



Analysis Of Critical Thinking Skills Students Of Sanata Dharma University Through LAVA LAMP Experiments

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ABSTRACT

This study aims to describe the analysis of the implementation of learning critical thinking skills for Sanata Dharma University students through the LAVA LAMP experiment. This study uses a qualitative approach with the type of experimental research. Data from this study were obtained through participatory observation, through interviews with supervisors, and through student work, as well as documentation to support student work. The results showed that the researchers efforts were in using the LAVA LAMP experiment to improve the critical thinking skills of university students Sanata Dharma: The research results show that the researchers' efforts in using the LAVA LAMP experiment to improve the critical thinking skills of Sanata Dharma University students: focusing questions 10 % with category good, ask and answer questions that require explanation 20 % with category very good, observe and consider the results of observations 20 % very good, carry out deductions and assess the results of the deduction 10 % with category good, doing induction 10 % with category good, define terms and consider definitions using appropriate criteria 10 % with category good, identify assumptions 10 % with category very good, and integrate with others 10 % with category good.

Keywords:

Critical Thinking, Lava Lamp Experiment.

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INTRODUCTION

According to the National Education System Law number 20, article 3 of 2003, it is stated that "National education functions to develop and shape the character or civilization of a dignified nation, as well as to educate the life of the nation. "National education aims to develop the potential of students to become human beings who have faith and are devoted to God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens" (Ramly, 2010). Education is also a means of being equipped to achieve better and more decent activities or work. As an



educator, creativity is needed in providing education that actualizes the needs of learners in the learning process.

Learning is planned efforts to manipulate learning resources so that a learning process occurs within students (Sadiman et al, 1986:7). Good learning is learning that provides opportunities for students to actualize themselves in analyzing and finding solutions to problems. that they encounter in everyday life. In this case, what educators can apply is critical thinking skills.

Critical thinking according to Jensen (2011: 195) argues that critical thinking means an effective and reliable mental process, used in teaching relevant and correct knowledge about the world. Wijaya (2010: 72) also expressed the idea of critical thinking skills, namely the activity of analyzing ideas or ideas in a more specific direction, distinguishing them sharply, selecting, identifying, studying and developing them in a more specific direction, distinguishing them sharply, selecting, identifying, studying and develop it in a more perfect direction.

Johnson (2009: 183) states that critical thinking is a directed and clear process used in mental activities such as: solving problems, making decisions, persuading, analyzing opinions or assumptions, and conducting scientific research. Cottrel (2005: 1) suggests that "Critical thinking is a cognitive activity, associated with using the mind" which means that critical thinking is a cognitive activity, namely related to the use of the mind. Based on Bloom's cognitive dimensions, critical thinking skills occupy the dimensions of analysis (C4), synthesis (C5), and evaluation (C6). It appears that these dimensions are taken from Bloom's taxonomy system which has been revised by Anderson & Krathwohl (2010), so critical thinking skills occupy part of the analysis (C4) and evaluation (C5) dimensions, because in the revised version, the synthesis dimension is integrated into the analysis dimension.

Bobbi De Porter, et al (2013: 298) state that critical thinking is one of the high-level skills that is very important to teach to students besides creative thinking skills. In critical thinking, we practice or include careful judgment or evaluation, such as assessing the feasibility of an idea or product. Meanwhile, according to Beyer (Filsaime, 2008: 56) critical



thinking is a disciplined way of thinking that someone uses to evaluate the validity of something (questions, ideas, arguments, and research).

Critical thinking skills are the ability to question, analyze, evaluate, and make conclusions logically and objectively. This skill is very important in everyday life and also in the academic world, because it can help a person make the right decisions and avoid unnecessary mistakes.

Learning critical thinking skills through LAVA LAMP experiments is an effective method to apply to students. Through this experiment, students will learn to understand scientific concepts in more depth and improve their ability to analyze, evaluate and make conclusions based on existing evidence. Apart from that, learning critical thinking skills can also help students to develop good communication skills, because they will learn to convey arguments clearly and effectively. This will be very useful for their social development in the future.

Implementing critical thinking skills learning through the LAVA LAMP experiment, it should be emphasized that this method not only provides benefits for students' academic development, but also helps them face challenges and problems in everyday life. Therefore, this method is very important to apply in the learning process at universities.

Therefore, starting from the various problems that occur as described above, in this case research can be carried out with the title "Analysis of the Implementation of Critical Thinking Skills Learning for Sanata Dharma University Students Through the LAVA LAMP Experiment."

The formulation of the problem in this research is how to implement critical thinking skills learning for Sanata Dharma University students through the LAVA LAMP experiment. The aim of this research is to describe the implementation of critical thinking skills learning for Sanata Dharma University students through the LAVA LAMP experiment. The benefit of this research is to make an important contribution to the development of more effective and innovative critical thinking skills learning.



RESEARCH METHODS

This research uses a qualitative approach. According to Moleong (2011:6), qualitative research is research that intends to understand phenomena about what is experienced by research subjects, for example behavior, perceptions, motivations, actions, etc. holistically and by means of descriptions in the form of words and language. , in a special natural context and by utilizing various natural methods. Qualitative research is research that provides explanations using analysis, based on phenomena experienced by research subjects. Data collection prioritizes words and images as findings. Thus, a qualitative approach is an approach that is natural and has a comprehensive perspective or as a whole as a whole in a study.

A continuation of the qualitative approach, this type of research is experimental research. According to Schoenner (1996) in Palendeng (2003:81), this type of experimental research is research that is suitable for science learning, because this type of experimental research is able to provide learning conditions that can develop thinking abilities and creativity optimally. Students are given the opportunity to develop their own concepts in their cognitive structure, which can then be applied in their lives. In this way, students can develop and apply knowledge through experiments and can increase students' critical thinking abilities.

The data sources in this research are Lecturers in Innovative Science Education Courses and Semester IV Class A PGSD Students at Sanata Dharma University. The data collection techniques used in this research were interviews with lecturers, observations of students, and documentation. Observations look at students' initial abilities, implementation, and work results as evidenced by student worksheets.



Table 1. Observation Grid Guidelines

Variable	Indicator	Sub Indicator
Improving Critical Thinking Skills Through LAVA LAMP Experiments	Identify the problem or question	Students are able to use critical thinking skills to identify problems contained in the LAVA LAMP experiment
	Collect data, opinions and arguments	Students are able to use critical thinking skills to collect data and opinions regarding the LAVA LAMP experiment
	Analyze and evaluate the data that has been collected	Students are able to use critical thinking skills to analyze data through data that has been collected based on the LAVA LAMP experiment
	Identifying data	Students are able to use critical thinking skills to identify data based on the LAVA LAMP experiment
	Synthesize data	Students are able to use critical thinking skills to synthesize data through various reference sources based on the LAVA LAMP experiment
	Draw a conclusion	Students are able to use critical thinking skills to draw conclusions based on the LAVA LAMP experiment

Table 2. Aspects and Indicators

Aspects of Critical Thinking Skills	Critical Thinking Skills Indicator
Provide a simple explanation	Focusing questions
	Ask and answer questions that require explanation
Build basic skills	Observe and consider the results of observations
Make conclusions	Carry out deductions and assess the results of the deduction
	Doing induction
Make further explanations	Define terms and consider definitions using appropriate criteria
	Identify assumptions
Create estimates and integrations	Integrate with others

Then the data analysis techniques in this research are data reduction, data presentation, and drawing conclusions. So the data analysis carried out was descriptive qualitative analysis.

RESEARCH RESULTS AND DISCUSSION

Results

The research results show that the researcher's efforts in using the LAVA LAMP experiment to improve the critical thinking skills of Sanata Dharma University students: (i) Preparation, the researcher provides concepts regarding critical thinking skills to students and determines course learning outcomes (CPMK); (ii) Implementation, researchers carry out LAVA LAMP experimental activities and ask students to prepare tools and materials and discuss procedures. After that, the researcher supervised and guided students in carrying out the LAVA LAMP experiment; (iii) Assessment, researchers provide evaluations to students in the form of worksheets, to see students' critical thinking skills. The students' critical thinking skills include, students are able to think critically by analyzing problems from beginning to end. Students have also identified problems or questions from lava lamp science experiments, collected data, opinions and arguments, analyzed and evaluated the data that has been collected, identified data, synthesized data, and drawn conclusions.

Discussion

Implementation of LAVA LAMP Science Experiment Activities





Assessment of LAVA LAMP science experiment activities

Table 3. The results of student work are based on several groups from groups 1-7

Questions	Answers
<p>1. Based on the findings with group friends, what type of thinking skills was the experiment carried out? Explain!</p> <p>2. Describe the findings with your group friends regarding the LAVA LAMP experiment!</p> <p>3. Explain what obstacles were encountered when conducting the LAVA LAMP experiment!</p> <p>4. Based on the LAVA LAMP experiment that has been carried out, how do you teach this to elementary school students?</p> <p>5. What learning innovations have you produced to teach elementary school students apart from the LAVA LAMP experiment?</p>	<p>1. Critical, because we are asked to do or make something using the materials that have been given.</p> <p>2. After inserting jesscool into a glass containing oil, jesscool reacts and produces bubbles which make the dye rise to the surface and fall back to the bottom of the oil.</p> <p>3. Too little food coloring was given so the resulting color was less beautiful.</p> <p>4. a. Students are given tools, materials and instructions for conducting experiments. b. Students are given the freedom to carry out experiments individually or in groups according to instructions. c. Students will be curious about the results of experiments. d. Students can find answers to their questions.</p> <p>5. Make ice cream using cans, salt and ice cubes. The tools and materials used are as follows: Ice cubes, water, salt, powdered milk, cans, basins. The steps taken are as follows: a. Dissolve powdered milk and water b. Put ice cubes in the basin and add salt. c. Put the milk solution into the can. d. Place the can in the middle of the ice cubes. e. Rotate the can so the milk freezes.</p>
	<p>1. Critical thinking skills, to find findings, you must first analyze existing objects and be consistent in observing.</p> <p>2. a. Before being given water, Jesscool did not react. After being given water, jesscool and the dye react to rise to the surface of the oil. b. When the reaction occurs (jesscool and dye rises) light is given at the bottom of the container then the LAVA LAMP will glow, if the bubbles and reaction start to fade, the existing light will also fade.</p> <p>3. The problem is that it turns out that the LAVA LAMP requires a small amount of dye water which settles and is not soluble in oil. After being given water, the dye and jesscool begin to react to rise to the surface of the oil.</p> <p>4. From the experiment, then the observation, then the teacher will connect the experiment with the material, namely the density of the object (in this experiment the liquid). The teacher also connects the jesscool and dye reaction with Archimedes' law (upper compression force).</p> <p>5. Make snow globes and miniature ships floating in the water. The steps are as follows: a. Carrying out experiments or observations</p>



	<p>b. Doing experimental problems c. The teacher connects the experiment with the material. d. The teacher explains the material further.</p> <p>1. Critical thinking skills. Because in the experiments we carried out we emphasized more complex thinking. 2. There is a relationship between jesscool tablets which produce bubbles and Archimedes' law or upward pressure. The more jesscool tablets you insert, the more bubbles will be produced. 3. Wrong procedure (stirring the solution) which resulted in invisible bubbles. 4. a. Explain the material of upward compression force (Archimedes' Law). b. So that students understand more about the concept of upward pressure force, children are asked to carry out a simple LAVA LAMP experiment. c. Students analyze and understand the concept of Archimedes' law on LAVA LAMP. d. After conducting the experiment, students and teachers draw conclusions together. 5. Explain the process of rain using an artificial rain jar. The steps are as follows: a. Use hot water then pour it into a tight jar. b. Then cover it with plastic and tie it with rubber. c. Ice cubes are given to the plastic. d. After a few minutes the water vapor will collect at the point and fall off.</p> <p>1. In our opinion, the experiments that have been carried out are a type of critical thinking skill, because through experiments students can analyze so they can find concepts from the experimental results. 2. a. The coloring water that is added to the jesscool tablet will cause bubbles or lava. Apart from that, water and cooking oil do not mix. b. When a glass containing oil, dye and water is placed on top of a cellphone flashlight, then a jesscool tablet is inserted, it produces a light or light effect like a lamp. 3. In our opinion, the problem is that when jesscool is put into a glass containing oil, water and dye, it takes a little time to react. 4. a. Explain material related to practicum. b. Provide LKPD containing practical steps. c. Ask students to experiment according to the LKPD and observe. d. Students convey the results of their observations through presentations in front of the class. 5. Our group's innovation to teach elementary school students apart from the LAVA LAMP experiment is making an ice puter</p>
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	<p>experiment.</p> <ol style="list-style-type: none"> 1. Critical thinking, because by conducting experiments we can analyze complex situations using standard objectivity and consistency. 2. After inserting Jesscool into a mixture of oil, water and food coloring, it will react to produce lots of small bubbles and continue until the Jesscool tablet dissolves or runs out. 3. Confused. Should the mixture of water, oil and food coloring be stirred or not. 4. From the LAVA LAMP experiment, it was then linked to the concept of water density. Because the three solutions cannot mix together because the density of each solution is different. 5. Make a rainbow experiment in a glass using 4 solutions: <ol style="list-style-type: none"> a. Honey b. Dish soap c. Water mixed with food coloring. d. Cooking oil. <ol style="list-style-type: none"> 1. Creative, because it can trigger students to develop curiosity about the experiments given by the teacher, and students will better understand knowledge about science or science by carrying out these experiments. As well as the ability to answer problems based on existing information data. 2. The LAVA LAMP experiment proves that the relationship between soda tablets can produce bubbles from the layer of cooking oil and change color when a flash is placed under it. After a few minutes, there is also a tablet or jesscool which gets smaller and floats up. 3. No obstacles were found in carrying out the LAVA LAMP experiment. 4. By using certain models, methods and media that are related to certain topics such as the nature of liquids and Archimedes' Law, namely objects that sink, float and float as well as CO₂. 5. An innovative model that can be applied to elementary school students using PBL and other models. <ol style="list-style-type: none"> 1. Creative thinking, because students answer problems based on the data or information provided. 2. <ol style="list-style-type: none"> a. Oil and water do not mix. b. Food coloring also doesn't mix with oil (it forms lumps). c. Water and food coloring combine in the oil. d. When you insert a jesscool tablet, the water rises or is thrown above the oil, then falls again after the jesscool runs out. e. Jesscool tablets only dissolve in water and release CO₂ gas. 3. We didn't encounter any problems. 4. <ol style="list-style-type: none"> a. Practice with a group in class to create a LAVA LAMP experiment. b. Students observe each step in the manufacturing process.
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	<p>c. Students record the results of experiments. d. Students conclude from the results of experimental notes. e. Together with the teacher, students solve problems or pay attention to the teacher's explanation.</p> <p>5. Make a rainbow experiment in a glass. The way to do this is to use different amounts of sugar in each glass (the amount of sugar in each glass). For example, glass 1 has no sugar (red), glass 2 has 2 tablespoons of sugar (yellow), glass 3 has 4 tablespoons of sugar (green), the last glass or 4 has 6 tablespoons of sugar (blue). After that, the order of pouring starts from the glass without sugar, then followed by the glass containing 2 tablespoons of sugar, 4 tablespoons of sugar, and at the top 6 spoons of sugar (each color will merge later, because the density is different).</p>
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Table 4. Percentage of Student Answers (%)

Aspects of Critical Thinking Skills	Critical Thinking Skills Indicator	Percentage of Student Answers (%)	Category
Provide a simple explanation	Focusing questions	10 %	Good
	Ask and answer questions that require explanation	20 %	Very good
Build basic skills	Observe and consider the results of observations	20 %	Very good
Make conclusions	Carry out deductions and assess the results of the deduction	10 %	Good
	Doing induction	10 %	Good
Make further explanations	Define terms and consider definitions using appropriate criteria	10 %	Good
	Identify assumptions	10 %	Very good
Create estimates and integrations	Integrate with others	10 %	Good

The research results show that the researchers' efforts in using the LAVA LAMP experiment to improve the critical thinking skills of Sanata Dharma University students: focusing questions 10 % with category good, ask and answer questions that require explanation 20 % with category very good, observe and consider the results of observations 20 % very good, carry out deductions and assess the results of the deduction 10 % with category good, doing induction 10 % with category good, define terms and consider definitions using appropriate criteria 10 % with category good, identify assumptions 10 % with category very good, and integrate with others 10 % with category good.



CONCLUSION

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REFERENSI

Arif S. Sadiman, dkk. 1986. *Media Pendidikan, pengertian, Pengembangan, dan Pemanfaatannya*. Jakarta: Rajawali.

Cottrell. (2005). *Critical Thinking Skill*. New York: Palgrave Macmillan.

Daniati, N., Handayani, D., Yogica, R., & Alberida, H. (2018). Analisis Tingkat Kemampuan Berpikir Kritis Peserta Didik Kelas VII SMP Negeri 2 Padang tentang Materi Pencemaran Lingkungan. *Atrium Pendidikan Biologi*, 1(2), 1–10.

Depdiknas. 2003. Undang-undang RI No.20 tahun 2003.tentang sistem pendidikan nasional.

DePorter, Bobbi. dkk. 2013. *QUANTUM LEARNING: Membiasakan Belajar Nyaman dan Menyenangkan*. Bandung: Kaifa.

Filsaime, Dennis K. (2008). Terjemahan oleh: Sunarni. *Menguak Rahasia Berpikir Kritis dan Kreatif*. Jakarta: Prestasi Pustaka Raya.

Hidayat, A., Rahayu, S., & Rahmawati, I. (2018). Analisis Keterampilan Berpikir Kritis Siswa SMP Pada Materi Gaya dan Penerapannya. *Pros. Semnas Pend. IPA Pascasarjana UM*.

Jensen, Eric. (2011). *Pembelajaran Berbasis Otak (Edisi Kedua)*. Jakarta: PT Indeks Permata Puri Media.

Johnson, Elaine B. 2009. *Contextual teaching and learning: menjadikan kegiatan belajar mengajar mengasyikkan dan bermakna*. Bandung: Mizan Learning Center.



Moleong, Lexy J. 2012. Metodologi Penelitian Kualitatif. Bandung: PT Remaja Rosdakarya.

Palendeng. 2003. Strategi Pembelajaran Aktif. Jakarta: Rineka Cipta.

Sugara, U., Studi, P., Pendidikan, M., Universitas, D., & Yogyakarta, N. (2022).
Etnopedagogi : Gagasan dan Peluang Penerapannya di Indonesia Ethnopedagogy :
Ideas and Probability of Its Implementation in Indonesia, 7, 93–104.
<https://doi.org/10.24832/jpnk.v7i2.2888>

Wijaya, Cece. 2010. Pendidikan Remedial. Bandung: Remaja Rosdakarya.