7th grade student’s creativity analysis on science learning

U N Rosyida\textsuperscript{1*}, Sukarmin\textsuperscript{2}, W Sunarno\textsuperscript{3}

\textsuperscript{1}Program of Science Education Graduate School, Universitas Sebelas Maret, Indonesia
\textsuperscript{2}Faculty of Teacher Training and Education, Universitas Sebelas Maret, Indonesia
\textsuperscript{3}Postgraduate Program of Science Education, Universitas Sebelas Maret, Indonesia

*Corresponding author: nuhoros@student.uns.ac.id

Abstract. Creativity is one of some competencies needed in the 21\textsuperscript{st} Century, therefore creativity is something that people should have to face challenges in the 21\textsuperscript{st} Century. The aim of this research was to 1) find the creativity’s level which measured based on aspects Fluency, Flexibility, Elaboration, Originality, and Problem Solving; 2) find the percentage of each creativity’s indicators. This research was held in SMP Negeri 1 Kawedanan Magetan on second semester 2017/2018. This research’s subject were 55 7\textsuperscript{th} grade students, determined with the random sampling technique. This research was descriptive quantitative research. Data were collected using observation technique. Analysis technique of observation sheet with quantitative analysis. The outcomes showed that: 1) student’s creativity in the high level was 31, in the medium level were 17, in the low level were 7; 2) the percentage of each creativity’s indicators in Fluency 74.55\%, Flexibility 78.64\%, Elaboration 77.42\%, Originality 87.73\%, and Problem Solving 88.41\%. The conclusion was the level of student’s creativity on Science learning was at high level seen on each aspect which gets the result over 50\%. Creativity analysis in this research can be used as a reference for further research about measuring deeper creativity.

1. Introduction
The rapid development of the world makes creativity a determinant of excellence. The competitive power of a nation can be determined by the creativity of its human resources. Unlike the classical view that considers creativity as an ability only possessed by extraordinary individuals, the current view of creativity places it as an ability that can be formed and developed including through well-planned learning activities. Creativity has been identified as the key educational goal and primary ability of the 21\textsuperscript{st} century, which must be supported in the school environment [1]. In recent years, educators have emphasized how important it is to prepare students for the future, which will demand complex problem solving and creative thinking [2].

Creativity is largely considered today synonymous with success, enjoyed by creative people who are accomplished in both their personal and professional life, for example innovative institutions capable of thriving in the complex and dynamic work environments[3]. Creativity is very useful and can be applied every day to various aspects of daily life\textsuperscript{4}. In reality, creativity can help in competing in modern life. Creativity facilitates and improves problem solving, adaptation, self-expression, and health[4]. Someone who learns and applies creativity upholds a flexible approach and avoids too much dependence on one view. Based on the research, teachers are the key as the implementer of creative approaches to learning before they can create students who have creative thoughts and actions[5,6].
Facing the challenges of the 21st century in the world of education needs several supporting aspects[7]. The first aspect is contributing to work and society. To be a productive contributor, someone must be a quick learner about the knowledge in the field. The second aspect is fulfilling personal talents. The use of mobile phones and the internet is not a foreign thing in various countries around the world. This provides many opportunities for individuals to always learn and develop their abilities. The third aspect is meeting public interests. The existence of internet-based applications that have developed greatly helps communicate with others without having to face to face. The fourth aspect, which is the last aspect, is bringing the existing traditions and values. The challenge of the 21st century is to build and uphold the identity of a tradition and various traditions around it.

Based on the explanations above, it is very important to know the level of one's creativity, especially in the school environment, so that the school especially the teacher can provide a strategy for further learning to be applied and familiarized with the importance of creativity in students. Creativity is the main capital in dealing with various problems in everyday life. Creativity can also stimulate broad thinking to improve the quality of one's thinking. Science learning that uses a scientific approach is one of the facilities in developing students' creativity.

2. Methods

This research was conducted in SMP Negeri 1 Kawedanan. The research was conducted during the science learning process in several meetings. The research subjects were the seventh-grade students with only a few students as samples. The selected samples were 55 students. This research is quantitative descriptive research. The data were collected using observation techniques during the science learning process. The instrument of this research was an observation sheet that contains the indicators of creativity and the aspects of its translation. The indicators of creativity consist of five, namely: 1) Fluency with three aspects; 2) Flexibility with three aspects; 3) Elaboration with three aspects; 4) Originality with 2 aspects; 5) and Problem Solving with 2 aspects. Each aspect of each indicator describes the activities of students in the science learning process which can then be observed by observers. The data were analysed quantitatively using a Likert scale guideline with four answer choices i.e. 4 = always, 3 = sometimes, 2 = seldom, 1 = never.

Student creativity is grouped into three categories, namely high, medium and low. The results of data analysis were in the form of total scores from each aspect on the five indicators of creativity. The total score was processed to obtain the average score of creativity and standard deviation. The criteria for grouping student creativity are divided into the following Table 1, with $X$ as the total score of each student creativity; $\bar{X}$ as the average score of creativity of all students; and $SB$ as standard deviation [8].

| Categories of Levels of Student Creativity | Score Range                     |
|------------------------------------------|----------------------------------|
| High ($X \geq \bar{X} + SB$)            | $X \geq 76.066$                  |
| Moderate ($\bar{X} - SB \leq X < \bar{X} + SB$) | $64.564 \leq X < 76.066$        |
| Low ($X < \bar{X} - SB$)                | $X < 64.564$                     |

After the score range was obtained, the total creativity scores of each student were grouped into high, medium, and low categories. Each category is calculated in percentage. The percentage was calculated using the following equation:

$$A = \frac{n}{B} \times 100\%$$  \hspace{1cm} (1)
A is the percentage of high or medium, or low creativity categories; \( n \) is the number of students who have high or medium, or low creativity, and \( B \) is the total number of research samples. After obtaining the percentage of student creativity, the next step was to calculate the percentage of each indicator of creativity. The percentage of indicators of creativity was calculated using the following equation:

\[
R = \frac{X}{Y} \times 100\% \tag{2}
\]

\( R \) is the percentage of each indicator of creativity; \( X \) is the score obtained from the observation sheet on each indicator of creativity; and \( Y \) is the maximum score derived from the observation sheet in each indicator of creativity. After obtaining the data needed, they were analysed descriptively based on the results of the data quantitatively calculated.

3. Results and Discussion

The research results, show that creativity and academic achievement have a positive significant relationship [9]. In facing the challenges of the 21st century, the country must provide generations with high creativity to compete globally [10,11]. Based on this, it can be concluded that the level of student creativity is essential to know in the learning process, so that in the future teachers and schools can provide appropriate actions according to the results of the level of creativity of their students considering that creativity is a required skill in the future. In this research, student creativity was measured using an observation sheet developed based on the indicators of [10]. The indicators of creativity are shown in Table 2:

| Indicators of Creativity | Translation |
|--------------------------|-------------|
| Fluency                  | Quantity is needed in generating ideas that come out of fast thinking rather than quality. |
| Flexibility              | The ability to produce varied answer ideas or statements, see a problem from a different perspective, be able to use various ways of thinking. |
| Elaboration              | The ability to develop ideas and add or break down the details of the object of ideas or situations. |
| Originality              | The ability to produce unique or original ideas. |
| Problem Solving          | The ability to solve a problem logically. |

The creativity observation sheet is translated from five indicators into thirteen aspects that describe student’s activities in the learning process. The observation results were used for student creativity profile data so that the level of student creativity was recognized. Thus, the researcher could choose the appropriate model and method to use during further research based on the level of student creativity. The results showed that the average creativity score of 55 students was 70.315 and standard deviation was 5.751. These results were used to group the levels of student creativity, namely the high, medium, and low groups. The scores on each indicator on the observation sheet were summed so that the total score was obtained which became a reference for creativity grouping. The grouping of levels of creativity is shown in Table 3:

| Categories of Student | Number of |
|-----------------------|-----------|

Table 2. Indicators of Creativity

Table 3. Number of Students in Grouping Levels of Creativity
Based on Table 3, the number of students included in high creativity is 31, moderate creativity 17, and low creativity 7. The number of students that have been categorized was then calculated. The percentage of each category is shown in Table 4:

| Category of Creativity | Students |
|------------------------|----------|
| High                   | 31       |
| Moderate               | 17       |
| Low                    | 7        |

Based on Table 4, the high creativity category obtained a percentage of 56.36%, the moderate creativity category 30.91%, and the low creativity category 12.73%. The bar chart to describe each category of student creativity in science learning is described in Figure 1.

**Table 4. Percentage of Categories of Creativity**

| Percentage of Categories of Student Creativity | Percentages |
|-----------------------------------------------|-------------|
| High                                          | 56.36%      |
| Moderate                                      | 30.91%      |
| Low                                           | 12.73%      |

Based on the results of the categories of creativity, most students belong to the category of having high creativity. The number of students who have moderate and low creativity is also still relatively moderate, not very few. According to the observation, creative people are always interested in looking for "why" and "how" things happen[11]. Creative people are those whose curiosity is very large, so that there are various kinds of thought processes in their brain that can lead to new ideas. 56.36% of the students in the learning process were the students active in both asking and answering. In discussion, they often suggested problem solving ideas, could enrich or complement ideas expressed by their friends, and could also explain in detail some kinds of alternative solutions to a problem. The students who have high creativity can follow the science learning process well, and these students are expected to help the success of 2013 curriculum-based learning, which is student-centred learning.

30.91% of the students belong to the category that has moderate creativity. In the science learning process, these students were good enough, but were often hesitant in expressing their opinions during discussions and question-and-answer. 12.73% of the students with the low creativity category seemed less enthusiastic and some were silent. In the question and answer session, they were mostly silent. These students can also be categorized as less active students. Scientific creativity is simply any thought or behavior in science that is both novel and useful, with creative thought or behavior in science being manifested throughout the scientific process, from theory construction and hypothesis...
formation, research and study design, to publication and communication of results[12,13]. The process creativity is the same as the scientific approach, namely the discovery of something using the scientific method. Therefore, creativity is essential for individuals and must be developed continuously in order to expand their mindset and perspective in facing a problem. Regarding the importance of creativity, especially in school learning, the teacher must have the initiative to always facilitate students to think broadly, familiarize them in thinking independently to get used to thinking before being told and assessing problems from various perspectives[11]. Those will have a positive impact on students in facing various problems in their lives.

The indicators of student creativity are divided into five, namely fluency, flexibility, elaboration, originality, and problem solving[10]. In this research, the percentage of indicators of creativity was calculated to find out the achievement in each indicator. From the results of the calculations, the percentage of indicators of creativity is shown in Figure 2:

![PERCENTAGE OF INDICATORS OF CREATIVITY](image)

---

**Figure 2.** Percentage of Indicators of Creativity

Based on Figure 2, the percentage of the indicators of fluency is 74.55%, flexibility 78.64%, elaboration 77.42%, originality 87.73%, and problem solving 88.41%. The highest percentage of indicators is problem solving, and the lowest is fluency.

In the first indicator, fluency, the percentage is 74.55%. The percentage of this indicator is the lowest compared to the other indicators. In this indicator, there are three aspects, namely responding quickly, answering with varied answers, and having many ideas and thoughts. In the science learning process, the students have been actively involved, but not fully. If asked by the teacher, not all the students answered quickly. Sometimes none answered, and the answers were varied. In terms of having a lot of good ideas or thoughts, it can be seen from the discussion where the students were actively involved even though not all of them were active. Broadly speaking, the achievement in this indicator has been good seen from the results of observation even though the percentage of this indicator is the lowest compared to the others.

The second indicator is the flexibility with the percentage of 78.64%. In this indicator, there are three aspects, namely asking rarely-asked questions, providing alternative solutions to problems, and identifying problems from various perspectives. In the science learning process, the students were quite actively involved. Many of them often asked if they did not understand. During the discussion, there were several students who provided alternative solutions to problems being discussed so that the discussion went smoothly. To solve the problems in various perspectives, the students still need to be guided by the teacher. The achievement in this indicator is quite good in general.

The percentage of the third indicator (elaboration) is 77.42%. There are three aspects in this indicator, namely having different ways of thinking, thinking about things that have never been thought of, and thinking about old methods and then finding new ones to solve problems. The aspects of this third indicator are the most difficult to observe. Therefore, the research assistant had to really
pay attention to the students during the discussion and question and answer. In science learning, there were several students who did express unexpected thoughts so that they made new discussions in group discussions. To search for new methods to solve problems, the students still need teacher guidance, but not entirely. The achievement in this indicator is good.

The percentage of the fourth indicator (originality) is 87.73%. In this indicator, there are two aspects, namely enriching other people's ideas and determining detailed steps in solving problems. The achievement in this indicator is high. Based on the results of observations, in the science learning process in general the students discussed actively and enthusiastically, complementing their friends' opinions. In problem solving, the students also had enough details in writing and explaining the steps so that it was easily understood by other group friends. The achievement in this indicator is very good.

On the fifth indicator of problem solving, the percentage is 88.41%. The achievement in this indicator is the highest. This indicator consists of two aspects, namely solving problems logically, in detail, and having reasons that can be accounted for in decision making. In the science learning process, in general the students are good and quite detailed in solving problems. In essence, the students follow the science learning process seriously and enthusiastically. This is also because science learning is in accordance with the 2013 curriculum that is student centred. The students felt challenged because the teacher was trying to get them to think independently.

Based on the results of the achievement in the indicators of creativity of student creativity are achieved very well. It can be seen that the score for each indicator is greater than 50%. The result indicates that the students in general already have good bases of creativity in themselves so that it will be easier to give them treatment using various models and methods of learning in science learning every day because it will be able to explore the potential that exists in students as [14,15] stated.

4. Conclusion
Based on the results of the research, the category of student creativity is generally in the high category, but the number medium and low category creativity is not small either. The high student creativity is supported by the student interest in science learning itself. The teacher also facilitates them to seek knowledge independently, exchange ideas with their friends, present the results of discussions, experiment, make a product, and many more. The results of the achievement in each indicator of creativity are also quite high. Based on these results, the condition of students is ready to be given any learning model or method that supports an active learning environment. This research can be used as a reference for further research to measure deeper creativity, as well as other research that requires analysis of this creativity.

References
[1] Richardson C and Mishra P 2018 Think. Ski. Creat. 27 45
[2] Wagner T 2010 The Global Achievement Gap: Why Even Our Best Schools Don’t Teach the New Survival Skills Our Children Need and What We Can Do about It (New York: Basic Books)
[3] Glăveanu, V P 2018 Think. Ski. Creat. 27 25
[4] Runco M A 2004 Annu. Rev. Psychol. 55 657
[5] Daud A M, Omar J, Turiman P, and Osman, K 2012 Procedia-Soc. Behav. Sci. 59 467
[6] Reilly P 2017 Nord. J. Inf. Lit. High. Educ. 9 21
[7] Bellanca, J A 2010 21st Century Skills: Rethinking How Students Learn (Ed.). (Solution Tree Press).
[8] Arikunto S 2008 Research Procedure (Revision Edition) (Jakarta: Rineka Cipta)
[9] Nami Y, Marsooli H, and Ashouri M 2014 Procedia-Soc. Behav. Sci. 114 36
[10] Munandar U 1999 Pengembangan Kreativitas Anak Berbakat (Departemen Pendidikan & Kebudayaan).
[11] An D and Runco M A 2016 Eur. J. Psychol. 12 523
[12] Piffer D. 2012 Thinking Skills and Creativity. 7 258
[13] Runco M A and Jaeger G J 2012 Creat. Res. J., 24 92
[14] Nurhamidah D, Masykuri M, and Dwastuti, S 2018. J. Phys.: Conf. Ser. 1006 012035
[15] Fazelian P and Azimi S 2013 Procedia-Soc. Behav. Sci. 82 719