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Relationship between Analytical Thinking Ability and Creative Thinking Ability in Ecological Materials

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ABSTRACT

The 21st century is a century full of challenges for developing countries, including Indonesia. Indonesia has very complex challenges, especially in the era of globalization and digitalization. By facing this challenge, of course the quality of human resources needs to be prepared in various ways, such as ensuring welfare and justice for all Indonesian people. To improve human resources, it is also necessary to improve the quality of education and the quality of learning, so that the state's goal to be able to educate the nation's children can be achieved and able to face challenges in the era of globalization and digitalization. This research uses the correlation description method, to see the relationship between analytical thinking and creative thinking. Participants who helped this research came from high school as many as 43 students, totaling 2 classes. Data were collected from the instrument about the ability to think analytically and the ability to think creatively and then analyzed using linear regression correlation test. The students had an average analytical thinking ability of 89.56 and creative thinking ability of 82.63. The results showed that $r_{count} > r_{table}$ with r_{count} obtained a value of 0.69 and a value of r_{table} with a significance level of $\alpha = 5\%$ of 0.38 then, H_a was accepted and H_0 was rejected. The conclusion from the results obtained is that there is a relationship between the ability to think analysis with the ability to think creatively in class X SMAN Bakti Idhata Jakarta. The development of analytical and creative thinking skills needs to be applied in all learning carried out.

Keywords: 21st century; Analytical Thinking Ability; Creative Thinking Ability

INTRODUCTION

The rapid development of science in the 21st century requires humans to adapt to responding to the challenges in the 21st century. Science education plays an important role in helping humans prepare themselves to enter an increasingly modern world [1]. The world of education in the 21st century has growing challenges in this modernization era, so that the quality of education and the development of learning models should also have novelty in this increasingly globalized era to improve the quality of human resources. Learning that is carried out is required to improve the quality of learning and can improve and develop an attitude of collaboration, communication and cultivate skills in creative thinking. Knowledge required in the 21st century such as analytical thinking skills and creative thinking skills [2].

The 21st century is very different from the previous century, because in this century the role of teachers is very important to face international demands in the learning process which requires 4C skills consisting of critical thinking, creative thinking, communication, and problem solving [3]. 21st century learning emphasizes learning that applies higher order thinking skills or Higher Order Thinking Skills (HOTS) and development of literacy skills and character education [4].

The quality of human resources required is to have the ability to think or think systematically, analytically, logically, critically, and creatively, balanced with the inner will to work together effectively. Indonesia is involved in the Program for International Student Assessment (PISA), which is a way to see how far learning programs in Indonesia have progressed, compared to other countries in the world. This PISA describes an international level research made by the Organization for Economic Cooperation and Development (OECD). PISA questions require the ability to solve problems, as well as abilities in reasoning and analysis [5].

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This shows that there needs to be an increase in the quality of education in learning to support students' analytical thinking skills and creative thinking skills to answer the challenges of the 21st century. As in the journal Setiawati, the ability to think analytically is also one of the life skills that students must have as a preparation for life in order to compete in the 21st century [6]. Not only that, in the current era of globalization, it shows that students' creative thinking skills are very important [5].

Analytical thinking skills need to be developed because analytical thinking skills are needed [7]. The low ability of this analytical thinking requires the importance of developing higher order thinking skills such as analytical thinking skills [8]. Improving low analytical thinking skills is done by honing more analytical thinking skills in the learning process [9]. Research conducted on eighth grade students in Surakarta got low results on students' analytical thinking skills [6]. Low analytical skills need to be improved with the help of motivation for each individual to get enthusiasm in developing analytical thinking skills [10].

The characteristics of someone's analytical thinking ability, namely: thinking systematically, having high discipline, being able to appreciate and respect a fact that is conveyed logically, like things that are arranged, careful and focus on small parts of the problem, usually have rigid character or personality, making decisions tends to take longer than others [11].

There are indicators on the ability to think analysis which are listed in table 1. as follows:

Table 1. Indicators of Analytical Thinking Ability

No.	Categori	Indicator	Verb
1	Differentiating	Be able to select related pieces of information	Find Knowing
2	Organizing	Able to compile relevant information sections	Examining Rationalize
3	Attributing	Able to choose the purpose and relation of an information	Conclude Hook up

There are factors that affect a person's thinking ability which are divided into two, namely internal factors that come from the individual himself who is learning. Internal factors consist of: the student's desire, a source of reference or reference, the habit of using analytical thinking skills when studying, adjustments in the face of a new experience, and the person's physical and psychological state.

External factors that affect the ability to think analytically, namely someone who is learning is affected by a situation from outside the person. External factors consist of: the learning methods given are related or not related to the development of analytical thinking skills, the learning media used are able or related to sharpening analytical thinking skills, display of the learning media used, learning activities carried out, evaluation of learning related to analytical thinking, about whether or not he used to develop analytical thinking skills.

Higher order thinking skills that need to be honed and developed, in addition to analytical thinking, are the ability to think creatively. Asmi's research on the understanding of the ability to think creatively, which is creativity in a person in developing ideas or ideas or products on problems [12].

The ability to think creatively is a very important part of learning for students to have this creative thinking ability. Creative thinking is the skill to discover and produce something new by sharing current thoughts that can be used for problem solving or skills to see interactions between existing parts [13]. Research on students' creative thinking skills conducted at SMAN in Samarinda, found that students tend not to think creatively [14]. Another study conducted obtained the results of high school students' creative thinking skills belonging to the weak category [15].

Low creative thinking skills in students require appropriate methods to improve it by continuing to apply training to the learning process [16]. The creative thinking ability of students at SMA N 5 Depok is still low,

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so there is a need for training in questions for the development of creative thinking [17]. Higher-order thinking skills such as the ability to solve problems, skills, be creative, think critically, and have a scientific attitude are very adaptable to the environment, because the environment plays an important role in the growth and development of students' abilities [18].

The ability to think creatively leads to the ability to generate an idea to solve various or different problems that are new and open compared to previous ideas or problem solving. Creative thinking is also defined as producing a product [19].

The characteristics of someone who has the ability to think creatively are as follows: able to ask questions or thoughts that are different from other people, curiosity about something is high, has an open mind to new experiences, is interested in experimenting, has and likes his own way of understanding things, likes something that is challenging for him, likes things related to discussion, likes new things compared to existing or usual things or ways of solving problems [20]. The indicators on creative thinking skills are listed in table 2. As follows:

Table 2. Indicators of Creative Thinking Ability

Indicator	Information
Fluency	Able to generate an idea to solve a problem
Flexibility	Able to generate a variety of ideas in solving problems
Originality	Able to produce a new thought and different from others
Elaboration	Able to develop and detail a thought

The research objective was to determine the relationship between analytical thinking skills and creative thinking abilities of class X SMA Bakti Idhata on ecology material. This research is expected to find out analytical thinking skills and creative thinking skills in students.

RESEARCH METHOD

The research method used is descriptive correlation research method, to determine the relationship between analytical thinking skills with students' creative thinking abilities in ecological material. This research was conducted in June - August 2020 at Bhakti Idhata High School. The study population was 43 students of SMA Bhakti Idhata. Saturated sampling technique was used for sampling in this study. Researchers conducted research by collecting information about the ability to think analytically and creatively to 43 class X students. The test instrument was given online with the help of google form, after testing the validity and reliability.

There are as many as 6 items on ecology material with indicators of analytical thinking skills, while in questions of creative thinking skills as many as 8 items that the researcher has designed for this study. The question indicators used in the research for the instrument of analysis were distinguishing, organizing and connecting. Meanwhile, indicators for creative question instruments are fluency, flexibility, authenticity and elaboration. The questions used are in the form of a description. The essay test is a question that demands answers in the form of a description, provides an excuse, explains, and differentiates, using your own language according to the questions given because the written test demands reasoning skills such as analytical thinking [21].

The data validity test was collected by providing question instruments to respondents, namely students of class XI at SMA Bhakti Idhata via google form. Researchers obtained data with an instrument, namely a test, in the form of a description of 6 items of analytical thinking skills and 8 questions of creative thinking skills. Data validity was analyzed using Microsoft Excel application as well as calculations on reliability using Microsoft Excel.

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The validity formula used to calculate using the product moment correlation technique is as follows [22], [23]:

$$r_{xy} = \frac{n \sum xy - (\sum x) (\sum y)}{\sqrt{\{n \sum x^2 - (\sum x)^2\} \{n \sum y^2 - (\sum y)^2\}}}$$

Information:

- r_{xy} : The correlation coefficient for the variables x and y, the two variables being correlated
- $\sum xy$: The sum of the multiplication of the variables x and y
- $\sum x^2$: Sum of the squares of the x values
- $\sum y^2$: Sum of the squares of the y value
- n : Number of students or respondents

There are criteria for the validity of the assessment used presented in table 3. As follows:

Table 3. Criteria for the Validity of the Assessment

Validity	Interprestasi	Kriteria
0,00 – 0,20	Very Low	Invalid
0,21 - 0,40	Low	
0,41 – 0,60	Enough	
0,61 – 0,80	High	
0,81 – 1,00	Very High	

[24]

After calculating the validity of the questions, the calculation used is reliability with the following formula :

$$r_{11} = \left(\frac{n}{n - 1} \right) \left(\frac{\sum \sigma^2 i}{\sigma_i^2} \right)$$

Information :

- r_{11} : reliability
- n : number of valid items
- $\sum \sigma^2$: number of valid items
- σ_i^2 : total variance

The reliability interpretation criteria [24] used are listed in table 4 as follows:

Table 4. Reliability Interpretation

Validity	Interprestasi
0,00 – 0,20	Very Low
0,21 - 0,40	Low
0,41 – 0,60	Enough
0,61 – 0,80	High
0,81 – 1,00	Very High

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The research consisted of 3 stages, namely: preparation, implementation and observation. The preparatory stage that is carried out starts from making a permit letter to the school and making question instruments. The instrument was made by conducting expert validation by the supervisor and teacher of the Biology subject, the number of questions was 6 items for analytical thinking and 8 items for creative thinking skills.

$$\text{Coefficient value a} = \frac{(\sum x^2)(\sum y) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$\text{Coefficient value b} = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

After that the score of analytical skills and creative abilities is obtained by a formula [25]. In the implementation stage, data collection was carried out in the same way, namely giving and filling out the question instruments via google form. After analyzing the collected respondent data, data analysis was carried out using the Pearson product moment correlation. The calculation of the Pearson product moment correlation at the coefficient values a and b, to ensure the regression equation and determine the positive or negative regression direction with the formula $y = a + bx$ as follows: [26]

$$\text{Scoring} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100$$

RESULTS AND DISCUSSION

The research data from the analytical thinking ability obtained the average percentage value presented in Figure 1.

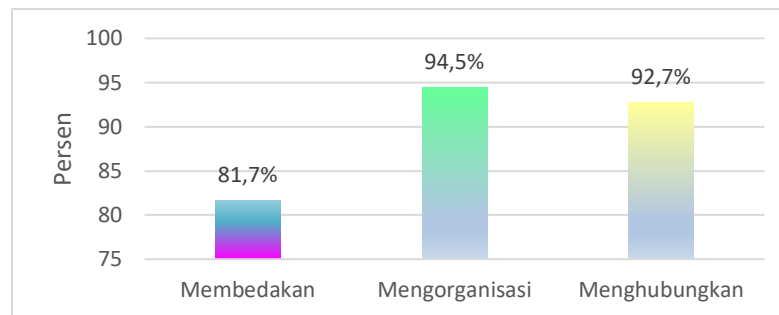


Figure 1. Bar Chart of Average Percentage of Analytical Thinking Ability

Figure 1. Shows the average percentage of analytical thinking skills with the highest average percentage found in the organizational ability indicator of 94.5%, then the ability to connect is 92.7%, and the lowest is 81.7% on the indicator of distinguishing ability. There is also an average percentage of creative thinking skills as presented in Figure 2.

Figure 2 shows the highest average percentage of creative thinking skills, namely the original ability or originality of 87.2%, then the fluency ability is 84.9%, the flexibility ability is 80.2%, and the lowest is 77.6% of the ability. elaboration.

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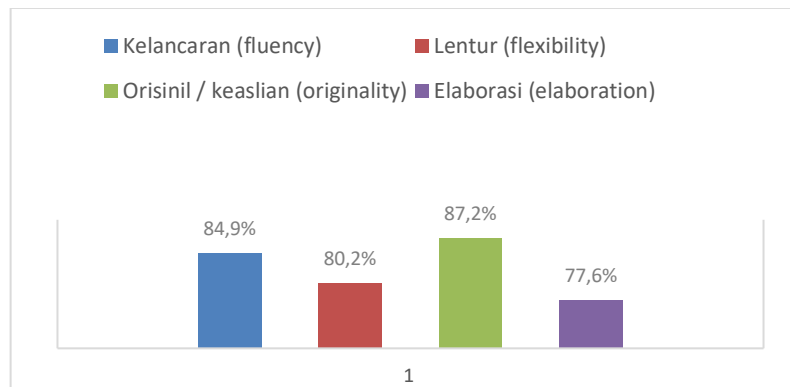


Figure 2. Bar Chart of Average Percentage of Creative Thinking Ability

Furthermore, in this research hypothesis experiment shows a significant relationship between analytical thinking skills (X) and creative thinking skills (Y). Hypothesis testing.

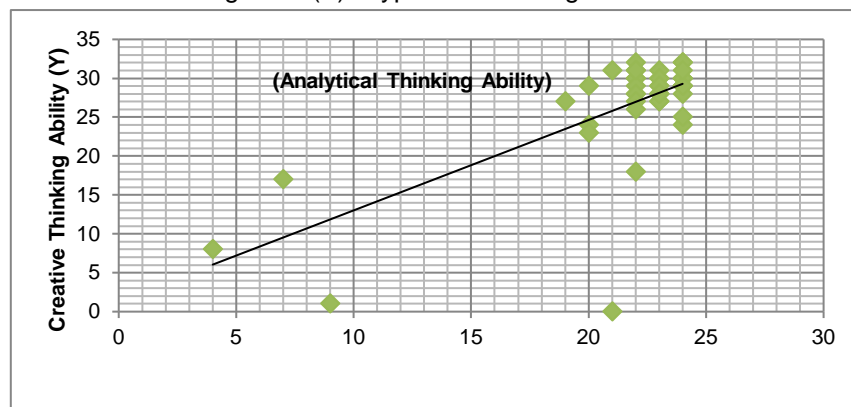


Figure 3. The Scatter Diagram of the Regression Equation $y = 30.37 + 1,16x$

used is simple linear regression which is notified in the format of the regression equation. Based on the calculation obtained from the translation of simple linear regression, it has a regression equation of $y = 30.37 + 1,16x$ on the relationship between analytical thinking skills and creative thinking skills as shown in Figure 3.

Figure 3. The points on the graph are near a line that shows a normal distribution and a positive relationship is obtained between variable X and variable Y, so it can be seen that the Y value will tend to increase or go upward, along with the increasing value of X. The results obtained are reinforced by the research that has been carried out, namely the results obtained from the calculation are $Y = 77.25 + 0.429x$, and the results of the calculation of linear regression analysis obtain the presence of points in the data according to totality, scattered around the line, thus indicating between variables X and Y have a positive correlation, and the calculation shows that the Y value tends to increase along with the increasing or increasing value of X (Rizqah et al., 2019)

Hypothesis testing is carried out in this research to determine whether there is acceptance or rejection of the hypothesis as follows:

H₀ = There is no significant relationship between analytical thinking skills and creative thinking skills

H_a = There is a significant relationship between analytical thinking skills and creative thinking skills

The determinant coefficient (kd) is a number used to determine the participation or contribution given by one variable or two variables X to the Y variable. The r value or the correlation value is used to measure the

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strength of the relationship between two variables, namely X and Y, or more variables. (Nasir, 2016). After doing the calculations, the α correlation value is 0.69 which means there is a strong relationship. Then for the value of r square or the coefficient of determination (kd) obtained a value of 0.49. As shown in table 7.

Table 7 . Determinant Coefficient

R	R Square
0,69	0,49

Based on table 7 regarding the determinant coefficient, the results are shown in table 7. So it can be interpreted that the variable x, namely the ability to think analysis in this study, has a contribution effect of 49% on the variable y where the y variable is the ability to think creatively. Based on the results of the calculations that have been done, it can be concluded that there is an influence between variable x on variable y with a contribution of 49%, while the rest is influenced by other factors of 52%. The hypothesis obtained from the research results is presented in table 8 below:

Table 8. Hypothesis Test Results

Correlation	R_{hitung}	R_{tabel}	Results
Analytical Thinking Ability with Creative Thinking Ability	0,69	0,38	H_a received

Based on table 8, the results of calculations carried out using the help of the casio fx-991ES calculator, the acquisition of rcount shows a value of 0.69, the value of the rtabel with a significance level of 5% or 0.05 of 0.38. So that based on the results of the calculations that have been done $0.69 > 0.38$. So that the calculation of the hypothesis based on the calculation is thus H_a accepted, H_0 rejected. So from the calculation results it can be concluded that "there is a significant relationship between analytical thinking skills and creative thinking skills".

There are factors behind the research results of students' analytical thinking skills and creative abilities, namely students are used to practicing higher-order thinking skills. Another factor that makes high-order thinking skills (HOTS) high in students is because students have high enthusiasm for studying so that they get good results on higher-order thinking skills (Suratno et al., 2020). The way that must be applied or done to help develop higher-order thinking skills is to train students in solving and solving problems both through the questions given (Suryapuspitarini et al., 2018)

The results of the analysis obtained in this study, there is a contribution between analytical thinking skills and creative thinking skills of SMA Bakti Idhata students of 0.48 or 48%. As in the following theory which states that creative thinking by implementing it into a work of creativity to be able to increase the ability to think creatively, creative thinking aims to solve the problem requires the stages of analyzing the problem, then finding an idea, then arguing with the idea that is owned, then applying it be a creation or creativity (Firdaus et al., 2018). Analytical thinking skills and creative thinking skills are part of HOTS that must be trained to be able to reason problems to find solutions to these problems, innovate, and try to create something for the development of higher-order thinking skills that are owned (Nisa et al., 2018).

The research that has been obtained is based on the research that has been done, the authors provide suggestions for learning to be carried out that must always be related to a thought-solving problem related to higher-order thinking skills, so that the abilities that are owned can continue to be felt and developed, so that it becomes a habit of thinking. high level.

CONCLUSION

Based on the results of the study, the contribution of analytical thinking skills to creative thinking skills has a strong category with a contribution of 48%.

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