Critical Thinking Skills of Fifth Grade Elementary School Students in Bandung City on the Topic of Water Cycle in Natural Science Subjects

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Abstract. Critical thinking skills are skills that a person needs to have. Therefore developing students' critical thinking skills is one of the main goals in 21st century education. The purpose of this study is to describe the critical thinking skills of fifth grade elementary school students on natural science subjects on water cycle topics. The research method used in this research is a quantitative descriptive method. The participants of this study were 25 elementary school students in Bandung city. The data is collecting by tests, interviews and documentation. After the data is obtained, the test is processed and analyzed using quantitative methods. The results of interviews and documentation studies were analyzed using descriptive methods. The research results showed that the critical thinking skills of fifth grade students in the elementary school of Bandung city were in the very poor category. The average score of students' critical thinking skills is 48.3 (very low). The interview results show that students' critical thinking skills are low because students do not like the type of description questions and because they did not willing to write. Students, who are in the low and medium category, are having another reason, which is they do not like to learn science.

1. Introduction
The education agenda in various schools throughout the world oriented to develop thinking skills [1]. Thinking skills that are the focus of 21st century education are higher order thinking skills which include analysis, synthesis, evaluation, understanding and problem solving [2,3]. In this 21st century, critical thinking skills are skill that must be mastered by every individual [4,5,6,7]. Critical thinking skills are one of the essential basic skills and must be continuously developed. Critical thinking skills are seen as intellectual disciplinary processes that actively and skillfully conceptualize, apply, analyze, synthesize, and evaluate information collected from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide for beliefs and actions [8,9]. Critical thinking is a very important component in the contemporary education system. In 21st century education, active
learning, problem solving learning, and empowering learning are recognized as the skills needed to survive. To achieve this goal, there is a consensus that critical thinking helps students to be active in learning and more effective in learning [10,11].

Starting with the description above about the benefits of critical thinking skills, there are other benefits and advantages of critical thinking skills namely students who have critical thinking skills have advantages compared to other students including (1) being able to adapt to situations and the environment; (2) can work productively which produces knowledge; (3) encourage progress; and (4) has a filter in receiving developing information; and (5) able to recognize and solve problems in the world of work [12,13,14]. From the explanation above, critical thinking skills have benefits for each individual because through critical thinking, a person can recognize and solve problems in his life. This is in line with one of the main objectives of education, which is to prepare students to be able to live independently with analytical, problem-solving and critical thinking skills [15,16].

In line with the explanation above, given the importance and criticality of critical thinking skills, it is necessary to continuously develop efforts to consistently improve critical thinking skills. One way that can be done to develop students' critical thinking skills is through education in schools [12]. Critical thinking skills are very well developed in the school environment, because it can encourage students to have high curiosity and accustom students to think [17]. Critical thinking skills can be developed through learning in schools one of which is learning science. Natural Sciences (Ilmu Pengetahuan Alam/IPA) play a very important role in human life. This is because humans have a dependency from nature and all phenomena that occur in nature to meet their needs. Learning science in elementary schools is not just to build knowledge about concepts, facts, or principles of science, but also to build students' thinking skills [18,19]. Natural science subjects in elementary schools have a lot of material that must be taught to students as a means to practice students' thinking skills. One of the natural science topics in elementary schools is water cycle topic. Water cycle topic is important to be studied and mastered by students so that students gain a more understanding of the environment. Develop an understanding of the structure, processes, and behavior of the biosphere, atmosphere, hydrosphere, and aerosphere subsystems oriented towards environmental literacy. There are two principles relating to the understanding of water cycles and the impact of human activities on water cycles. Every individual should not only understand about the process of the water cycle, but further more should be understand the impact of human activities on the water cycle system so people aware that humans are part of this environmental subsystem [20].

2. Methodology

this research methodology was quantitative descriptive. Quantitative descriptive research is research that aims to explain the phenomenon that exists by using numbers to describe the characteristics of individuals or groups [21]. The purpose of this study is to describe students' critical thinking skills in natural science subjects. This research was a descriptive qualitative research. The subject of this research is the fifth grade elementary school in one school in the city of Bandung. The numbers of participants in this study were 25 students. Characteristics of students who become participants in this study are students who are cognitively different. They were a high, intermediate, and low level. Data collected by using tests, interviews and documentation. This test question was developed to test students’ critical thinking skills. The indicators of critical thinking skills used in this study are indicators developed by Angelo, namely (1) analyzing; (2) synthesizing; (3) recognize and solve problems; (4) concludes; and (5) evaluating [8].

Research procedure, begin with validated the instrument by two expert and conducted a test to determine students’ critical thinking skills. Then, researchers conducted interviews with teachers and students. Furthermore, researchers conducted a documentation study by analyzing teacher lesson plans documentation. The test results are processed and analyzed using quantitative methods, while for the interview data and documentation study results are processed and analyzed using descriptive analysis.
3. Result and Discussion
In this section, the research findings of critical thinking skills for fifth grade elementary school students are explained. The critical thinking skills test in this study consisted of five indicators, namely analytical, synthesizing, problem knowing and solving, concluding, and evaluation skills [8]. Written tests were given to 25 students who had studied water cycle topic. From the research that has been done, it is obtained that in general; the students’ critical thinking skills are still relatively low. This is based on the data results of the percentage of the average score of critical thinking skills obtained by students reaching 48.3% and classified in the category of very low. The students’ critical thinking skills on each indicator can be seen in figure 1.

![Figure 1. Students’ Critical Thinking Skills](image)

Figure 1. shows a comparison of students’ critical thinking skills in each indicator. From the five indicators of critical thinking skills, the evaluation indicator is the highest achievement compared to other indicators even though the criteria were classified as very poor (the average score is 56). The lowest achievement was found in recognizing and solving problems indicator with average score is 42. The more detail of the percentage and achievement of students’ critical thinking skills presents in Table 1.

| Critical Thinking Skills indicators                      | Average Score Percentage | Category  |
|----------------------------------------------------------|--------------------------|-----------|
| Analyzing                                               | 45.5 %                   | Very low  |
| Synthesizing                                            | 52 %                     | Very low  |
| recognizing and solving problem                         | 42 %                     | Very low  |
| Concluding                                              | 46 %                     | Very low  |
| and evaluating                                          | 56 %                     | Very low  |
| Average Score Percentage Critical Thinking Skills        | 48.3 %                   | Very low  |

Table 1. Test Result of Students’ Critical Thinking Skills

Table 1. shows the results of students’ critical thinking skills in the very poor category. This is based on the average percentage of critical thinking skills scores which is 48.3%. Explanation of each indicator of students’ critical thinking skills explained in the following section.
3.1 Analytical skills

The results showed that the students’ critical thinking skills were in very low category or average score is 45.5%. It means that students are still unable to analyze human activities that have an impact on the water cycle process. From the 25 students, who took the test, only 2 students or 8% were in the good category, 2 students or 8% of students in the good enough category, 2 students or 8% of students were in the low category, and 19 students or 76% included in is very low category.

Figure 2. Students’ answer in analytical Test

Figure 2. showed the students' answers to the analysis questions were not optimal. Student knowledge about human activities that have an impact on the disruption of the water cycle process is still lacking. This can be seen from the results of student answers that are only able to determine one of two human activities that have an impact on the water cycle process. The lack of students' analytical skills is consistent with the results of interviews conducted with the teacher that students are still having trouble working on analytical problems, solving problems, and concluding. Whereas based on the results of interviews with teachers regarding the strategies used to develop critical thinking skills, the teacher has implemented demonstration and experimental methods. It's just that students are not accustomed to being given questions that require students to think at a high level and students do not like questions that must be answered with long answers such as the questions in Figure 2 that require students to answer and be accompanied by explanations. This is in line with the results of interviews conducted with students that students are not accustomed to working on questions that require answers in long descriptions and do not like questions with these characteristics.

Based on the explanation above, science learning should in addition to conducting scientific inquiry activities using experimental methods, discussions, or other methods. It also trains students by giving practice questions that require students to think at a higher level to achieve better understanding of the material [22,23,24].

3.2 Synthesis skills

The results showed that the critical thinking skills of students on synthesizing skills indicators were in very poor category or the average percentage score is 52%. From the 25 students who took the test, there was only 1 student or 4% included is in the very good category, 7 students or 28% were in the good category, and 17 students or 68% of students were in the very low category. The lack of students 'synthesizing skills can be seen from the results of students' answers to question number 2, which shows as follows.
Based on Figure 3, students' answers to the synthesis questions are not optimal. Students' knowledge about the impact of the reduced presence of forests on water availability is still classified as lacking. This can be seen from the results of the students' answers which were only able to answer one impact from the decreasing presence of the forest. The reason for the lack of students' synthesizing skills is that the experimental activities carried out by students are often not carried out based on a scientific inquiry approach. This is based on the statement of one of the students that is when conducting an experimental activity student directly prepares tools and materials, read procedures, and make according to ways according to the teacher's instructions. Experimental activities carried out in the learning process should go through the stages of scientific inquiry by involving students in the investigation of problems or symptoms that exist by observing objects and conducting their own trials so that they can solve these problems or symptoms so that students master learning [15,23]. This activities encourage Students synthesize ability’s [25].

3.3 Recognizing and solving problem skills

Critical thinking skills of students on indicators of the skills to recognize and solve problems in the category are very less or the percentage score is 42%. From 25 students, 1 student or 4% in the very good category, 5 students or 20% in the good, and 19 students or 76% of students in the very low category. The lack of students 'synthesizing skills can be seen from the results of students' answers to question number 5.

Figure 4. Student Answers on Problem Solving

Figure 4. shows that the students' answers regarding problem solving efforts to maintain the water cycle process were still not optimal. Students are only able to write one effort to keep the water cycle process from being interrupted. This condition can be caused by the teacher's intensity in implementing problem solving models that are still lacking. This is in line with the results of interviews conducted with students in the process of learning science. It does not always depart from the problems faced by students or are in the student environment. Whereas ideally, all natural science learning in any material must depart from contextual issues, and involve students in a series of scientific processes through inquiry, preparation and presentation of ideas so as to obtain ideas to solve these problems [24]. Thus, students have good problem-solving skills in real-world applications [12,26].
3.4 Concluding skills
Critical thinking skills of students on the indicators of concluding skills in the category of very low or a percentage score was 46%. Of the 25 students who took the test, 1 student or 4% is in the very good category, 8 students or 32% in the good category, and 16 students or 64% of students in the very low category. The lack of students' synthesizing skills can be seen from the results of students' answers to question number 3b as follows.

Figure 5. Students' Answers to Concluding Questions

Figure 5. shows that the students' answers 3b were incorrect. Students are still unable to conclude the stages of the water cycle process. The low ability to conclude in accordance with the statement of the teacher in the class, that students often have difficulty when making conclusions. In addition, the results of interviews with students also confirmed that the confusing questions were question number 3b. The inability of students to infer is basically caused by a lack of ability to interpret pictures or observational tables. Even if students have an understanding of the process of water recycling, students can easily make conclusions from that information. The low ability to conclude students in Class V can be interpreted that students do not have good ability to identify and use the elements needed to form guesses and consider relevant information to draw conclusions in problem solving [27]. This is because they are not accustomed to getting the questions as they were given during the study and rarely draw conclusions from a learning activity carried out. In the experimental activity, it should be after students' record the phenomena that occur, analyze, and present data, followed by drawing conclusions or experimental results [15, 23,28]. This will certainly improve the ability to interpret data and the ability to draw conclusions.

3.5 Evaluation skills
Students' critical thinking skills on the indicator of evaluating skills are in the very poor category or the percentage average score is 56%. From 25 students who took the test, 1 student or 4% in the very good category, 11 students or 44% in the good category, and 13 students or 52% of students who were in the very low category. The lack of students' synthesizing skills can be seen from the results of students' answers to question number 3b, which is as follows.
Figure 6 shows that the results of student answers are still incomplete so that the scores obtained by students are not optimal. This means the lack of students’ ability to synergize the cognitive aspects they have in assessing a fact or concept [29]. The low of student abilities’ to evaluate is caused by students not accustomed to working on problems that require students to think at a high level. This is in line with the results of interviews conducted with teachers that students rarely work on problem solving questions that require high-level thinking. One effort that can be done to improve evaluation skills is to provide descriptive questions that encourage students to argue, criticize, assess, and claim so that it forces students to think deeper [30].

4. Conclusion
Based on the results of the study, it can be concluded that, in general, students' critical thinking skills are still classified as very low categories. This is based on the percentage of the average score obtained at 48.3%. The low of students critical thinking skills score caused by several factors. From the research findings, the contributing factor is the learning process that is carried out less encouraging students to solve problems. Students are not accustomed to working on problem solving questions that require high-level thinking, and the experimental methods conducted do not emphasize the scientific approach.

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References
[1] Zohar A and Ben David A 2015 “Paving a clear path in a thick forest: A conceptual analysis of a metacognitive component Paving a clear path in a thick forest: a conceptual analysis of a metacognitive component,” no. October.
[2] Ennis R H 2009 “A Logical Basis for Measuring Critical Thinking Skills.”
[3] Tsaparlis G, Georgios and Papaphotis 2009 “High-School Students’ Conceptual Difficulties and Attempts at Conceptual Change: The Case of Basic Quantum Chemical Concepts,” Int. J. Sci. Educ., vol. 31, no. 7, 895–930
[4] Griffin E P, Mc Gaw B and Care 2012 Assesment and Teaching of 21st Century Skills. London: Springer Dordrecht Heidelberg
[5] Kivunja C 2014 “Do You Want Your Students to Be Job-Ready with 21st Century Skills? Change Pedagogies: A Pedagogical Paradigm Shift from Vygotskyian Social Constructivism to Critical Thinking, Problem Solving and Siemens’ Digital Connectivism,” vol. 3, no. 3,81–91
[6] Morocco et. al 2008 Supported Literacy for Adolescents: Transforming Teaching and Content Learning for The Twenty-First Century. San Fransisco: Jossey-Bass Awiley Imprint., 2008.
[7] Brinkley M 2012 Defining Twenty-First Century Skills. dalam Griffin, P. Assesment and Teaching of 21st Century Skills. New York: Springer
[8] Angelo T A and Cooper J L “BEGINNING THE DIALOGUE: THOUGHTS ON PROMOTING CRITICAL THINKING Classroom Assessment for Critical Thinking Cooperative Learning and Critical Thinking.” 6–7.
[9] Piauw C Y 2010 “Building a Test to Asses Creative and Critical Thinking Simultaneously. Kuala Lumpur,” Procedia Soc. Behav. Sci.
[10] Kincheloe J L 2008 “Critical Pedagogy and the Knowledge Wars of the Twenty-First Century by,” vol. 1, no. 1
[11] Lai Y 2009 “Assessing students’ Critical Thinking Performance: Urging for measurements using multi-response format. Thinking Skills and Creativity,” vol. 4, no. 1, pp. 70–76
[12] Halpern D F 2014 Thought And Knowledge: An Introduction To Critical Thinking Fifth Edition. New York: Taylor & Francis
[13] Butler H A 2012 “Critical Thinking Assessment predicts real world outcomes of critical thinking.” Appl. Cogn. Psychol., vol. 26,721–729
[14] Costa A 2008 “The Thought-Filled Curriculum. Educational Leadership,” vol. 65, no. 5,20–24
[15] Aun S and Kaewurai W 2017 “Kasetsart Journal of Social Sciences Instructional model development to enhance critical thinking and critical thinking teaching ability of trainee students at regional teaching training center in Takeo province, Cambodia,” Kasetsart J. Soc. Sci., vol. 38, no. 1,88–95
[16] Brierton D S, Wilson E, Kistler M, Flowers J and Jones 2016 “A comparison of higher order thinking skills demonstrated in synchronous and asynchronous online college discussion posts,” vol. 60, no. 1,14
[17] Molnar A et al., “S CHOOLHOUSE C OMMERCIALISM Academic Editor,” no. 802, 2014.
[18] Badan Standar Nasional Pendidikan 2006 Kurikulum KTSP.
[19] Holbrook M J and Rannikmae 2009 “The meaning of scientific literacy,” Int. J. Environ. Sci. Educ., vol. 4, no. 3,275–288
[20] Swartz R 2008 “Energizing Learning,” Educ. Leadership, vol. 65, no. 5,26–31
[21] Syamsudin and Damaianti 2011 Metode penelitian pendidikan bahasa. Bandung: Rosdakarya
[22] Allison E 2018 “Modern Scientific Literacy: A Case Study of Multiliteracies and Scientific Practices in a Fifth Grade Classroom,” 270–283
[23] Dirman C and Juarsih 2014 Pengembangan Kurikulum. Jakarta: Rineka Cipta
[24] Donovan A and Mcfarlane D A 2013 “Understanding the Challenges of Science Education in the 21st Century: New Opportunities for Scientific Literacy Understanding the Challenges of Science Education in the 21st Century: New Opportunities for Scientific Literacy,”
[25] Kemendikbud 2014 Materi Pelatihan Guru Implementasi Kurikulum 2013. Jakarta: Badan Pengembangan SDM dan Penjamin Mutu Pendidikan Kemendikbud.
[26] Widodo A 2014 “Pembelajaran IPA di Sekolah Dasar. Modul PGSD UPI Bandung,”
[27] Facione P A 2013 “Critical Thinking: What It Is and Why It Counts,” 1–28
[28] Florea NM and Hurjui E 2015 “Critical thinking in elementary school children,” Procedia - Soc. Behav. Sci., vol. 180, no. November 2014, pp. 565–572
[29] Sudjana N 2014 Penilaian Hasil Proses Belajar Mengajar. Bandung: Rosda karya.
[30] Cazier J D 2010 “Fostering Critical Thinking,” 1–7