2016; Muhlisin *et al*. 2016). Critical thinking is also the ability to analyze existing facts, make ideas and defend those ideas, then make comparisons (Howard *et al.*, 2014). Critical thinking skills are the essential basic skills to adapt to the demands of 21st-century education (Kalelioğlu & Gülbahar, 2014). Critical thinking skills are considered necessary in 21st-century learning because they are higher-order thinking skills that are useful for building knowledge (Kalelioğlu & Gülbahar, 2014). Critical thinking requires getting used to high-level abstract thinking and logical thinking, which are characteristics of a person's intelligence in dealing with problems and identifying alternative solutions to solve problems (Mary & Nel, 2013).

Critical thinking skills increase students' awareness to learn, design their learning process well, have high curiosity, be responsible for decisions taken, find solutions to a problem, evaluate learning that has been done, and reflect on their strengths and weaknesses. This is in line with the research conducted by Muhlisin et al. (2016) that understanding ideas, analyzing, interpreting ideas, making conclusions, giving opinions, and self-regulation is activities that can facilitate students to develop critical thinking skills. Research conducted by Mustofa, (2018) proves that critical thinking skills are essential for students because they train students to find answers to the problems they face by linking their knowledge with the knowledge they have just received to improve their learning outcomes. This

is following the study results that students who are taught using the LCI learning model tend to be more independent in finding and able to build knowledge of a new phenomenon they encounter.

Schafersman (1991) argues that critical thinking must be empowered at every level of education. It is also stated that education as a facilitator can help students develop critical thinking skills through models, strategies, and learning methods oriented towards student learning activities. Referring to Facione's (2013) opinion, the critical thinking ability measured in this study is a mental process that includes analyzing, evaluating, arguing, and self-regulating. Thinking requires analytical and logical reasoning and demonstrates higher-order thinking skills.

4. CONCLUSION

The LCI learning model is significantly different from the inquiry, LC, and conventional learning models in improving students' critical thinking skills. The LCI learning model is considered the most effective in improving critical thinking because through LCI, and students can visualize abstract knowledge into concrete concepts. This change is essential for students to build their knowledge based on the phenomena around them, causing students to be more sensitive to the surrounding environment. Therefore, this LCI learning model has great potential to be implemented in 21st-century learning.

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