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Application of ERP (Engage, Research, And Present) Learning Model in Online Scheme in Science Learning to Improve Critical Thinking Skills of Junior High School Students

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ABSTRACT

Critical thinking skills are one of the 21st century skills that are very important to mastered. Several studies show that the critical thinking level of students is still quite low. Critical thinking skills can be trained through the learning process, the right learning model is able to activate the potential of students who can improve critical thinking skills. This study aims to analyze the effectiveness of the ERP learning model in an online scheme towards improving the critical thinking skills of junior high school students. This research is an educational experiment research using the Quasi Experiment method with the type of research approach, namely quantitative research. The design used in this research is the Nonequivalent Control Group Design. Based on the results of the study, the effect size test shows that the effect size value is 0.77 where the value is included in the large category. Based on the results of the effect size test that has been carried out, these results show the effectiveness of the ERP learning model is greater than the conventional learning model (discovery learning) in improving the critical thinking skills of junior high school students in science subjects.

Keywords: ERP learning model, critical thinking skill, online learning, research-based learning.

INTRODUCTION

Critical thinking skills are one of the 21st century skills that are very important to mastered. These skills include the ability to access, analyze, synthesize information that can be learned, trained and mastered [13]. According to Facione [5] critical thinking is a thinking skill that has goals such as proving something, interpreting the meaning of something, and solving problems. Critical thinking skills are needed in the field of education because critical thinking skills are able to help students understand the conditions of the surrounding environment [10]. Critical thinking skills need to be trained in learning to help students be able to reflect on themselves and apply the knowledge they already have with the knowledge gained while at school [8].

Several studies show that the level of critical thinking skills of students is still low. Supported by research that has been carried out by Prihartiningsih [12], it shows that 75.63% of junior high school students' critical thinking skills are still low or not yet developed. The results of this study are in line with Nuryanti's research [11] where junior high school students have low critical thinking skills. Critical thinking skills in students need to be trained through learning activities. This is supported by the opinion of Yuliati [20] which states that critical thinking skills require practice to be improved. Critical thinking skills can be trained through the learning

process, appropriate learning models are able to activate the potential of students who can improve critical thinking skills [7]. The learning model that can be applied is by integrating research activities into the learning process (research-based learning).

The ERP learning model is a learning model that can be used as an alternative for today's learning. The ERP learning model is a research-based learning model, where the learning process is designed to train students to conduct research activities in order to acquire knowledge, while educators serve as facilitators. In practice, the ERP learning process

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must be able to facilitate students in training 21st century skills, especially critical thinking skills [15].

This study uses an ERP learning model with an online scheme, because this research was conducted during the COVID-19 pandemic. Online learning is learning that is carried out through the internet network without being limited by space and time by using teaching materials from various sources on the internet [19]. Based on the existing problems and because of the importance of training critical thinking skills for students. The researcher intends to examine how the application of the ERP learning model in an online scheme to improve critical thinking skill of junior high school student.

RESEARCH METHOD

This research is an educational experiment research using the Quasi Experiment method with the type of research approach, namely quantitative research. The design used in this research is the Nonequivalent Control Group Design. This study used one experimental class and one control class. The experimental class was treated with an ERP learning model in an online scheme and the control class was treated with a discovery learning model in an online scheme. This research was conducted to determine the effectiveness of the ERP learning model in an online scheme on the critical thinking skills of junior high school students.

The population of the research to be carried out is all 7th grade students of SMP Negeri 5 Magelang which consists of 8 classes. The samples used in this study were seventh grade students from two different classes at SMP Negeri 5 Magelang.

Data collection techniques and instruments used in this study were tests and student activity observation sheets. The test instrument in this study was in the form of a description test that had been adjusted to the indicators of critical thinking skills according to Ennis as many as 12 questions. Before the instrument is used, the validity of the research instrument will be tested through the content validity of Aiken's V. To determine the magnitude of the change between the pre-test and post-test of students, the data were analyzed using the Gain normality test (N-Gain). The test shows whether or not there is an increase in students' critical thinking skills. N-Gain is calculated with the help of *IBM SPSS Statistics 25*. With the N-Gain criteria described as follows:

Table 1. N-Gain criteria according to Hake [6]

Gain	**Interpretation**
$g < 0,3$	Low
$0,3 \leq g < 0,7$	Middle
$g \geq 0,7$	High

To determine the effectiveness of the ERP learning model on students' critical thinking skills. The formula for the effect size based on Thalheimer [17] is:

$$d = \frac{\overline{X}_t - \overline{X}_c}{S_{pooled}}$$

$$S_{pooled} = \sqrt{\frac{(n_t - 1)s_t^2 + (n_c - 1)s_c^2}{n_t + n_c}}$$

description:

d = *Effect size*
$\overline{X}_t$ = Average *gain* of experimental class
$\overline{X}_c$ = Average *gain* of control class
S_t = Deviation standard of experimental class
S_c = Deviation standard of control class
n_t = Number of experimental class sample
n_c = Number of control class sample

Effect size criteria [2] described as follows:

Table 2. Effect Size Criteria

Effect Size	**Criteria**
$d \leq 0,2$	Low
$0,2 < d < 0,5$	Middle
$0,5 < d \leq 0,8$	High

Meanwhile, the data obtained from the observation instrument were analyzed for the percentage of

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learning implementation and the level of independence of students in each activity which was calculated by the percentage formula as follows:

$$\%\ implementation = \frac{total\ score\ obtained}{maximum\ score\ total} \times 100\%$$

RESULT AND DISCUSSION

The discussion of the results of this study discusses in depth the results of data processing with relevant theories regarding critical thinking skills which are assessed based on critical thinking indicators according to Ennis [4] which consists of 5 indicators, namely Elementary clarification (focusing questions, analyzing arguments, asking and answering questions about an explanation). and challenging questions), basic support (considering the credibility of a source, observing and considering the results of observations), inference (making deductions and considering the results of deductions, making inductions and considering the results of inductions, making and considering the results of decisions), Advanced clarification (identifying assumptions, defining terms, considering definitions), and Strategies and tactics (deciding an action, interacting with others).

This study discusses the effectiveness of the ERP learning model on the critical thinking skills of junior high school students compared to conventional learning models (discovery learning). The difference in the effectiveness of a learning model is seen from the magnitude of the increase or the N-Gain value from the test results between classes.

The research was conducted in the experimental class using the ERP learning model. Learning activities in the experimental class begin by giving a pre-test of critical thinking skills to experimental class students to determine students' critical thinking skills before being given treatment. Learning activities in the experimental class begin with the teacher opening learning in the classroom through virtual meetings and then entering the learning phase which is divided into 3 phases, namely the engage phase, the research phase, and the present phase. The design of the learning activities carried out are as follows:

Table 3. Experimental Class Learning Activities

Phases	**Student Activities**	**Teacher Activities**
Engage	Reading phenomena or problems regarding environmental pollution as presented on student worksheets.	Showing phenomena regarding environmental pollution as presented on student worksheets through virtual meetings.

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	Identify important points in phenomena or problems as presented on student worksheets through virtual meetings.	Identify important points in phenomena or problems as presented on student worksheets through virtual meetings.
	Develop research questions based on the problems presented on student worksheets.	Guiding students to formulate questions based on problems.
	Reviewing the literature related to the formulated research question.	Presenting literature/ reading on environmental pollution.
	Mapping the stages of the investigation, stages.	Guiding students in making the stages of investigation.
Research	Formulate hypotheses based on research questions.	Directing students to formulate research hypotheses.
	Carry out investigation activities in accordance with the provided student worksheet.	Provide assistance when carrying out research activities.
	Analyze the data and discuss the data obtained with the help of several questions. on student worksheet.	Provide assistance to analyze the data obtained.
	Summarizing the results of research activities.	Guiding students in making conclusions .
	Make a short report of learning activities.	Guiding students in compiling short reports.
Present	Make a mind map of research activities. Mind map that should be arranged.	Directing students to make mind maps.
	Presenting the results of the investigation with the mind map that has been made.	Facilitate students to present the results of the mind map that has been made.

Based on the activities that have been carried out by students in the experimental class, the results show that the ERP learning model can improve the critical thinking skills of junior high school students, especially in the experimental class. This can be seen from the results of the critical thinking skills test which shows that there is a difference between the results of the pre-test and post-test scores. Based on Table 4., the increase in critical thinking in the experimental class is included in the high category with an N Gain score of 0.7 or 70%.

Table 4. Critical Thinking Result of Experimental Class

Result	**Experimental Class**	**Gain**	**Category**
Pre test	60.12	0,70	High
Post test	87.68		

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Based on the increase in each sub-indicator of critical thinking in Figure 1, the ERP learning model is very good in improving critical thinking skills, especially on the indicators of strategies and tactics of 0.89 with a high improvement category. This is because the ERP learning model contains research-based learning activities where the learning is able to help students combine theory and practice to make solutions and actions to problems encountered through research activities [14]. The research-based learning process is a means to prepare students who are able to become challenges through investigation activities [15].

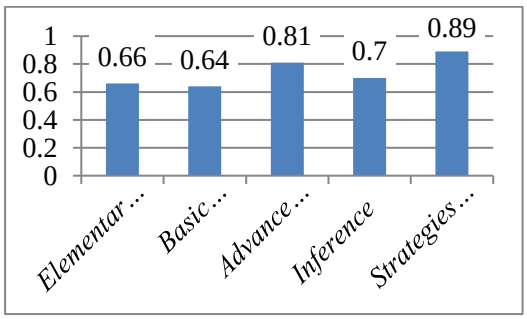

Figure 1. N-Gain graphs for each indicators in experiment class

This increase in critical thinking skills shows that through learning activities on the ERP learning model in an online scheme it is able to improve students' critical thinking skills. This is in line with Sukarno [15] who stated that the ERP learning model is able to train the skills needed by a researcher such as critical thinking, emotional intelligence, and analytical skills.

The research was conducted in the control class using a conventional learning model, namely the discovery learning model. Learning activities in the control class began by giving a pre-test of critical thinking skills to control class students to determine students' critical thinking skills before being given treatment. Learning activities in the control class begin with the teacher opening learning in the classroom through virtual meetings and then entering the learning stage. The design of the learning activities carried out are as follows:

Table 5. Learning Activities of Control Class

Phases	**Student Activities**	**Teacher Activities**
Stimulation	Pay attention to the material provided by the teacher and the phenomena displayed by the teacher as presented on student worksheets through virtual meetings.	Showing phenomena regarding water pollution as presented on student worksheets and asking questions to help students understand the material through virtual meetings.
Problem Identification	Discuss the problem based on the picture of the phenomenon presented on the student worksheets.	Guiding students to identify problems based on the images displayed.
	Asking questions about environmental pollution material presented on student worksheets.	Guiding students to ask questions based on the pictures of the phenomena displayed.
	Formulate hypotheses to answer the questions that have been made.	Directing students to formulate research hypotheses.
Data Collection	Observing the pictures displayed by the teacher and filling in the observation	Provide assistance when conducting observation activities .

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	data table on the student worksheet.	
	Gather as much relevant information as possible to prove whether the hypothesis is true or not .	Guiding students in proving the hypothesis that has been made.
Data Processing	Analyze the data and discuss the data obtained.	Provide assistance to analyze the data obtained.
Verification	Answer the questions that have been presented to the student worksheet to find theories based on observations.	Guiding in answering questions and providing reaffirmation of the theory obtained.
Generalization	Summarizing the results of observation activities .	Guiding students in making conclusions.

Based on the activities that have been carried out by students in the control class, the results of the study show that the Discovery Learning model can improve the critical thinking skills of junior high school students. This can be seen from the results of the critical thinking skills test which shows that there is a difference between the results of the pre-test and post-test scores. Based on Table 6, the increase in critical thinking in the control class is included in the medium category with an N Gain score of 0.59.

Table 6. Critical Thinking Result of Control Class

Result	Control Class	Gain	Category
Pre test	61.24	0,59	Middle
Post test	84.44		

Based on the increase in each critical thinking sub-indicator in Figure 2, the Discovery Learning model is quite good in improving critical thinking skills on the Strategies and tactics indicator with an increase of 0.73 in the high category. This is because in the Discovery Learning model in training these skills, students are trained to seek and find the information needed independently so that students are able to build their own knowledge [16]. The information possessed by students is able to enrich knowledge and assist in analyzing problems properly so that students are able to make the right decisions [1].

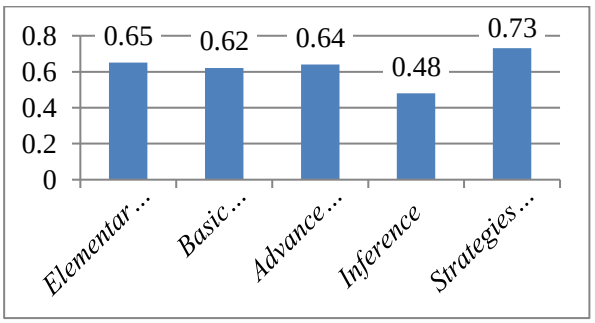

Figure 2. N-Gain graphs for each indicators in control class

This increase in critical thinking skills shows that through learning activities in the Discovery Learning model in an online scheme, it is able to improve students' critical thinking skills. This is in line with Dimyati [3] who argues that the Discovery Learning model aims to develop intellectual abilities, think critically, and solve problems.

Table 7. Total N-Gain Result

Class	N	Lowest Result	Highest Result	N-Gain Average	Category
Experiment	25	0,48	0,94	0,70	High

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Control	25	0,34	0,86	0,59	Middle

Based on the results of the study, it is known that the critical thinking skills of the experimental class in total there is an increase of 0.70 in the high category compared to an increase in the control class of 0.59 with the medium category. This shows that the ERP learning model in the experimental class is able to support the improvement of students' critical thinking skills as well as the conventional learning model in the control class. The N Gain test was also carried out on each critical thinking indicator in each class, both the experimental class and the control class. The results in Figure 3, it is known that there is a difference in the increase in critical thinking skills in each indicator between the experimental class and the control class. In the experimental class critical thinking skills on each indicator experienced a higher increase than the control class. Improvement of class critical thinking skills Based on the results of the N gain test on each indicator, it is known that ERP learning models and conventional learning models (discovery learning) are able to improve students' critical thinking skills, but there is a difference between learning models where the ERP learning model has a greater increase in value compared to the conventional model with a higher number of high improvement categories than the conventional learning model.

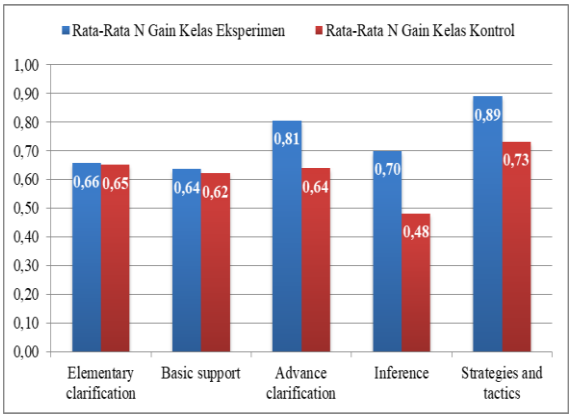

Figure 3. N-Gain graphs for each indicators in experiment and control class

Based on the N Gain test that has been carried out both in total and for each indicator, there is a difference between the experimental class and the control class, as evidenced by the significance test. Based on the significance test, the significance value obtained is 0.020 where the value is smaller than 0.05. This shows that the implementation of the ERP learning model in learning is able to have an influence on students' critical thinking skills compared to conventional learning models, the significance value determines that there is a significant difference (difference) in the results of critical thinking skills between classes using the ERP learning model (class experiments) and classes that use conventional learning models (control classes).

Based on the results of the N Gain test and the significance test, the two learning models improve students' critical thinking skills and there are significant differences so that to determine the effectiveness of the ERP learning model against conventional learning models (discovery learning) it can be seen based on the effect size test results. The effect size shows the magnitude of the effect of learning using the ERP learning model compared to learning using the conventional learning model. The effect size test shows that the effect size value is 0.77 where the value is included in the large category. These results indicate the effectiveness of the ERP learning model is greater than the conventional learning model (discovery learning) in improving the critical thinking skills of junior high school students in science subjects. The effectiveness of the learning model depends on the learning activities in it. In this study, each activity in each learning model was carried out well with a 100% implementation percentage. This percentage shows that each student activity in each model can be carried out properly and completely in each meeting so that the level of effectiveness obtained is determined by the type of activity that exists in each learning model. The ERP learning model consists of learning activities in which some of the learning activities are in the discovery learning model, but the learning activities in the ERP learning model are complete and more complex than the discovery learning model. In the ERP learning model there are activities to make research stages, review literature, make short reports, create and present mind maps, these activities help students think systematically and coherently so that they help build higher-order thinking skills.

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Activities in the ERP learning model are designed based on the Research Skill Development (RSD) Framework to assist teachers in preparing learning activities that support research activities. The RSD Framework is used as a guideline for integrating research activities in learning because understanding of the research experience needs to be actualized both as a product and a process in the learning process. Learning activities in the ERP learning model raise problems regarding learning materials related to the real world so that students get a transformative experience. Research activities that are integrated in learning are able to improve student learning outcomes which include the cognitive, affective, and psychomotor domains [7]. Research activities in research-based learning models such as the ERP learning model can help students build basic skills and be able to stimulate high-order thinking skills, one of critical thinking skills [9]. The ERP learning model is designed based on research with the concept of learning because research-based learning is a trend in current learning [18] and research is an important aspect of learning [8]. The ERP learning model brings the values embedded in research activities into learning so that students can be skilled in applying research skills. The ERP learning model facilitates students in exploring their skills in solving problems they face by combining intellectual and practical activities.

The ERP learning model is designed to train students to have 21st century skills, especially in the way of thinking dimension, one of which includes critical thinking skills. The ERP learning model can be a solution to facilitate 21st century learning because the activities in this learning model are able to facilitate various skills mastered in the 21st century which include way of thinking, way of work, tool of work, living in the world. This is supported by the results of Haryati's research [7] which states that ERP learning model activities are able to facilitate students in training High Order Thinking Skills (HOTs) and 21st century moral values. Thus, the application of ERP learning models in online schemes in science learning is able to improve critical thinking skills of junior high school students because the ERP learning model and learning model are more effective in improving critical thinking skills of junior high school students than conventional learning models (discovery learning).

SUMMARY

Based on the results of research that has been carried out in one of the junior high schools in the city of Magelang on science learning about environmental pollution, this study obtained several conclusions. These conclusions include:

1. Based on the significance test that has been carried out, the significance value obtained is 0.020 where the value is smaller than 0.05, then H_0 in this study is rejected and H_1 is accepted so that it can be stated that there is a significant difference in the results of critical thinking skills between the classes. using ERP learning model and conventional learning model.
2. Based on the effectiveness test that has been carried out, the ERP learning model has a large effectiveness of 0.77 with a large category. Thus, the ERP learning model in the online scheme is very effective in improving the critical thinking skills of junior high school students in science learning about environmental pollution.

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