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The Effect of The Learning Cycle 7E Model on Magnetic Field Materials to Improve Student's Deductive Reasoning

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Abstract: Learning Cycle 7E is a model that is student-centered. Students must be active in the form of learning activities that are structured in such a way that they can master the material well. This research aims to test the effect of the Learning Cycle 7E model on magnetic field material to improve students' deductive reasoning. The type of research used was quasi-experimental with a one-group serial design. The population in this study was all class XII MIPA MAN 2 Mataram, with a sampling technique using purposive sampling, and class XII MIPA 1 was obtained as the experimental class. The data collection technique is a test consisting of 10 question items that have been validated and reliable. Based on the research results, students' levels of deductive reasoning were obtained with high, medium, and low criteria. Where the low criteria are 2 people, medium 29 people, and high 7 people. The results of the research show that the independent variable, namely the 7E learning cycle model, increases students' deductive reasoning abilities, with the highest score on the initial test being 71 while the lowest is 55. The highest score in the final test is 92 and the lowest is 77. Apart from that, seven phases contained in the learning model can also be used as well as possible, for example, students are given explanations for elicitation and engagement, and then students carry out exploration and explanation activities to elaborate their understanding after they are applied and in the last two phases students enter the evaluation phase. And material expansion or extension. This can also be proven based on the results of the N-Gain test with moderate and high gain with an average of 0.57.

Keywords: Learning Cycle; Magnetic Field Material; Deductive Reasoning

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Introduction

The development of learning models is one of the supporting media for improving the knowledge attitudes possessed by students. At the same time, students can encourage their ability to make changes in behavior that are by indicators such as learning motivation (Noor & Wilujeng, 2015). Every student must strive to be actively involved during learning activities to achieve learning goals (Fathurrohman, 2006).

Students are required to be more active in responding, thinking, and being creative with thoughts they believe are correct. Teachers must be able to be a bridge and intermediary to achieve all of this. Based on research conducted by (Indah & Nuraeni, 2021), it is explained that one of the reasons why students fail in learning is because students do not understand and use reasoning in solving their problems. The reasoning is a part that can encourage for students to be more creative, critical, broad, and even able to play with their imagination in thinking as well as in solving problems. Learning Cycle; Magnetic Field Material; Deductive Reasoning.

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Students are also required to have scientific thinking so that students can reason well. If students have difficulties in reasoning, students will also experience difficulties with other things. This is also in line with research conducted by (Fuadah., et al, 2019) which states that the ability to reason supports for students to be ability to play logic, which will create a line of thought that makes sense for students to understand the purpose of the lesson. Which is being studied.

The reasoning is a way of thinking carried out by someone in interpreting what they understand in the form of words or by giving certain expressions as a sign that they understand what they have learned (Fuadah., et al, 2019). In other words, if students are unable to use their reasoning then they will experience difficulty in expressing the knowledge they have learned. So it will be difficult for teachers to know whether the learning that has occurred has achieved the goals or indicators. If the essence of education is to gain learning experience and grow the potential of students (Nababan, 2020), then one of the potentials that must be developed is students' ability to use their reasoning.

Deductive reasoning is a thinking ability that helps in providing general to specific conclusions (Fuadah., et al, 2019). Deductive reasoning tends to rely on logic to prove a statement. Students are invited to be able to search for the truth of the statements given by the teacher. Either in the form of a physical concept or theory that needs to be proven with a more specific explanation (Wijayanti, 2017). Learning theoretical physics will certainly be a problem in understanding it. This will make students come up with various kinds of facts that become statements or at least will give them a little more thinking ability.

The problem is that students tend to be lazy in finding premises to be able to express physics concepts. Most students only refer to one premise given by the teacher and have difficulty finding other premises that can explain physics concepts and theories. This tendency makes students less advanced in thinking and have difficulty illustrating physics concepts and theories in everyday life.

There needs to be encouragement or a little special treatment that must be done by the teacher to be able to invite students to interact and express the statements they find. One way that teachers can do this is by using the 7E Learning Cycle model. Learning Cycle 7E is a model that is centered on students who must be active in the form of learning activities that are structured in such a way that they can master the material actively (Sugiman et al., 2019). The 7E Learning Cycle model requires students to be more active in expressing opinions and thinking.

The 7E Learning Cycle model consists of 7 stages, including, Elicit, Engage, Explore, Explain, Elaborate, Evaluate and Extend (Balta & Sarac, 2016). In short, this learning method begins with bringing in students' knowledge, involving them in direct experience activities, gaining experience from the concepts being studied, providing opportunities to express their opinions, and applying their understanding in project-based learning finally the teacher guides them regarding the concepts put forward in different situations. (Eisentraft, 2003).

The 7E Learning Cycle model allows students to hone their ability to think, search for, and explain the concepts being studied. For students, using this learning model will provide satisfaction because what students gain in thinking, finding out and expressing their opinions is based on their own abilities. At the same time, using the 7E Learning Cycle model can increase students' self-confidence in the learning process. To understand physics concepts, students must be more active in finding out about what they are learning. Students' ability to find contexts that suit the concepts being studied will be supported by using the 7E Learning Cycle model.

The 7E Learning Cycle model is a method that can apply learning contextually in the (Elaborate) phase by designing media that can provide a conceptual understanding of the material being studied. This activity certainly requires basic knowledge, such as students must be able to investigate and be directly involved, so that it will be easy to generate initial knowledge, and students are asked to design ideas or knowledge obtained, explain, evaluate shortcomings, and expand and reflect on their knowledge. This learning model is also of course in line with the ability to reason deductively, where students will find it easier to provide specific general conclusions.

Method

The type of research used in this research is quasi-experimental with a qualitative approach. Quasi-experiment is the same type of research as a real experiment, the only difference is that the subjects are not randomly assigned, but instead use existing groups (Setyosari, 2016). The use of quasi-experimental research methods is based on unnatural learning because students feel like they are research subjects.

The design used in this research is a group time series design. In this study, one experimental group was used without a control group. Then the experimental group was given an initial test to determine the initial knowledge possessed by the students, after which they were given treatment using the Learning Cycle 7E learning model.

Table 1. *One Group Time Design*

Initial Test	O_1
Treatment	X_1
Final Test	O_2

Information:
O1 = Initial test score before treatment;
X1 = Treatment using the model Learning Cycle 7E learning;
O2 = Final test score after treatment

The data obtained was then analyzed to answer the questions formulated in this research. The data was tested for normality and then used for the N-Gain test.

The normality test is sought using the chi-square formula.

$$\chi^2 = \sum_{i=1}^{k} \frac{(f_o - f_h)^2}{f_h}$$

(Sugiyono, 2013)

Information:

f_o = Observed frequency;

f_h = Expected frequency.

Next, an N-Gain test was carried out which aims to determine students' deductive reasoning abilities.

$$N\text{-}Gain = \frac{Score\ Posttest - Score\ Pretest}{100 - Score\ Pretest}$$

In this case, the normalized gain criteria according to Hake (1998) are divided into several categories according to Table 2.

Table 2. N-Gain Score Criteria

Criteria	N-Gain Score
Tall	g > 0,7
Currently	0,3 < g ≤ 0,7
Low	g ≥ 0,3

Result and Discussion

1. Preliminary and Final Test Results

1.1. Preliminary Test and Final Test

The results of the initial and final tests carried out during the research can be seen in Table 3.

Table 3. Preliminary and Final Test Results Data

Evaluation	Initial Test	Final Test
Higher Value (Deductive Reasoning)	71,00	92,00
Low value (Deductive Reasoning)	55,00	77,00
Average	61,6	82,36

Based on Table 3, the initial test results of students with the highest score on deductive reasoning ability were 71.00 with a total of 37 students the lowest score was 55.00 and the average initial test score was 61.6. Meanwhile, for the final test, the highest score for deductive reasoning ability was 92.00 with a total of 37 students the lowest score was 77.00 and the average score for the final test was 82.36.

1.2 Normality Test

Before being given treatment, the samples were first tested for normality and homogeneity using SPSS 16. This test was carried out using Shapiro-Wilk because the number of students was less than 50 with a significance level of 5% (0.050).

Table 4. Results of Normality and Homogeneity Preliminary Tests

Class	Significant	Significant Level	Criteria
Experiment	0,224 0,084	0,050	Normally Distributed

2. Iinstrument Test Results

The test instrument used in this research is a test of students' deductive reasoning abilities. The research instrument test consists of an expert validity test and an empirical validity test, where the expert validity test is carried out by the thesis supervisor. Meanwhile, the empirical validity test was carried out at MAN 2 Mataram, which was guided directly by the tutor teacher. The instrument tests carried out were validity tests, reliability tests, difficulty level analysis, and different power tests.

2.1 Validity and Reliability Test

The question instrument used to measure deductive reasoning abilities is 10 descriptive questions. Each question item contains different levels of validity and reliability, with a total of 37 students. The results of the validity and reliability test analysis are shown in the following table.

Table 5. Validity and Reliability Test Results

Test Analysis	Number of Questions
Valid	9
Revised	1
Rejected	0
Reliable	10

2.2 Different Power Tests

The next stage is to test the different powers of the questions which aims to determine the student's ability to master or not the material being asked.

Table 6. Different Power Test Results

Question Power Criteria	**Number of Questions**
Very Well	10
Good	0
Enough	0
Bad	0

2.3 Difficulty Level Test

The final stage in instrument testing is to carry out a difficulty-level test to find out whether the questions are difficult or easy.

Table 7. Difficulty Level Test

Difficulty Level Criteria	**Number of Questions**
Hard	2
Currently	5
Easy	3

3. Response Questionnaire Results

The response questionnaire given to students can be seen in Table 8 below.

Table 8. Student Response Questionnaire on Using the 7E Learning Cycle Model

Aspect	Percentage	
	Positive Response	Negative Response
Relevance	64,86	35,14
Attention	73,45	26,55
Satisfaction	87,5	12,5
Self-Confident	76,6	23,4

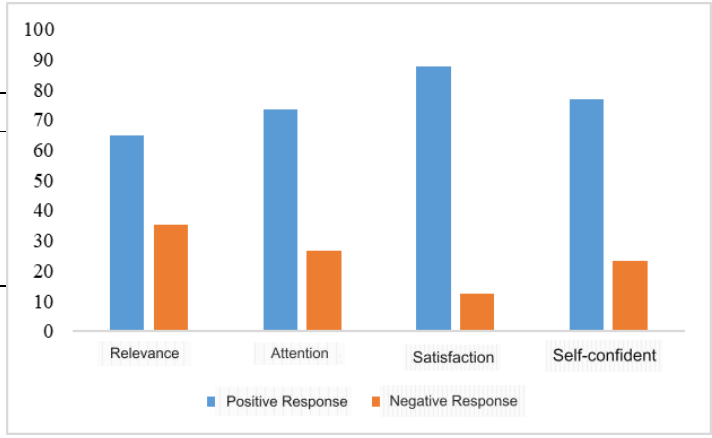

Figure 1. Student Response Questionnaire on Using the 7E Learning Cycle Model

4. N-Gain Test Results

In this research, the N-Gain test was used to determine the effect of the 7E learning cycle learning model on students' deductive reasoning abilities. After carrying out a normality test on the initial and final test data, it was found that the students came from a normally distributed population. Therefore, the population test used is the N-Gain statistical test.

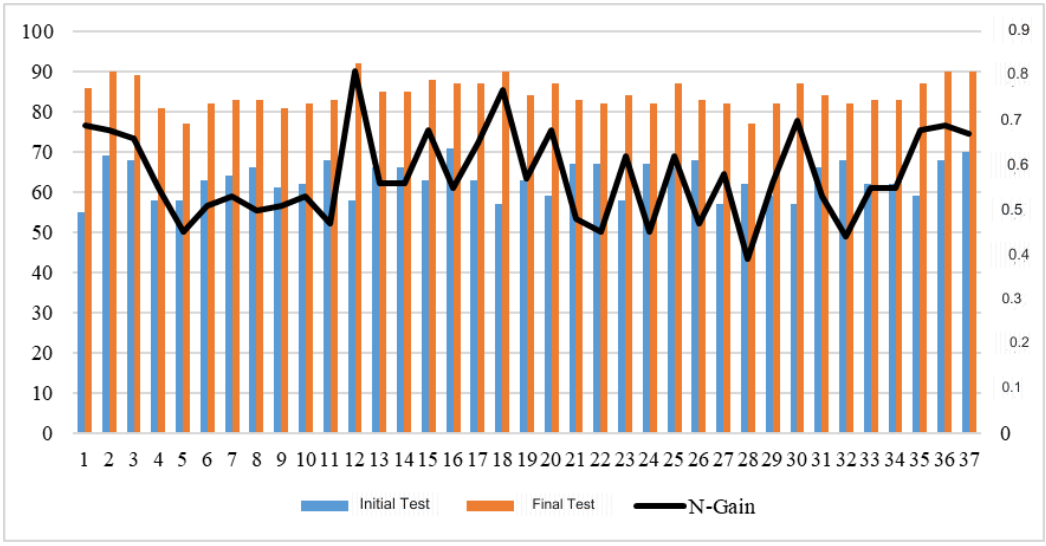

Figure 2. N-Gain Test Results

Figure 2 shows a comparison between the initial and final tests, then the black line shows the N-Gain value for each 37 students.

5. Discussion of Deductive Reasoning Results

Based on the research results, students' levels of deductive reasoning were obtained with high, medium, and low criteria. Where the low criteria are 2 people, medium 31 people, and high 7 people. In Table 2, the level of deductive reasoning of students based on gender is known. For males, there was 1 person with a high level of deductive reasoning, and 10 people with a medium level, while for the low category, there was none. For women, the level of deductive reasoning was low at 2 people, medium at 18 people, and high at 6 people. This category is taken based on the final test given to students.

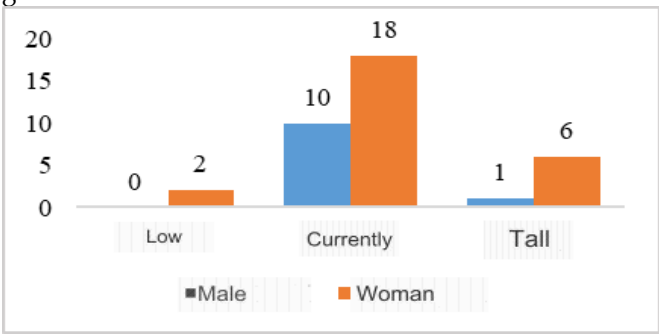

Figure 3. Deductive Reasoning Level Categories Based on Gender

The research results show that the independent variable, namely the 7E learning cycle model, provides an increase in students' deductive reasoning abilities (Nuryualis, 2019). Where the highest score in the initial test was 71 while the lowest score was 55. The highest score in the final test was 92 and the lowest score was 77.

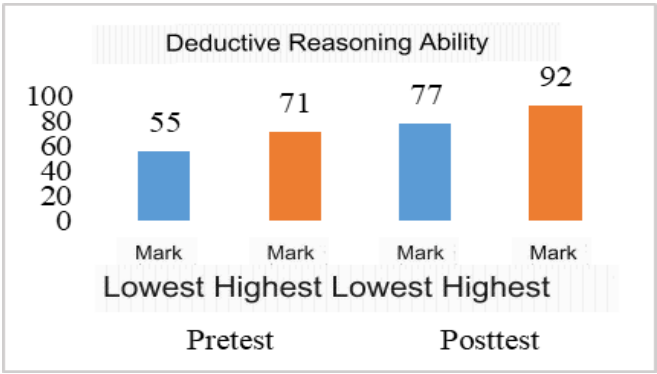

Figure 4. Deductive Reasoning Ability

This value is measured based on several indicators to determine students' deductive reasoning abilities. The indicators taken in this research are the indicators used by (Rich & Thomas, 2009).

1. Make a general statement. Write down the statement (magnetic field or electromagnetic induction) used in answering the test given.
2. Make a special statement. Write a logical argument that refers to a general statement (magnetic field or electromagnetic induction) based on the test given.
3. Drawing conclusions. Determine a strategy to answer the given test.

Table 9. Indicators of Deductive Reasoning in Solving Physics Problems

Stages of Deductive Reasoning	Deductive Reasoning Indicators
General Statement	Write down the statement (magnetic field or electromagnetic induction) used in answering the test given
Special Statement	Write a logical argument that refers to a general statement (magnetic field or electromagnetic induction) based on the test given
Drawing Conclusions	Determine a strategy to answer the given test

6. Discussion of the N-Gain Test

The N-Gain test shown in Figure 2, obtained two main categories, namely high and medium with the score value of the N-Gain provisions being $g>0.7$ with high criteria, $0.3<g\leq0.7$ medium and $g\geq0$, 3 is low with an average of 0.0156. The results obtained were that there was an influence of using the 7E learning cycle model on students' deductive reasoning. This is supported by the use of a model with syntax that can achieve each indicator of deductive reasoning.

The 7E learning cycle model requires students to be more active in learning according to existing steps (Septianingrum, 2022), so that they can interpret students' knowledge and abilities into ideas that help students solve the problems they face. (Princess, 2021). Apart from that, the use of media in the form of simple tools in carrying out practical work to determine the direction of the magnetic field is also able to improve students' reasoning abilities (Hartati, 2010).

Physics is a science that is closely related to everyday life. So it will be easier to understand if physics theories and principles are applied with the help of certain media (Harefa, 2019). As well as inviting students to be more active during learning activities (Zuhra et al., 2017). The learning model used so far tends to be more dominant in lectures so that students are not too active and are able to develop their potential, including reasoning abilities (Agus, 2014).

Next, the researcher gave several questions to stimulate students, as well as train students' reasoning abilities (Hariyanto & Esser, 2018). The questions given by researchers refer to the syntax of the learning cycle model, where in the elicit phase students are required to focus their attention to find out their knowledge about the material being studied (Imaniyah et al., 2015). The next stage is that students are invited to get directly involved by discussing, reading or finding out existing problems, which is where this phase enters the engage phase (Ardilah & Budiharti, 2015).

Then, in the next stage, students are asked to explore the concepts studied by researchers giving students the opportunity to use the tools that have been given to apply the concepts or principles that have been learned (Siswanto & Kusumah, 2017). Apart from that, students are also given the freedom to use other supporting tools that students bring or find in the classroom or school environment (Sumanto et al., 2020). Even during the learning process, there were students who tried using fire to find out whether the magnetic field would continue to flow when heated and it was found that the magnetic field did not function when heated. Because one way to eliminate magnetic properties is by heating (Pisah, 2021).

The next stage is that students are asked to enter the explanation phase where each group that has been distributed prepares a plan to be able to find out the direction of the magnetic field with the help of simple tools. At the same time, students plan a discussion that will be explained to other groups (Anugrah, 2015). This is also included in the syntax of the learning model used, namely the elaborate phase, where students explain the plans they have made (Adnyani et al., 2018). Next, the researcher helps students to carry out an evaluation phase regarding the learning that has been carried out, either by asking questions related to the material or knowing students' reasoning by providing opportunities for students to explain the learning results again (Hariyanto & Esser, 2018).

Finally, students enter the extend phase, which is a situation where students are asked to develop learning outcomes with matters related to students' daily lives (Rohaniyah & Azizah, 2017). So that students are able to identify phenomena or causes related to theories, principles and physical laws of the magnetic field itself (Marzuki et al., 2018). More indicators of deductive reasoning abilities that must be achieved by students are obtained in the application of the 7E learning cycle model. This is also supported by the syntax of the learning model itself (Sari, 2016).

This is also by research conducted by (Rafiqah et al., 2019) stating that the use of the 7E learning cycle model has an influence on increasing understanding of physics concepts, with the hypothesis testing carried out, H_0 is accepted. Apart from that, research conducted by (Khotimah et al., 2018) also found that there was an influence of using the 7E learning cycle model on students' mathematical literacy abilities with indicators that there was a higher increase in students' scientific literacy abilities compared to N-Gain.

Based on research conducted by (Latifa et al., 2017) and (Septiana et al., 2018) it shows that the use of the learning cycle model influences students' critical thinking abilities. Of course, this is also a reference to reasoning abilities, where students will be able to reflect on their abilities by thinking critically. This is also able to minimize student errors in learning by research conducted by (Haeroni et al., 2019) where the use of the learning cycle model can reduce student errors during learning.

The same research was conducted by (Sugiharti et al., 2019) regarding the use of the 7E learning cycle model, where the use of this learning model helped students develop critical thinking skills with an average increase of 0.829. So it can be said that the use of the 7E learning cycle model influences each use of students' thinking and reasoning abilities.

Conclusion

Based on the explanation that has been given in the research results and data analysis, it can be concluded that there is an influence of the 7E Learning Cycle model on magnetic field material to improve students' deductive reasoning.

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