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Concept Analysis of Logical Think of High School Students in Environmental Pollution Lessons

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Abstract

This study aims to determine, 1) The logical thinking ability of students in the science subject of environmental pollution class X SMA Negeri 3 Pemekasan. 2) Factors that affect the logical thinking ability of class X students are the polluting materials environment of SMA Negeri 3 Pemek a san. The method used in this research is qualitative. The analytical technique used is the Miles and Haberman analysis technique. The subjects in this study were six students, with the criteria of two high skills, two medium skills, and two low skills. The tool used is an environmental pollution test with three levels of logical thinking: impaired thinking, ability to reason, and drawing conclusions. Based on logical thinking analysis shown that 1) Subjects with high skill criteria show good logical thinking skills. Thus, subjects with moderate ability criteria show adequate logical thinking skills. Meanwhile, subjects with low skill criteria showed poor logical thinking skills. 2) Factors that can affect the logical thinking ability of SMA Negeri 3 Pemekasan students are motivation, skills start, strategy learning, and condition physical.

Keywords— *Thinking Logically, Science Learning, Environmental Pollution.*

INTRODUCTION

The success of education will be achieved by a country if there are efforts to improve the quality of the nation's education itself. The quality of education needs to be improved to produce graduates who can compete with other countries. The advancement of science, technology, and tight information has led to global competition and requires people with the ability to think logically, critically, creatively, problem-solving, collaboration and leadership, agility and adaptability, creative and has an entrepreneurial spirit, able to communicate morally good and written, able to access and analyze information, have high curiosity and nature imaginative.

Lesson Knowledge Nature (IPA) is a lesson given at every level of education in Indonesia, from elementary school (SD) to university. Through science lessons, students are trained to develop their abilities reasoning, thinking critical, and logic a Logical thinking skills are skills that must be possessed by students in uncovering facts.

Close ability related to problem-solving is the ability to think logically based on facts and the ability to be logically certain. Students' ability to think independently in logical thinking involves logical action that is analysis, synthesis, comparison, and generalization.

Logical thinking is a coherent and reasonable way of thinking based on fact objective certain. Science learning requires series Skills complex thinking skills think logically It is a complex skill and must be developed. The ability to think logically is an important ability to improve student academic achievement. However, in contrast to the reality on the ground, there are still many students who cannot think logically. This logical thinking ability requires development to improve results study students.

Think logical is a consistent thought process for an interesting conclusion. Logical thinking is the ability of students to draw valid conclusions according to rule logic and capable prove the conclusion is true and rational by known knowledge before. The ability to think

logically has been identified as a very important ability to support the development of learning science and mathematics.

Students who have understood the concept correctly will be trained and able to develop logical thinking skills to be able to solve problems every day. In this case, the ability to think logically is needed by every individual in operating his life. The ability to think logically is needed by good students when studying in class, discussing in groups, solving problems of course requiring the ability to connect something around that can be understood by the mind so that it can be implemented as logic to solve problems solve something problem.

Solution problem always requires the ability to think logically to solve them based on the experience gained. Logical thinking is a coherent and reasonable way of thinking based on fact objective certain. Science is the science of the physical world whose influence not only changes the environment but also changes people's views and approaches to the problems they face in life every day. So it can be interpreted that science or science lessons are the right lessons to improve logical thinking skills.

According to (Ni'matus, 2011) there are 3 indicators of logical thinking, namely 1) coherence of thinking, coherence of this thinking so that students can mention the information obtained, and be able to analyze the phenomena found and so on plan what to do with their information analyzed. 2) Ability to argue. After analyzing the problems faced, students are required to reveal how to solve the problem. Students can present logical reasons about all stages of completion that will be carried out from planning to conclude correctly and appropriately. Then students are trained to solve problems logically or logically and can express their opinions about the solution steps used in solving these problems. 3) Production of conclusions, students are asked to take responsibility for the problems and strategies used in solving them. Then students conclude from each of these strategies. So that students get the right conclusion on the final result. At the last stage, students are asked to make conclusions based on the rare completion. The conclusion is Step final of the splitting process problem.

Motivation study is a process that encourages someone to do something. A person who is motivated to learn shows an earnest effort to think and focus, and to plan and execute various activities supporting activities study.

Facts in the field found by researchers, namely from the results of an interview with one of the science teachers at SMA Negeri 3 Pemekasan found that ability logical thinking of students who are still lacking. The difficulty level of the questions given by the teacher has been adjusted to the ability level of the students, namely difficult, medium, and easy. However, in the process of working on the questions, there are still many students who get a score that is minimal or still less than the score KKM.

A total of 15 students responded to class X A, 4 students, or 26.6% had high logical thinking skills, 6 students or 40% had moderate logical thinking skills, and 5 students or 33.3% had low abilities. From these data, it is clear that the students' logical thinking ability is still lacking. In addition, it also explains the factors that affect students' logical thinking skills, namely lack of reading and writing, lack of attention to material, and lack of motivation from other people. old.

METHOD

This study uses a qualitative research method that produces descriptive data in the form of words. The research location is in SMA Negeri 3 Pemekasan for class X students. The subjects involved in this study were 29 junior high school students. Of the 29 students given an initial ability test on environmental pollution, then from initial ability test on environmental pollution, six students were selected, namely two students with high criteria, two students with medium criteria, and two students with low criteria to be interviewed. The following is the profile of the subject in the study.

Table 1. Profile of research subjects

No	Subject	Profile
1	ICE	High ability
2	FRA	
3	IFN	Medium ability
4	RTT	
5	AR	Low ability
6	RA	

The research was conducted by giving a test in the form of a description of 5 questions. The problem description aims to make it easy to examine students' logical thinking abilities. The questions given are related to the problem of environmental pollution in this case, students are instructed to mention the factors, impacts, and solutions for their prevention. The test given is in the form of a test in the form of description and its preparation is adjusted to the measured logical thinking ability indicator. The process of data analysis in this study includes data reduction, data presentation, and concluding. The stages and indicators of logical thinking in this research are as follows: following.

Table 2. Stages and indicators of logical thinking

No	Logical Thinking Stage	Indicator
1	Thought Confusion	Students mention all the information that is known and what is asked from the questions correctly.
2	Arguing Ability	Students can express reasons for all completion steps that will be used from the beginning to the conclusion correctly.
3	Withdrawal of Conclusion	Students give correct conclusions on each solution steps
		Students get a conclusion correctly at the end of the answer

The data analysis technique used in this study is the *Miles and Huberman analysis technique. The steps* used are data reduction (data *reduction*), data presentation (*data display*), and verification (*conclusion drawing*).

RESULTS AND DISCUSSION

Research result

The description questions used in the test in this study are: 1) mentioning all information on the causes of environmental pollution due to human activities, 2) what is the right solution for farmers in using pesticide fertilizers so as not to pollute the fields? 3) Finding smart strategies on how to properly dispose of waste, 4) explaining 2 examples of how to reduce environmental pollution, 5) why plastic can pollute the soil so plants can't grow? After the subject was given a test in the form of a description, the six selected subjects were asked for interviews. Interviews were conducted regarding the results of the answers from the tests the results can be obtained as follows: following.

Thought Confusion

Based on the results of interviews with high-ability subjects, students can mention all the information presented in the problem, namely by mentioning that the known information is

human activity that can pollute the environment such as household waste disposal, illegal felling of trees, fishing with explosives, and factory waste that is disposed of carelessly. Meanwhile, in understanding the problems asked by the ES and FRA subjects, they answered that human activities caused environmental pollution. ES and FRA subjects showed that they had mastered the questions.

The excerpts of interviews with RTT and IFN subjects who are moderately capable shown that the subjects can mention the information and problems asked. RTT's answer is to mention that human activities that can pollute the environment include cutting down trees illegally, catching fish using explosives, and dumping waste into rivers or the sea. While IFN's answer reiterates that humans can pollute water, soil, and air, IFN's answer can be said to be incomplete. Subjects with moderate ability have shown a fairly correct answer so that moderately capable subjects are said to have been able to solve problems at the stage of thinking coherence.

Based on excerpts from interviews with low-ability subjects in the cognitive stage, the subject can mention information that is known but not quite right. AR subject mentions information, namely environmental pollution, while RA subject mentions information, namely environmental pollution. AR subject answers are broadly correct but do not mention all the known information. Based on interview excerpts, AR and RA subjects answered that they had understood the problem being asked, but the answer was still not quite right. The subject looks very confused about the question so he can't answer the interview that was asked given.

Argumentation Ability

Based on excerpts from interviews with ES and FRA subjects, it shows that the subject can express arguments regarding the use of pesticide fertilizers on plants. ES and FRA explained that using pesticide fertilizers was not excessive and using natural fertilizers could reduce soil pollution, so the subject of FRA. While in question number 3, the subject of ES and FRA has explained the argument from the answer to how to properly dispose of garbage, namely throwing garbage in the right place or correctly is a must so that the surrounding environment is protected from pollution pollution.

Based on excerpts from interviews with RTT and IFN subjects, moderately capable subjects have explained their arguments according to the answers they have written. In question number 2 the subject answered how to use pesticide fertilizers not excessively to reduce pollution in rice fields. While in answer number 3, RTT and IFN explained the arguments from the test answers why it was necessary to dispose of garbage properly, IFN explained that properly disposing of garbage is easy to do and does not harm the environment.

Meanwhile, the AR and RA subjects at the time of the interview could not explain the arguments for using sufficient pesticide fertilizers on plants. While on question number 3 AR can answer but AR cannot explain the argument about the answer from the test results. So at the time of the interview AR and RA were not able to express their arguments whatever.

Withdrawal of Conclusion

From the excerpts of interviews with high-ability subjects, ES and FRA can conclude answers number 4 and 5. In answer number 4 ES conveys how to reduce environmental pollution by reforestation and disposing of waste in its place, ES concludes broadly and precisely.

Based on excerpts from the interview, RTT can conclude the answers from the previous test, RTT concludes that garbage dumped in rivers or sewers will cause garbage to accumulate and will rot. As a result, rotting waste will cause an unpleasant odor and also cause flooding. RTT conclusions show the right conclusion. Meanwhile, in answer number 5, RTT concluded briefly that plastic cannot be decomposed by decomposing bacteria. Meanwhile, with the IFN subject, the conclusions conveyed are almost the same as the Subject RTT.

From the results of interviews with AR subjects, AR is not able to conclude the answers to the test results. In the answer to question number 4 AR only gave an answer not littering,

while in the answer to question number 5 AR forgot the answer so AR was unable to conclude. While on the subject of RA, RA is not able to conclude the answer from the test. In question number 4 during the interview, AR gave the correct answer, namely not littering. Then in the answer to question number 5 during the interview, AR gave a different answer from the test results, in the AR test wrote the wrong answer and at the interview, AR answered because plastic pollutes the environment but AR is not able to provide conclusions.

Based on the results of interviews with students and supporting science subject teachers regarding factors that can affect students' logical thinking skills, the researchers obtained the results, namely motivation, students' initial abilities, learning strategies, and physical conditions.

Discussion

Thinking Confusion Stage

Subjects with high abilities can state all the information presented and asked in the question. Based on the interview answers high ability subject, it appears that the subject mentions all the information presented and asked in the question completely and clearly. The answers to the interview results of high-ability subjects are following the answers to the test results, this shows that high-ability subjects can understand the meaning of the questions.

Based on the results of the written test and interview, it is known that moderately capable subjects can mention all the information that is known and what is being asked in the questions. At this stage, the moderately capable subject showed that when he read the questions carefully enough the moderately capable subject, he was able to answer the written test and interview questions well even though the answers were incomplete.

At the stage of thinking disorder, low-ability subjects can mention information and what is being asked in the question, but only in outline. This can be seen from the answers during the interview that the low-ability subject answered "environmental pollution", the answer was correct but the answer did not mention all the information presented in the question. It can be seen that the subject of low ability does not understand the meaning of the question so it is difficult to answer interview questions.

The findings of this study are in line with research conducted by Budi, and Mega (2014) that the character of logical thinking is being able to mention all information and what is asked in the question (thinking disorder), which contains the results that subjects with low and moderate abilities have been able to complete properly and correctly. Meanwhile, low-ability subjects are also able to complete but are still unable to mention all the information that is known.

The findings on the indicators of thinking continuity are in line with constructivism learning theory in research (Dewi & Jatiningsih, 2015), where one important principle in educational psychology in this theory is that teachers cannot simply provide knowledge to students. Students must construct their knowledge in their minds. Teachers can facilitate this process by allowing students to discover and apply their ideas. So constructivism learning theory is a cognitive learning theory that states the students must find themselves and transform complex information.

Arguing Ability

The next stage is the ability to argue. Based on the results of the written test and interview at this stage, the highly skilled subject can give a true and clear argument. High-ability subjects provide arguments for each test answer broadly and in sync with the test answers. High-ability subjects explain answers about how the steps taken in solving the problem are used so that the arguments given are very appropriate.

Based on the results of written tests and interviews moderately capable subjects can express reasons or arguments regarding all answers to test results. The arguments of moderately capable subjects have shown logical arguments it's just that the arguments given are less broad. Subjects who are capable are giving arguments to the test answer correctly but the arguments are still lacking. It can be seen that one of the moderately capable subjects only gave answers

that did not show the correct argument. From the results of the arguments presented, moderately capable subjects were not so broad when compared to high-ability subjects.

Low-ability subjects at this stage are not able to express arguments at all low-ability subjects only answer briefly. The short answer shows that the high-ability subject is not able to provide an argument about the answer from the test results. Low-ability subjects looked confused with the questions given so in answering interviews it was difficult to provide arguments.

This finding is in line with the research conducted by Budi, and Mega (2014) that high and medium subjects can complete the argumentation ability stage well, according to the results of the test. While the subject of low ability is not able to complete at the ability stage argue.

Withdrawal of Conclusion

Based on the results of the test answers and interviews, researchers can judge that high-ability subjects can provide good and correct conclusions, this means that high-ability subjects can complete the conclusion drawing stage. From the results of tests and interviews, high-ability subjects show that providing conclusions is in line with the intent of the problem being asked. So that high-ability subjects provide clear conclusions about the answers from the test results so that they get the final answer from the completion.

At the stage of concluding, moderately capable subjects can provide conclusions but the conclusions conveyed are not quite right. Moderately capable subjects indicate that the conclusion from the answers is still lacking because they only repeat the test answers. So at the stage of concluding, moderately capable subjects are not able to finish properly good.

Meanwhile, low-ability subjects gave conclusions but were not correct, because they did not match the answers to the test results. One of the low-ability subjects said that he forgot the answer so the low-ability subject had difficulty making conclusions. Low-ability subjects show that they are not able to complete the conclusion drawing stage with good.

Based on the results of tests and interviews with subjects with high, medium, and low abilities, the researchers summarized the logical thinking abilities of students as follows.

Table 3. Research Data on Logical Thinking Ability

Research subject	Stages of logical thinking	Detectability
High ability subject	Confusion of thinking	Students can state all the information and problems asked for completely and clearly.
	Ability to argue	Students can convey arguments regarding all the steps to answer the test results so that got the final right answer.
	Conclusion	Students can provide conclusions on each answer broadly and correctly
Medium ability subject	Confusion of thinking	Students can mention all the information and the problem asked in the question is correct
	Ability to argue	Students can provide arguments for each answer, but there are still some who still do not enough
	Conclusion	Students in giving conclusions are still lacking The answer given is very short.
Capable subject low	Confusion of thinking	Students can mention information but not entirely, and do not understand the problem being asked in question
	Ability to argue	Students cannot give arguments to each the answer, because in the test answers the students' answers are not correct

	Conclusion	Students are not able to give conclusions at the end answer because participants educate sob to understand about and answers so that no conclusions are obtained

Factors Affecting Students' Logical Thinking Ability

Based on the results of interviews with students using questions about activities that can affect logical thinking skills, researchers obtained the results that several factors can affect students' logical thinking abilities. Some of the factors that affect the ability to think logically are as follows.

Motivation

Based on the results of interviews with all subjects regarding *online games*, subjects who like *online games for a* long time tend to focus on *the game*. So that subjects who like to play *online games* will spend less time studying. However, some subjects don't like *online games* but study time in a day is less than two hours, this shows that the encouragement from themselves, parents, and teachers is not being realized. If the encouragement or motivation of students does not grow in students, learning will be lacking. As a result, the thinking power of students will decrease towards the material being delivered or being studied.

It can be seen that motivation is a very significant factor in improving students' thinking abilities. Why is that, that motivation from within is what influences student learning. When students have no motivation at all to learn, meaningful learning will not occur. When students in learning are not so focused, the thinking ability of students will not work, because students themselves do not make movements to learn to understand the material or a problem. As a result, student learning outcomes are not optimal because the thinking ability of students is not capable develop.

In addition to motivation from within students, the motivation of parents and teachers is also very important in thinking skills. When the encouragement from parents and teachers is strong, gradually students will also follow the directions of the parents and teachers. In the excerpt of the interview with Mrs. Ida Ardiyana, she also conveyed that apart from encouragement from parents, teachers must also motivate (encourage) students to be enthusiastic about learning so that teachers can grow students' thinking skills. This finding is in line with Kort's theory (in Dewi & Jatiningsih, 2015) which states that motivation is the result of internal and external factors. Motivation is an effort to cause stimulation, encouragement, or power generation for someone to want to do something or show certain behaviors that have been planned to achieve predetermined goals.

From the theory, it can be seen that motivation is the result of internal and external factors, in this study the result of internal factors is the interest or intention from within the individual itself which can create a willingness to do learning. While the results of external factors in this study are the motivation of parents and teachers who can increase their willingness to learn. When the motivation of students has been formed from within the individual, the motivation of parents and teachers will be easily realized, to improve the thinking skills of students. On the other hand, if the motivation from within the individual does not exist, then the motivation from others will be ignored so that the thinking ability of students will not develop at all.

Initial Ability

Based on the results of interviews with science subject teachers at SMA Negeri 3 Pemekasan that the level of intelligence of students is different, if students have low background or intelligence, their thinking ability, and comprehension power will be low and vice versa. This is in line with the theory of Irvaniyah & Akbar (2014) which states that the *logical thinking*

ability of each individual or student is not the same depending on their intellectual development. This shows that each student has a different intelligence power. Students who have high intelligence tend to develop faster than students with low intelligence so that when they understand the questions they also understand will be different. This understanding or absorption is very influential on the thinking ability of students. This finding is also supported by (Pamungkas et al., 2017) who states that prior knowledge has an important role in thinking skills. Students who have good prior knowledge will get good results and vice versa.

Learning strategies

The next factor is learning strategy. The results of the interview with Mrs. Rina Hidayati said that the learning strategy is one of the factors that affect the thinking ability of students. Interesting learning strategies will encourage students to be more active during the learning process than monotonous learning strategies. If students are active in learning, it can be interpreted that the thinking ability of students is working so that it is easy to understand the material. This finding is supported by the theory (Uno, 2011 ; 3) that learning strategies are methods used by teachers to choose learning activities used during the learning process to make it easier for students to accept and understand them so that at the end of learning activities, the intended learning objectives are controlled by students.

Condition Physique

The results of the interview with Mrs. Ida Ardiayana said that the physical condition also affects the thinking ability of students. He said if the *mood* or enthusiasm of the students was not good, the enthusiasm for learning would also decrease so that in learning it was difficult to understand the material. Ibu Ida Ardiyana's opinion is supported by Maslow's theory in Siti Mariyam (2006) in (Halim, 2012) Physical conditions are the most basic physiological needs for humans to carry out life. When the physical condition of students is disturbed, then they are faced with situations that require careful thinking to solve a problem, such conditions greatly affect the thinking ability of students. As a result, students cannot concentrate and think quickly because their bodies do not allow them to react to existing responses. This shows that when the physical condition of the students is not good, the brain work is also not good as a result, the thinking ability cannot accept the response given by the teacher.

Based on the presentation of the results of interviews with students and the supporting subject, namely the science subject teacher, researchers can conclude that several factors can affect students' logical thinking abilities. Factors that can affect students' logical thinking skills are motivation, initial abilities, learning strategies, and physical conditions. From the factors that have been mentioned that motivation is a factor that greatly affects the logical thinking ability of students. That it is students who can build self-motivation to improve logical thinking skills, the role of parents and teachers is as a motivator for these students, so that motivation is the most dominating factor.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that high-ability students have been able to fulfill three logical thinking indicators, namely thinking ability, argumentation ability, and concluding. This shows the logical thinking ability of highly capable students is very good. Furthermore, students with moderate abilities have been able to complete two indicators, namely coherence in thinking and argumentation skills, subjects with moderate abilities have weakness in giving conclusions so that moderately capable subjects have sufficient logical thinking skills. Then students with low abilities are only able to fulfill one indicator, namely coherence in thinking, while the indicators of ability to argue and draw conclusions cannot complete well. This shows that students have less logical thinking ability. The factors that can affect the logical thinking ability of students at SMA Negeri 3 Pemekasan are motivation, initial abilities, learning strategies, and conditions. physique

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