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Analysis of Students Creative Thinking Ability in Environmental Problem Solving

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ABSTRACT

The quality of teachers in education plays an important role in building various skills of students to face life's demands. Creative thinking skills are one of the competencies needed in this century. This study aims to provide an overview of students' creative thinking skills on environmental problems. This research uses quantitative descriptive methods. Sampling methods is carried out by cluster random sampling involving 48 Biology Education students in the third semester of class 3A and class 3B. The instrument used was an essay question with a total of 8 questions on the topic of solid waste management. Analysis of the factors that are thought to affect creative thinking skills using independent t-test and Mann Withney U-test. This article begins with the results of an assessment of the ability to think creatively in early semester students in the Biology Education study program major then analyze the factors that affect critical thinking skills through a questionnaire instrument to describe learning activities that build creative thinking skills both from the internal and external aspect. The results of this study were The factors that estimated influence students' creative thinking value are economic factors, non academic achievement, authentic experience of environment practical activities, openness for opinions in making decisions in the family.

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1. INTRODUCTION

Current environmental problems are problems experienced by every individual, wherever they are. Increase of population, modernization, culture and lifestyle are factors that influence environmental problems. Therefore, creative ideas are required from the home and school environment to solve environmental problems (Idris, & Lestari, 2017). Creative ideas can be grown through learning methods related to real activities that are challenging and in the form of problem solving. Khanafi et al., (2013) mentions that these creative thinking skills will involve imagination, intelligence, insight, and ideas when facing certain situations. In addition, tried to suggest authentic and new designs, generate different hypotheses, solve problems with the help of finding and finding new applications.

Creative Thinking Ability is skills to think in line with discourse of education quality improvement through a learning process that meets the objectives. Therefore, need a strategy or method that can improve the quality of learning that is oriented towards achieving goals is needed. The ability to think is a learning and teaching situation that can encourage processes that produce the desired mental results from an activity. This statement is strengthened by the assessment that a teacher's intervention can improve thinking and by requiring the use of mental processes to plan, describe, and evaluate thinking and learning processes (Pratiwi., & Sunarso, 2018). Everyone has important thinking skills or trained thinking. Good thinking skills could be an asset to solve problems that occur in their lives. People who think are people who have an idea or opinion about something or a process of looking for meaning and an effort to reach an appropriate decision. In learning that required thinking skills, teachers should refer to approaches of specific strategies and procedures that can be implemented and can make students learn more effectively. Sudarmanto, (2018) suggests that thinking skills involve six types of thinking, namely metacognition, critical thinking, creative thinking, cognitive processes (problem solving and decision making), core thinking skills (such as representation and summarization), understanding the role of knowledge content.

Creativity is an intelligence that develops in individuals, in the form of attitudes, habits, and actions in giving birth to something new and original to solve problems Sudarmanto, (2018). According to Wahyudin, (2018) can be defined as a process to produce something new from existing elements by rearranging these elements. Creative thinking can produce quality thinking, this creative process certainly cannot be carried out without the knowledge gained by developing good thinking. Creative thinking provides support to students so that students are more motivated to be more creative. Wulandari, (2016) argues that creative thinking is the ability to develop unusual, quality, and appropriate ideas. This shows that creative thinking can develop thinking power that includes insight with broad elements. There are three main components related to creativity, including: creative thinking skills, expertise (technical, procedural, and intellectual knowledge), and motivation. Creative thinking skills in solving a problem are shown by submitting ideas that are different from solutions in general. Each person's creative thinking will be different and related to the way they think in approaching the problem. Creative thinking is related to knowledge possessed by a person and is relevant to the proposed creative idea or effort. Meanwhile, motivation is the key to generating creativity. Creativity or creative thinking is operationally formulated as a process that is reflected in fluency, flexibility, and originality in thinking.

Based on cognition and thinking process, Abdullah, Abidin, & Ali, (2015) clarifies some of the characteristics of students who have the ability to think creatively in the learning process, those are Skills to think smoothly, generate many ideas, solve problems or questions, provide many ways or suggestions for do various things, always think of more than one answer, flexible thinking skills, generate various ideas, answers or questions, can see problems from different points of view, look for many alternatives or different directions, be able to change the way of approach or way of thinking, original thinking skills, able to generate new and unique expressions, think of unusual ways to express oneself, be able to make unusual combinations of parts or elements, detail (elaborate), be able to develop and enrich an idea or product , adding or detailing the details of an object, idea or

situation so that it becomes more interesting. According to Bart et al., (2015), the ability to think creatively can be explored in the opportunity to receive many ideas, to exchange ideas without limits in an effort to think broadly and deeply about solutions to practical problems. The strategy of educators reflects the joy of bringing ideas to life to build something tangible from an idea. Schools face challenges, from designing lessons for content mastery, funding for professionals, development, to creating 21st century learning experiences. Cheung, (2013) looked at three main uses of creativity tests, namely to identify creative gifted students for gifted child programs, for research purposes, and for counseling purposes. 1) Identification of Creative Gifted Children. Creativity tests are most often used to identify creative gifted students for talented student programs. Most talent programs have the principle that a) creative students need to be identified and b) creativity needs to be taught. 2) Research. Research can help in understanding the concept of creativity, creative people, and help in understanding the development of creativity. Creativity tests in research can be used in two ways: a) to identify creative people and compare them to ordinary people. b) creativity tests in research can be used to assess the impact of creativity training on participants' creativity. 3) Counseling. Creativity tests can help counselors, teachers, parents, and students themselves to recognize and understand students' hidden creative talents. This makes it possible for teachers to be able to design activities that are challenging for creative students. Isaksen, Dorval, & Treffinger, (2011) has tested the effectiveness of an 11-week program that aims to improve the creativity and creative counseling skills of counseling candidates, which is based on Guilford's creative thinking model, and scores from four perspectives, namely: Fluency, flexibility, originality and elaboration. The result is that this program is effective for all dimensions.

In general, creative thinking correlates with critical thinking, and problem solving. These skills are very much needed and are one of the skills that are the target of 21st century education. Research results Kamaei, & Weisani, (2013) show that students' creative thinking skills contribute 68% to their problem-solving abilities. According to Karpova, Marcketti, & Kamm, (2013) the use of problemsolving methods in the learning process affects the level of creativity compared to traditional methods. Indonesia's creativity is among the lowest ranks compared to other countries in the world. The 2015 Global Creativity Index (GCI) ranked Indonesia at 115 out of 139 countries. A fact that is very important for us to respond to because it relates to the integrity of the nation among other country. This ability can be possessed by a child by providing him with experience and direction in learning at school. For example, how to deal with environmental problems in the school environment contextually, namely the concept of learning that helps teachers link the material they teach with students' real-world situations and encourages students to make connections between knowledge it has with its application in their daily life. This learning involves seven main components of effective learning, namely: constructivism, questioning, inquiry, the learning community, modeling, reflection and authentic assessment.

The ability to think creatively requires a method that provides a climate for the emergence of ideas with interesting challenges in both the home and school environment. Many researches on creative thinking are associated with level of learning ability (Lassig, 2013). It still needs to be further observation how the creative thinking ability in solving life problems, especially the environment around students. According to Laisema, & Wannapiroon, (2014) and Lin et al., (2012) who has identified an important relationship between creative thinking and environmental education, there needs to be a more thorough and in-depth theoretical exploration of the topic. The ability to think creatively in environmental education through the formation of problem-solving abilities is very beneficial in responding problems that arise in the environment. In the school environment, students are given an atmosphere of natural learning process by working and experiencing it firsthand. Students are conditioned to understand the meaning of learning, find ways to achieve and feel the benefits of learning activities. Learning in schools should be a preparation for real-life learning by focusing on practical skills and relevant topics. Authentic learning can include teaching techniques, student learning outcomes, and affective learning that students can develop towards their

learning. Based on the concepts described above, it is necessary to know the critical thinking profile of students and analyze the factors that influence it in order to develop creative thinking skills through intervention in the form of various approaches in learning activities.

2. METHODS

This type of research is descriptive quantitative, to determine what factors are thought to contribute to creative thinking skills in solving environmental problems. This research was conducted at the Uhamka campus in East Jakarta in December 2019-April 2020, Sampling methods is carried out by cluster random sampling involving 48 Biology Education students in the third semester of class 3A and class 3B. The instrument used was an essay question with a total of 8 questions on the topic of solid waste management. The essay test is prepared based on indicators of students' creative thinking abilities with indicators of fluency, flexibility, originality and elaboration. The creative thinking test instrument grid is used as a reference for researchers in making questions. Before the instrument is used, it is first tested for validity and reliability by an expert, then tested statistically.

Analysis of students' creative thinking skills was carried out by processing quantitative data in the form of creative thinking ability test and questionnaire of factors that influenced creative thinking abilities. Quantitative data were obtained from students' scores in answering questions on creative thinking skills and the factors involved. The score obtained from each indicator is calculated and converted into a percentage as the final score of the students. Based on calculations (Purwanto, 2013) this calculation is also called percentages correction, with the formula:

$$NP = \frac{R}{SM} \times 100\%$$

SM

Description:

NP: The percent value sought or expected

R: The raw score obtained by students

SM: The ideal maximum score from the test concerned

100: Fixed number

Analysis of the factors that are thought to affect creative thinking skills using independent t-test and Mann Withney U-test.

3. FINDINGS AND DISCUSSION

Lecturers of the courses use a variety of methods provided by lecturers of the courses. The curriculum used in learning activities on campus has already referred to KKNI and learning activities are directed at student activity through various models and approaches. Likewise, learning related to environmental education uses several approaches and methods including problem solving, discussion and field observations. Students have diverse abilities in creative problem solving. In addition, students at the high level of ability are quite able to solve problems in different ways and in quite new ways with their own thoughts. Based on the results of the creative thinking questions test, the researcher grouped them into two classes, namely the upper class of 24 students and the lower class of 24 students. The highest value of creative thinking skills is 73 and the lowest is 24 with three categories of high, medium and low with the distribution as presented in table 1:

Table 1. Creative Thinking Ability

	Number		Categories
	of Students	Percentage	
	4	8.3%	Low
	38	79.2%	Moderate
	6	12.5%	High
	48	48%	Medium

The results showed that most students have the ability to think creatively at a moderate level based on Arikunto's category reference. Only 12.5% in the high category and 8.3% low and all students have the ability to think creatively. Every person has the ability to think creatively at various levels based on the experience he has gone through, so the creativity level he had is also differ respectively. Based on the aspect of creative thinking abilities, the distribution of students' creative thinking abilities in this study presented in table 2 :

Table 2. Aspects of Creative Thinking Abilities

Aspects	Percentage	Category
Fluency	62%	Moderate
Flexibility	51%	Moderate
Originality	49%	Moderate
Elaboration	27%	Low
	48%	Moderate

The highest creative thinking ability of third semester students was the fluency aspect, 62% and the lowest was elaboration, 27%. Every aspect of the average has a moderate category except for the elaboration aspect.

Fluency Aspect

Students have sufficient ability (62%) in the fluency aspect of how to solve environmental problems around campus. This aspect measures the student's ability to express ideas smoothly. According to Mrayyan (2016), this aspect of fluency is the skill of producing many relevant ideas that are also smooth. Most students can provide ideas and ideas in various ways of socializing the dangers of sterofom and solutions to reduce plastic around campus, fluency or smoothness is judged by the number of alternative ideas for solutions expressed. The ability of students to express ideas smoothly is influenced by the amount of memory they get from various sources and learning approaches carried out at school and college, which are then used to answer the problem of how to tackle waste through socialization of hazards and ways to reduce plastic and Styrofoam waste around campus. The ideas expressed by these students are their abilities in retrieving information stored in their memory to be used when needed. there is a real difference between having information in memory storage and being able to retrieve it and use it when needed in new situations.

Flexibility Aspects

Students have sufficient ability (51%) on flexibility aspects. The ideas expressed by students in answering questions in this aspect have various answers that indicate the direction of each student's thought in overcoming environmental problems around campus. Students who have flexible thinking skills are able to change their approach and have different directions of thought. Based on the analysis of the answers to the questions raised by the students, they showed their thinking skills by build the idea of designing anti-sterof foam campaign designs on campus and managing campus waste through waste banks. The form of evaluation in the form of real case studies around the environment gives students the opportunity to answer from different points of view in understanding it. This difference in perspective will guide students in giving answers with different approaches. Students have their own way of designing these activities, but there are still many answers that lead to the same approach.

Originality Aspect

Students have sufficient ability (49%) in the originality aspect of how to solve environmental problems around their house. The evaluation form is a real case studies on how to solve the problem of domestic waste with residents in neighborhood, it gives students the opportunity to express ideas based on the experiences and information they get on campus. Another problem is the idea of making waste management in the environment where they teach with their position as decision makers. Creative ideas often arise from thoughts that are contrary to other ideas in general. New ideas that emerge are related to their ability to think flexibly. the nature of flexibility is related to the production of transformations in the form of different ideas and contributes to insight, intuition, and inspiration that are often the hallmarks of creative thinking. Based on the analysis of the answers to questions, some students answered general questions because they only repeated answers from the previous answer and they gave minimal new ideas in designing actions through their own way. Several students were able to express their new ideas that were uncommon in context of making a domestic waste management plan that involves several stakeholders and various management techniques in the community, as well as original ideas emerged in making school waste management regulations. Original thinking skills do require development of the aspects of fluency and flexibility first. When these aspects have not been fulfilled it will be difficult to achieve the original thinking skills of students.

Collaboration Aspect

This aspect of detailed thinking is a skill in developing, adding, enriching an idea, or focusing on details, as well as expanding an idea. The results of measuring the students' ability in detailed thinking were low (27%). Based on the analysis of the answers to the questions, the ability to detail the ideas of recycling the leaf litter problem in the campus yard is very minimal because only a few students can answer in detail how to develop the ideas they make. Generally, the answer to this open problem is not accompanied by detailed steps on how to treat leaf waste which is a problem in the campus environment and how to take steps to involve students and all campus residents to take responsibility for managing it in a sustainable manner.

Aspects that Influence Creative Thinking Ability

Other aspects examined for possible effects on the ability to think creatively include economic aspects, the living environment, student academic scores (GPA), student authentic experiences, freedom of opinion in the family and non-academic achievement.

Economy

Correlation between economic level with creative thinking ability in solving environmental problem presented in Figure 1

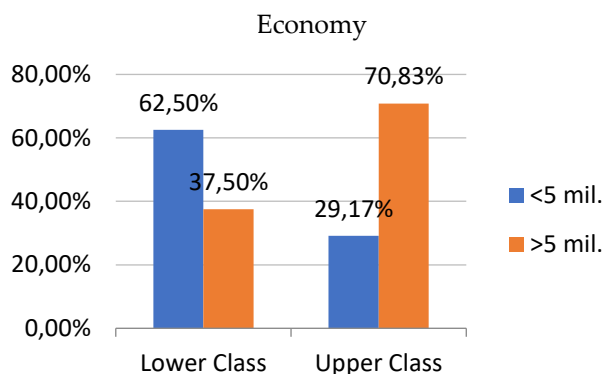


Fig. 1. Lower class and Upper class economic level

In the low class, namely students who have the ability to think creatively below the average in this study, have parents with an income above 5 million rupiah, reaching 37.50%. Meanwhile, upper class students with parents' income above 5 million rupiah reached 70.83%. According to Mann Withney-U test, a significant value was obtained 0.022, indicating that there are differences in economic conditions between lower class economy with high grade.

So it can be assumed that students' thinking abilities are supported by the economic prosperity of their parents. Economic factors provide opportunities for individuals to carry out various activities other than activities to meet their economic needs. Students with high economic levels have the opportunity to concentrate on their learning activities including increasing their creative thinking skills at school as well as having relatively much study time at home and more adequate facilities than low-income students. Research by Mrayyan (2016) shows that relatively poor farmers concentrate more on the urgent needs of life so they ignore sustainable land management, resulting in land erosion. Neglect on the environment can also occur in other professions, if they only spend time and thought to meet the basic needs of their family. This Condition can also result on neglect of environmental character building at the family level. According to Mallya et al., (2012) the socio-economic level has an influence on a person's caring attitude towards their environment. This environmental awareness can be in the form of the involvement of students' minds to find solutions to environmental problems in various ways, including being creative. Students who have the ability to think creatively above average come from families who live in urban areas. Information and environmental base activities that related to educational programs are many given in urban areas, besides that environmental problems as objects of study such as river pollution, vehicle pollution are more common in urban areas. Experience in direct contact with environmental problems can make individuals think to find solutions to problems by getting used to expressing ideas, however the problem is that some lecturers / teachers do not use authentic learning strategies that relate to the surrounding environment in urban area and rural also. According to (Prayitno & Khaidir, 2011) the indicators of intelligence that accompany the character's behavior are : active, dynamic and directed, analytical and objective, aspirational, creative and innovative, anticipatory, open-minded and forward, and seeking solutions. Teacher/lecturer has very important in building that character behavior.

Academic Score

Correlation between academic score achievement with creative thinking ability in solving environmental problem presented in table 3:

Table 3. Academic score achievement of lower and upper class students

Academic score achievement	Frequency (lower class)	Frequency (higher class)
0.00 – 1.00	0	0
1.01 – 2.00	0	0
2.01 – 3.00	4	1
3.01 – 4.00	18	23

Academic score achievement in the lower class students that value 3.00 and above is 18 students in total. In higher class almost all students have a competency achievement index with the predicate satisfactory to very satisfying. A total of 23 students have academic score achievement ranging from 3.01 to 4.00. Based on independent t-test obtained significant value 0.061, showed no difference in the academic achievement of low grade with high grade. Students who have high academic achievement should have higher creative thinking skills, Malik, & Ubaidillah, M. (2020) and Mallya et al., (2012), stated that a positive and significant relationship between creative thinking skills and learning achievement. In this research, it was found that there were more high-class students who had academic score achievement between 3.01-4.00, but had a similar academic score achievement between high and low classes.

Academic Experience

Correlation between academic experience with creative thinking ability in solving environmental problem presented in Figure 2:

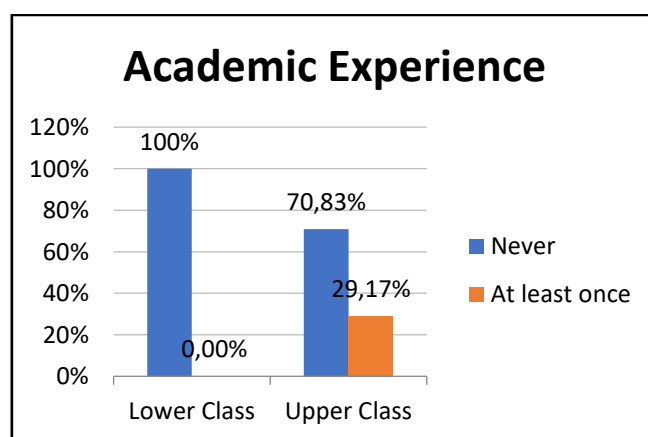


Fig. 2. Low class and upper class Academic Experience

In the lower class, only few parts of students has academic experience of practical activities to process leaf waste into compost. Among students in the upper class, as many as 29.17% stated that they have had academic experience in making compost from leaves waste during middle school. According to Mann Whitney U-test obtained significant value of 0.05, indicating there are differences

in academic experiences between lowerclass to upper class. Academic experience in the form of direct environmental management tends to increase students' creative thinking skills. Malik & Ubaidillah,(2020), stated that students who have a lot of knowledge and experience have higher mental imagination in creativity.

Openness

Correlation between openness with creative thinking ability in solving environmental problem presented in Figure 3.

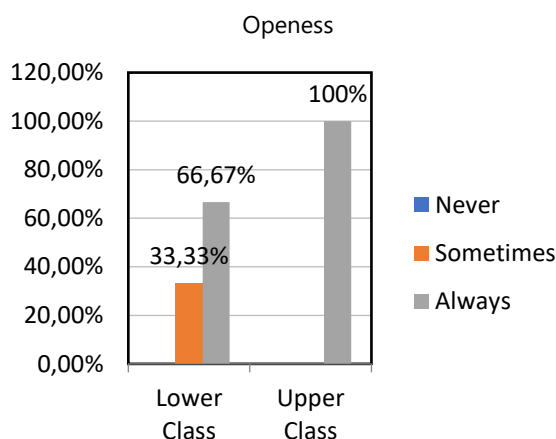


Fig. 3. Openness of lower and upper class

Students in this lower class have openness in their families. They always discuss in making a decision. In the table above, the percentage of openness in the family reaches 66.67% in the 'always' category. In the upper class, all students have an open family that is always having discussions with other family members before making decisions. based Mann Whitney-U test obtained value 0.02 significant, indicating that there is a difference in family environments openness in low-class and high-class. Creative thinking skills tend to be higher in students who have an open cultured family environment. An open environment habituate people in expressing ideas to solve problems in the family, so that this experience will bring good habits to thinking in other conditions or environments. According to Madhuri et al., (2012), Malik, & Ubaidillah, (2020) and Mallya et al., (2012), one of the driving factors for creativity is a conducive environment, not rigid and not authoritarian. Openness of opinion in the family can only occur if the head of the family is not authoritarian and rigid, so that family members are trained to put forward creative ideas

Non-Academic Achievements

Correlation beetwen non academic achievements with creative thinking ability in solving environmental problem presented in Figure 4:

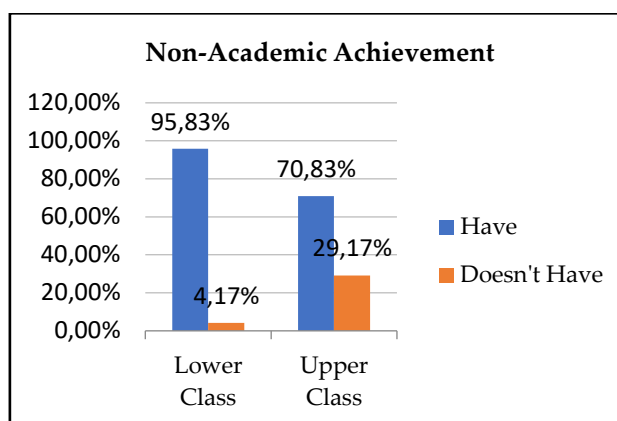


Fig. 4. Lower and upper class non-academic achievements

Almost all students in the lower class have no non-academic achievement. There is only one student who has achievements in non-academic fields. However, that does not mean that these students do not have activities in non-academic fields. In the upper class, there are 70.83% of students who have achievements in non-academic fields in the fields of arts, sports and other non-formal education. Based on the Mann Whitney-U test obtained a significant value of 0.00, indicating that there are differences in non-academic achievement between low and high classes

4. CONCLUSION

Students' creative thinking value in this study averaged 48, the highest 79,2 and the lowest 12,5. The grades achieved including: fluency 62, flexibility 51, originality 49 and elaboration 27. The factors that estimated influence students' creative thinking value are economic factors, non academic achievement, authentic experience of environment practical activities, openness for opinions in making decisions in the family. Recommendation for further researchers is the need to develop technology-based science learning models to improve other cognitive abilities.

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