Torrance Creative Thinking Profile of Senior High School Students in Biology Learning: Preliminary Research

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Abstract. One of the skills developed in the 21st century is creative thinking skills. Creative thinking is a thought process that produces a wide variety of possible ideas and various solutions. The theme of environmental change and waste recycling is one of the learning themes closely related to everyday life. This study aims to analyze students' creative thinking skills in biology subjects with environmental change and waste recycling. This research is descriptive quantitative research. The subjects of this study were 32 students of class X science Muhammadiyah 1 Pontianak. The technique of collecting data was a test of creative thinking skills in the form of description questions. The questions used were based on indicators from Torrance (1969). The percentage of each indicator, namely fluency was in the medium category (55.5%), flexibility was in the medium category (52.3%), originality was in the medium category (50.8%), and elaboration was in the low category (32.9%). The average of all indicators was 48%. Based on findings, it can be concluded that the ability to think creatively is still low. Further research requires a learning model to improve creative thinking skills such as the Creative Problem Solving (CPS) or Project Based Learning (PjBL) model.

1. Introduction
Challenges in the distribution era are things that must be faced by preparing a generation of students who can build and apply logical, critical, creative, and innovative knowledge information and can take advantage of natural phenomena and the surrounding environment as learning resources that can use them in everyday life contextually. 21st century learning requires educators to teach and carry out practical classroom activities and build effective relationships with student communities in their schools, be able to use technology to support education, and reflect on continuous learning [1].

The 21st century is marked by the development of information technology [2]. Their attachment to technology, they are courageous, self-motivated, and more likely to undertake more challenging learning for themselves [3]. Their curiosity and desire for knowledge depend on their satisfaction in the learning process [4]. Students can access useful information that can help broaden their understanding of the content of the lessons they learn in school [5].

The skills that every student must have to face 21st century learning are critical thinking skills, creative thinking, digital literacy knowledge and skills, information literacy, media literacy, and mastering information and communication technology [6]. In line with the Partnership for 21st Century Skill (2002), 21st century skills can be formed from an understanding of the content of knowledge
supported by various skills, expertise, and literacy both personally and professionally [7]. 21st century learning uses a term known as 4C (Critical thinking, Communication, Collaboration, and Creativity), which are four skills that have been identified as 21st century skills (P21) as essential skills and needed for 21st century education, one of which is skills creative thinking [8].

Research results from the International Trend of Mathematics and Science Study (TIMMS) state that the level of creative thinking skills of students in Indonesia are classified as low because only 2% of Indonesian students can work on high and advanced category questions which require creative thinking skills in solving them [9].

The component indicators of creative thinking identified by Torrance are fluency, flexibility, originality, and elaboration. Measurement using the Torrance Test of Creative Thinking (TTCT) was published by E. Paul Torrance and his colleagues in 1969 [10]. Of course, creative thinking skills cannot be separated from the biology subject in high school. The role of creative thinking skills is crucial in learning biology, which is useful for applying science in society [11]. The subject of environmental change and waste recycling is one of the issues in biology. Creative thinking skills can be trained for all students through a lesson. Learning will be easy to implement to achieve maximum goals if it is known the initial abilities of students in terms of creative thinking skills. Research conducted by Malisa, Bakti, & Iriani (2018) entitled "Creative Problem Solving Learning Model (CPS) to Improve Student Learning Outcomes and Creative Thinking Ability" from the results of this study shows that the CPS learning model can improve learning outcomes and the ability to creative students [12]. In addition, research conducted by Hidayati & Siswanto (2020) with the title "Profile of Creative Thinking Through Project-Based Learning (PjBL) with ESD in Cell Concept for Class XI MIPA Students of SMAN 1 Bantarbolang" from the results of this study shows that the creative abilities of class XI MIPA students of high school 1 Bantarbolang is classified as medium. To increase the potential for creativity of class XI MIPA students of high school 1 Bantarbolang, it is necessary to develop a PjBL learning model [13]. Based on this background, this study aims to describe the profiles of students' creative thinking skills on the subject of environmental change and waste recycling. This study aims to analyze students' creative thinking skills in biology subjects with environmental change and waste recycling.

2. Materials and Methods
The form of research used was descriptive quantitative research. Descriptive quantitative analysis is research that provides a clearer picture, exploration of a phenomenon or event by describing several variables relating to the problem and the unit under study [14]. The data collection method used a test in the form of description to determine the creative thinking skills of high school students. The population in this study were all students of class X science Muhammadiyah 1 Pontianak. The sampling technique in this research was random. The subjects of this study were students of class X science Muhammadiyah 1 Pontianak with a total sample of 32 students. The research instrument tested was the TTCT to measure the creative thinking skills of high school students in learning biology about environmental change and waste recycling. The technique of taking data was a test of creative thinking skills in the form of description questions. Data analysis in this study used the normalized average percentage of acquisition.

Researchers used an instrument to identify students' creative thinking abilities in descriptive questions totaling four items. In preparing the creative thinking test, researchers were guided by the temporal indicators used by the school and indicators of student creative thinking, according to Torrance. Indicators of creative thinking skills, according to Torrance that is fluency, flexibility, originality, and elaboration. The classification uses the percentage of creative thinking abilities [15].

| Percentage (%) | Category       |
|----------------|---------------|
| 81% - 100%     | Very good     |
| 61% - 80%      | Good          |
The test results were analyzed based on the criteria for using indicators of creative thinking skills. Creative thinking indicators can be seen in Table 2.

### Table 2. Indicators of Creative Thinking

| Indicator | Description |
|-----------|-------------|
| Fluency   | Fluency refers to the ability of students able to generate ideas and answers. |
| Flexibility | Flexibility refers to the ability of students to be able to generate various ideas and answers. |
| Originality | Originality refers to a student's ability to generate new and unique ideas. |
| Elaboration | Elaboration refers to a student's ability to enrich and develop ideas. |

The scoring level of creative thinking abilities of each student answers the results can be seen in Table 3 [16].

### Table 3. Creative Thinking Ability Level

| Indicators | Score | Characteristics |
|------------|-------|-----------------|
| Fluency    | 4     | Mention more than three different ideas, suggestions, or alternative answers. |
|            | 3     | Mention three different ideas, suggestions or alternatives. |
|            | 2     | Mention some ideas or alternative answers that are not too different. |
|            | 1     | Mention an idea, suggestion or alternative answer. |
| Flexibility | 4     | Write down some alternative answers that are logical and relevant to the given problem from several different perspectives. |
|            | 3     | Write down some alternative answers that are quite logical and relevant to the given problem from several different points of view. |
|            | 2     | Write down some alternative answers that are quite logical but less relevant to the problem given from several different points of view. |
|            | 1     | Write one answer which is quite logical and relevant to the given problem from only one point of view. |
| Originality | 4     | Mention some unique solutions that are interesting and logical, relatively new, and relevant to the given problem. |
|            | 3     | Mention some interesting and logical unique solutions, relatively new but less relevant to the given problem. |
|            | 2     | Mention some solutions that are quite unique, interesting and logical and relevant to the given problem. |
|            | 1     | Mention some general, logical and relevant solutions to the given problem. |
| Elaboration | 4     | Describe some logical details in the details so that the solution becomes easier to implement and precise. |
|            | 3     | Describe one logical detail in the existing solution so that the formulation of the solution becomes easier to implement and clear. |
|            | 2     | Describe some logical details on an existing idea but does not fit the concept of the solution and therefore cannot be used to clarify the solution. |
|            | 1     | Does not add detail to existing ideas so that solutions are less applicable. |

Based on the description in Table 3. To calculate the value of creative thinking abilities based indicators can be seen in the following equation:

\[
S = \frac{R}{N} \times 100
\]

Information: \(S\) = score creative thinking the ability; \(R\) = correct score and; \(N\) = the maximum score.
3. Result
The ability to think creatively is a complex thought process in describing the material, constructing representations, analyzing, and building relationships by involving the most basic mental activities. Higher-order thinking does not just come, but students also need the practice to think of this higher-order [17].

Creative thinking skills in science learning can open new perspectives for students to answer science problems at hand [18]. Activities such as observations, experiments, field trips can make students able to learn on their own, more comfortable to understand lessons, have a positive attitude towards science, and develop their creative thinking [19]. The subject of environmental change and waste recycling has essential competencies that students must achieve, namely K.D. 3.10 Analyzing data on environmental changes and the impact of these changes on life and 4.10 Solving environmental problems by designing waste recycling products and environmental conservation efforts.

The ability to think creatively as measured in this study consists of indicators of creative thinking, which include fluency, flexibility, originality, and elaboration. Every question tested was invincible with indicators of creative thinking on the subject of environmental change and waste recycling. Each question was a part that was related to other problems. Four questions were tested on creative thinking skills with the types of questions in the form of descriptions. The form of description questions type of progress test that requires an answer that is a discussion or worded in nature [20]. Descriptive tests can encourage students to express opinions and compose in good sentence form and provide opportunities for students to express their meaning in their language style and way. The results of the creative ability test are presented in Figure 1.

![Figure 1](image)

**Figure 1.** Graph Creative Thinking Results-Based Torrance Indicators Senior High School Students in Biology Learning.

The profile of students' creative thinking skills for each indicator, based on the creativity of the Torrance test, can be seen in Figure 1: the average value of the percentage of creative thinking abilities of each student is different. The percentage of each indicator, namely fluency was in the medium category (55.5%), flexibility was in the medium category (52.3%), originality was in the medium category (50.8%), and elaboration was in the low category (32.9%).

The results of the ability to think creatively on the fluency indicator had a percentage of 55.5% with a medium category. In this aspect, the research was the student's ability to ask questions related to the factors that caused air pollution and came up with many ideas on how to solve air pollution problems. The first problem in this aspect was a question related to air pollution cases based on the images that had been presented. Students were asked to identify the main issues related to air pollution problems from the pictures that had been given. Based on the students' answers, some students still did not generate ideas related to air pollution cases. The more ideas, the more likely there were to get a significant notion [21]. Students analyzed what problems were in the picture below [22].
The ability to think creatively on the flexibility indicator as a percentage of achievement of 52.3%, with a medium category. In this aspect, the researcher analyzed the students' ability to provide various interpretations (interpretations) of air pollution problems and classify ways of solving air pollution problems according to different divisions (categories). The second problem was that students provide various interpretations of an image related to air pollution problems. Based on the students' answers, some students were still lacking in interpreting air pollution problems. Ability to overcome obstacles or issues and not get caught up in assuming conditions that did not apply to a problem.

Thinking creatively on the originality indicator has a percentage of 50.8%, with a medium category. In this aspect, the researcher analyzed the students' ability to develop new (originality) solutions in solving air pollution problems and make designs in solving air pollution problems. The third problem, students provided unique or original solutions in delivering solutions to air pollution problems. Students were still lacking in suggesting new solutions. The originality category refers to the uniqueness of any given response. Students' answers were almost the same in class, namely planting trees for greening the environment. Originality is indicated by an unusual, unique, and rare response [23]. Problem the ability to think the original is a matter that requires thinking about something unusual, an example is generating new and unique ideas.

The ability to think creatively on the elaboration indicator has a percentage of 32.9% in the less creative category. In this aspect, the researcher analyzed the students' ability to take detailed steps in solving air pollution problems and develop an idea in solving air pollution problems. The fourth problem in this aspect was that students were asked to take detailed steps in providing solutions to air pollution problems. The question was students were asked to analyze based on the steps that had been given. Students still lack in detail in providing air pollution solutions and still lacking in analyzing the steps that had been stated.

The results of the analysis as a whole, the average creative thinking ability of students, has an achievement of 48%. It can be concluded the ability to think creatively is still low. This is consistent with other studies that state that the thinking skills of high school students are still low [24]. Students' creative thinking abilities are strongly influenced by students' initial skills on the subject being tested, while student gender differences do not affect creative thinking skills [25]. Regarding the gender aspects of both men and women, biology learning is aimed at all students equally. It is hoped that this will develop their potential according to the stage of student development [26].

Creative thinking skills need to be developed in science learning so that students can formulate ideas or ideas to solve a problem they are learning and facing in the learning process [27]. Therefore for further research it requires a learning model that can improve creative thinking skills such as the CPS or PjBL model. The results of the 2015 TIMSS show that Indonesian students have mastered questions like knowledge and facts that contextualize everyday life, but still need to improve higher-order thinking skills such as concluding, critical thinking, creative thinking, and integrate the information obtained.
4. Conclusion

Based on the results of the research conducted, it can be concluded that students' creative thinking skills for each indicator shows various achievements. Of the four indicators, elaboration is the lowest indicator. This is because, at this stage, the students do not have broader knowledge about the material of environmental change and waste recycling, so that they are not able to generate elaboration ideas from any given problems. Biology learning can take advantage of the surrounding environment, which is an effective way to focus students' attention during the learning process and gather information so that it can guide students to investigate science and ask questions based on the surrounding environment. Creative thinking skills need to be developed in biology learning so that students are able to formulate ideas or ideas to solve a problem faced by students in the learning process. Therefore for further research, it requires a learning model that can improve creative thinking skills such as the CPS or PjBL model.

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