

# Analysis of Students' Creative Thinking Abilities on the Topic of Energy in Living Systems

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**Abstract:** Creative thinking is a habit of sharp thinking with intuition, moving the imagination, revealing new possibilities, uncovering unique ideas, and inspiring unexpected ideas. Based on fluency, flexibility, and originality, this research aims to describe students' creative thinking abilities regarding energy material in class VII life systems at SMP Negeri 1 Tapa. This research type is descriptive qualitative research. The instrument used is a 10-number essay test whose validity has been tested. The sample used in this research was 30 students. The results of research on creative thinking abilities on energy materials in living systems are in the fluency aspect of 55.83% in the enough creative category, the flexibility aspect of 67.5% in the creative category, and the originality aspect of 52.5% in the enough creative category. This shows that the low ability to think creatively is due to students' need to understand the creative thinking ability test and students' unfamiliarity with creative thinking. Students are expected to be able to practice working on questions that can hone creative thinking skills and can use the results of this research as a reference for further research related to creative thinking skills.

**Keywords:** Creative Thinking; Energy; Living Systems.

## Introduction

The development of science and technology in the 21st century regarding educational institutions requires schools to have 4C skills [1]. The 21st-century curriculum is specifically designed to suit the future needs of students who can solve problems, think creatively, collaborate with other students, communicate well, and be creative. This change is happening quickly in this century, whether in social life or the educational environment [2-4].

Creativity makes learning more fun and effective. Learning guides students in acquiring knowledge, concepts, skills, values, thought patterns, and strategies for learning [5]. To develop skills and potential within themselves, students have different abilities depending on their respective levels of creativity. Creative thinking is considered a higher-order skill and can be viewed as an extension of fundamental competencies [6]. Creative thinking ability (CTA) is a habit of intuition-guided, insightful reasoning. It stimulates the imagination, explores new possibilities, generates unique ideas, and sparks unexpected inspirations [7]. One of the goals of education is to make children think creatively, both in terms of resolving or resolving problems and the ability to communicate or express their thoughts [8-9].

Creative thinking is solving a problem involving an unconscious experiential process characterized by the ability to quickly generate multiple ideas, adaptively manage time to explore diverse solutions and produce original or novel ideas and outcomes [10-11]. Creative thinking is of particular concern nowadays because it can be a solution to a problem from a different point of view so that it can create new solutions and ideas. In science

learning, students are required to interpret learning content and be able to solve problems in the surrounding environment. Science is one of the materials that contains the investigation of natural phenomena, which can be said to be a discovery process, so it is not just a collection of objects, theories, and concepts [12-13]. Students need CTA to study and understand natural objects or phenomena. One of the science learning topics that discusses natural phenomena is energy in living systems. Energy in living systems is essential because it is needed to carry out all human activities. Therefore, teachers must optimize students' creative thinking competencies in this science learning [14-16]. So, in learning, it is better to understand how much creative thinking the students have in understanding a lesson.

Based on initial observations of the learning process, students tend to think less creatively and only listen to explanations from the teacher. When the teacher explains the material, most students are distracted or playing, while only a few pay attention to what the teacher says regarding the presented material. So, the learning process makes students less active in participating in learning other than understanding science material and students' absorption of science material. So, this research aims to analyze students' CTA on energy in living systems. The student's CTA still needs to be developed more; we can improve our CTA by giving a problem that does not only produce one answer but can have various answers. By providing this problem, students can convey ideas or ideas that they generate from their thinking. Themselves by analyzing the given issues using the knowledge they have learned.

## How to Cite:

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## Research Methods

This research was carried out at SMP Negeri 1 Tapa, Kec. Bulango Timur, Kab. Bone Bolango, Prov. Gorontalo. This research was carried out during the odd semester of the 2023/2024 academic year. This research was conducted to see how students' CTA relates to energy in living systems. This research model uses a descriptive qualitative approach. Research with this approach aims to analyze, explore, and provide an overview of the conditions or phenomena of research subjects regarding CTA [17]. In general, the data collection methods carried out in this research are the preparation stage, research implementation stage, data analysis stage, and final research stage.

### Preparatory stage

At this stage, several things need to be done, including conducting observations and interviews, asking permission from SMP Negeri 1 Tapa to conduct research at the school, and making agreements with partner teachers at SMP Negeri 1 Tapa regarding the class that will be the research subject and the time of the research.

### Research implementation stage

At this implementation stage, things to be done include providing essay test questions on CTA related to energy in living systems.

### Data analysis stage

At the data analysis stage, researchers analyze data obtained from students' answers to essay test questions. The analysis was carried out using the techniques described in the data analysis techniques section.

### The final stage of research

The final stage of the research is the stage where the researcher makes a research report based on the results of the data analysis that has been carried out.

In this research, the test used was an essay sheet consisting of 10 questions, each representing an indicator of CTA. The test aims to measure students' CTA. The test sheet questions look at indicators of students' CTA based on the responses given, which include aspects of fluency, flexibility, and originality.

### Data Analysis Techniques

The data obtained will then be analyzed by coding the answers given by students and providing a score for each component of the student's answer according to the assessment rubric. After that, calculate the total score of the tests taken and determine the percentage value of CTA in each aspect that appears in the student himself in Table 1 [18].

**Table 1.** Categories of CTA and assessment guidelines.

Percentage (%)	Category
81-100	Very Creative
61-80	Creative
41-60	Enough
21-40	Less
0-20	Not

## Results and Discussion

This research was carried out at SMP Negeri 1 Tapa in the 2023/2024 academic year. It aimed to examine students' CTA regarding science learning material, namely energy in living systems. The instrument used is a test of 10 essay question numbers in Table 2. Two experts also first tested it for validity.

The research subjects were 30 students from class VII of SMP Negeri 1 Tapa. The instrument used is a CTA essay test question validated by expert validators. The test instrument aims to test students' CTA. Based on Table 2, this research will be grouped into three groups: test result data based on indicators of CTA, which include aspects of fluency for criteria 1-4, flexibility for criteria 5-7, and originality for criteria 8-10.

**Table 2.** Questions on Aspects of CTA on the Topic of Energy in Living Systems

Aspect	Criteria	Questions
Fluency	1	What is the difference between electrical energy and light energy?
	2	Mention some advantages of renewable energy?
	3	How would a wind power plant work?
	4	Name some changes in chemical energy into heat energy in everyday life?
Flexibility	5	What are the four forms of energy that exist in the environment around where you live?
	6	What is the difference between renewable and non-renewable energy sources?
	7	What are the main advantages of solar energy compared to other energy sources?
Originality	8	How does the use of energy sources impact the environment and human health?
	9	What are the impacts of dependence on fossil energy sources?
	10	Give an example of the role of biomass energy in everyday life?

### Students' CTA for Aspects of Fluency

In this aspect of fluency for questions of criteria 1-4 in Figure 1, the research results of students' CTA tests fall into the creative category with an average percentage score of 55.83%. This is because most students' answers only have one correct answer. This value shows that, on average, students can solve a problem using several alternative

answers [19-20]. The rubric for assessing students' CTA test scores in this research ranges from 0 to 4 for each question item.

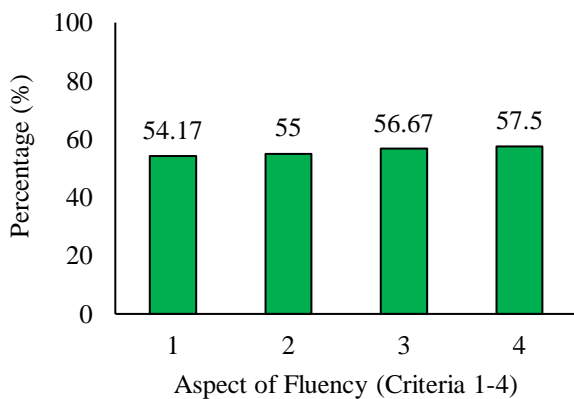
Based on the results of the analysis of the data obtained, it shows that students' CTA in the fluency aspect in expressing the difference between electrical energy and light energy in question number 1, with a percentage of 54.17%, it was found that at score four the percentage value

was 0%, score 3 with percentage value 16.6%, score 2 with a percentage value of 83.3%, score 1 with a percentage value of 0%, and score 0 with a percentage value of 0%.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of fluency in expressing ideas about the benefits of renewable energy in question number 2 with a percentage of 55%, it was found that at score four the percentage value was 0%, score 3 with a percentage value of 20 %, score 2 with a percentage value of 80%, score 1 with a percentage value of 0%, and score 0 with a percentage value of 0%.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of fluency in expressing ideas about the function of wind power plants in question number 3, with a percentage of 56.67%, was found to be 0% at score four, score 3 with a percentage value of 26.6%, score 2 with a percentage value of 73.3%, score 1 with a percentage value of 0%, and score 0 with a percentage value of 0%.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of fluency in expressing ideas about changing chemical energy into heat energy in everyday life in question number 4, with a percentage of 57.5%, was found that a score of 4 was obtained percentage of 3.3%, score 3 with a percentage value of 23.3%, score 2 with a percentage value of 73.3%, score 1 with a percentage value of 0%, score 0 with a percentage value of 0%.



**Figure 1.** Percentage of Students' CTA in the Aspect of Fluency

### Students' CTA for Aspects of Flexibility

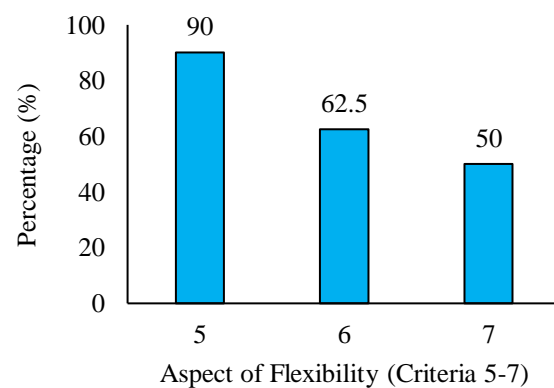
In this aspect of flexibility for questions of criteria number 5-7 in Figure 2, the assessment of students' CTA test results falls into the creative category with an average percentage score of 67.5%. This shows that, on average, students can solve a problem using various problem-solving strategies [21-22]. The scoring rubric for students' CTA test results used in this research has a score range of 0 to 3 for each question item.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of flexibility in expressing forms of energy in the environment where you live in question number 5, with a percentage of 90%, it was found that on score four a percentage value of 76.6% was obtained. 3 with a percentage value of 6.6%, score 2 with a percentage value of 16.6%, score 1 with a

percentage value of 0%, and score 0 with a percentage value of 0%.

The results of the data analysis show that students' CTA in the flexibility aspect of expressing the difference between renewable and non-renewable energy in question number 6 is 62.5%. It was found that a score of 4 obtained a percentage value of 0%, a score of 3 obtained a percentage value of 50%, a score of 2 obtained a percentage value of 50%, a score of 1 obtained a percentage value of 0%, and a score of 0 obtained a percentage value of 0%.

The results of the data analysis show that students' CTA in the flexibility aspect states the main advantages of solar energy compared to other energy sources in question number 7, with a percentage of 50%. It was found that a score of 4 obtained a percentage value of 0%, a score of 3 with a percentage value of 0%, a score of 2 with a percentage value of 100%, a score of 1 with a percentage value of 0%, and a score of 0 with a percentage value of 0%.



**Figure 2.** Percentage of Students' CTA in the Aspect of Flexibility

### Students' CTA Aspect of Originality

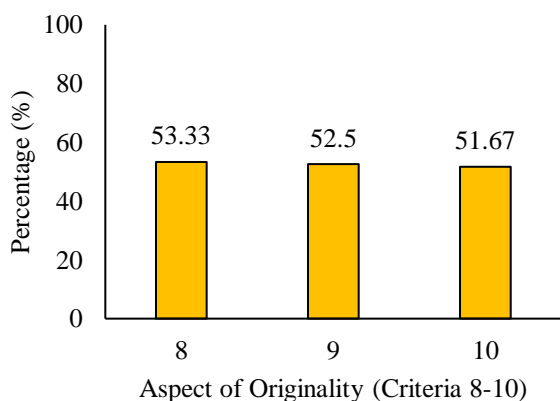
In this aspect of originality for questions of criteria number 5-7 in Figure 3, the assessment of students' CTA test results is innovative enough, with an average percentage score of 52.5%. This shows that students can provide answers or ideas that most students rarely express. The scoring rubric for students' CTA test results used in this research has a score range of 0 to 3 for each question item.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of originality in arguing that the use of energy sources can have an impact on the environment and human health in question number 8 with a percentage of 53.33%, it was found that on score four the percentage value was 0%, score 3 with a percentage value of 13.3%, score 2 with a percentage value of 86.6%, score 1 with a percentage value of 0%, and score 0 with a percentage value of 0%.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of originality in expressing the impact of dependence on fossil energy sources in question number 9, with a percentage of 52.5%, was found that at score four the percentage value was 0%, score 3 with a percentage value of 10%, score 2 with a percentage value of 90%, score 1 with a percentage value of 0%, and score 0 with a percentage value of 0%.

Based on the results of the analysis of the data obtained, it shows that students' CTA in the aspect of

originality in expressing the role of biomass energy in daily life in question number 10 with a percentage of 51.67%, it was found that on score four the percentage value was 0%, the score 3 with a percentage value of 6.6%, score 2 with a percentage value of 93.3%, score 1 with a percentage value of 0%, and score 0 with a percentage value of 0%.



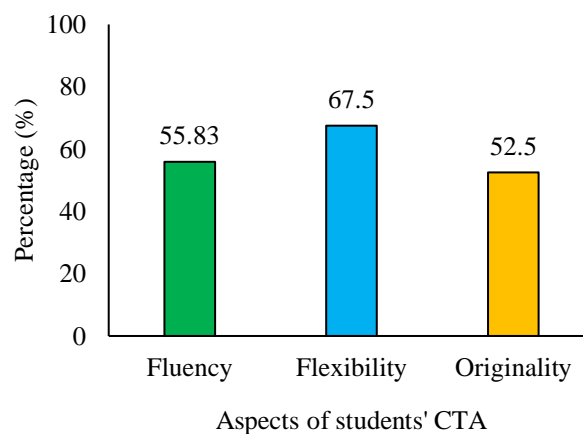
**Figure 3.** Percentage of Students' CTA in the Aspect of Originality

One of the goals of education is to make children think creatively, both in terms of resolving or resolving a problem and the ability to communicate or convey their thought patterns [8]. Students need to have the ability to think creatively. That way, they can solve their problems by using various alternative problem solutions and produce ideas that other students may rarely put forward [23-25]. The CTA that will be studied in this research consists of 3 aspects: Fluency, which can be defined as a condition where students can solve the problems they face using several alternative and correct answers. Flexibility is a condition when students can use various problem-solving strategies. Originality is a situation where students can solve the problem by using several alternative answers that are different but have the correct value, and there is one answer that students need to be used to at their level of knowledge or stage of development.

**Results of the Average Percentage of Achievement in Aspects of Students' CTA**

The data analysis results for each aspect of students' creative thinking show that each respondent has low to high creativity. The analysis of students' CTA from the innovative thinking ability test shows that the average students' CTA for each aspect is presented in Figure 4.

Figure 4 shows that the average percentage of students' CTA for each aspect, namely in the fluency aspect, is 55.83% in the enough creative category, the flexibility aspect reaches 67.50% in the creative category, and the element of originality reached 52.50% in the enough creative category. Based on these three indicators, the average student's CTA is 58.61% in the enough creative category. This shows that the low ability to think creatively is due to students' need to understand the CTA test and their' unfamiliarity with innovative thinking.



**Figure 4.** Percentage of Achievement in Aspects of Students' CTA

**Conclusion**

Based on the results of the analysis of CTA in class VII students at SMP Negeri 1 Tapa students on the topic of energy in living systems, the results of research on CTA on energy materials in living systems are in the fluency aspect of 55.83% in the enough creative category, the flexibility aspect of 67.5% in the creative category, and the originality aspect of 52.5% in the enough creative category. This shows that the low ability to think creatively is due to students' need to understand the CTA test and their' unfamiliarity with creative thinking. Students are expected to be able to practice working on questions that can hone creative thinking skills and can use the results of this research as a reference for further research related to creative thinking skills.

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