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## **Comparison of the Creative Thinking Abilities of Class XI High School Students on Environmental Pollution Material Given Gender Differences**

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### **Abstract**

Creative thinking skills are skills that develop an idea or ideas based on existing problems or solve problems from various points of view. The results of the 2015 GCI survey show that the creative thinking ability of Indonesian people is still low, ranking 86th in the creative class 93 countries. This research aims to determine the creative thinking abilities of high school students regarding environmental pollution material in terms of gender differences. This type of research is descriptive research with a quantitative approach. The research subjects were class XI students of SMA Negeri 4 Sidrap for the 2023/2024 academic year with a sample of 30 students. The sample was determined by random sampling. Data collection techniques use tests. The data analysis technique uses descriptive statistical processing. The results of the research show that the percentage score of students' creative thinking ability on the indicators of fluency is 65.52%, originality is 71.97%, flexibility is 69.97%, and elaboration is 73.64%.

**Keywords:** Fluency, flexibility, originality, elaboration, gender

**Acknowledgments:** Thanks to all parties who have supported the implementation of this research. I hope this research can be useful.

### **For citation:**

Amaliah, R., Bahri, A. (2024). Comparison of the Creative Thinking Abilities of Class XI High School Students on Environmental Pollution Material because of Gender Differences. *Journal of Digital Learning and Distance Education*, 3(2), 967-974. <https://doi.org/10.56778/jdlde.v3i2.279>.

### **Introduction**

The world of education is required to be able to create quality and high-achieving human resources. Teachers as educators provide learning facilities and students use the opportunity to learn lessons. The rapid development of information and communication technology affects all areas of life, including education. The world of education today requires students to have various

main competencies including learning skills, innovation, mastering media and information, and life skills so as to improve quality learning and change the way students learn and develop teacher creativity in student learning achievements (Muhammadiyah et al., 2022). Each student is a unique individual and has different characteristics in each aspect, including abilities, skills, interests, learning styles, socio-cultural background and other special needs. Talking about skills, basically creative thinking skills in generating and applying new ideas or ideas between students vary (Rusimanto et al., 2019). Humans are said to be qualified if they are able to achieve the goal of developing creative abilities.

Creativity is defined as the process of naturally using creative thinking to solve problems. According to (Isaksen, 2023); (Xu et al., 2024) creative thinking is a whole series of individual cognitive activities in developing imagination, intelligence, insight and ideas to face problems in finding something new. Creative thinking can be measured by predetermined indicators. (Fatmawati et al., 2022) argues skills guidelines. Creative thinking can be seen from four aspects including: (1) fluency; (2) flexibility; (3) originality; and (4) elaboration. Fluency refers to the production of a number of ideas or solutions to solve problems. Flexibility refers to a person's ability to see different points of view, approaches and strategies. Originality refers to someone being able to place information in a new way. Elaboration refers to someone strengthening an idea by providing detailed understanding of a topic. The differences in the four aspects of creative thinking are apparently influenced by several factors, one of which is gender. Gender is a difference in the functions, responsibilities and roles of individuals for both men and women which can change according to developments over time. This is in line with (Castillo-Vergara et al., 2018) who say that differences in creative thinking can be influenced by: age, gender, ability academics, socio-economic status, and culture.

Several supporting studies show that (Yildiz & Guler Yildiz, 2021) (1) the percentage of creative thinking ability of 59% is in the sufficient category with the results of male students being higher than female students (2) The results of XI IPA students' creative thinking abilities show that gender has no effect on students' creative thinking skills, (3) The average increase in students' creative thinking skills in each aspect is 17% compared to initial abilities, (4) Female students have significantly higher creativity and innovation than males. (5) Students' creative thinking abilities in class VIII D light material are still less creative (36.68%) in the cognitive aspect and quite creative (57.74%) in the affective aspect, in terms of gender differences. Therefore, researchers are interested in: (1) analyzing high school students' creative thinking abilities regarding environmental pollution material in terms of gender differences

## Method

The type of research used is quantitative descriptive research with comparative methods. This research involved two different groups, namely male and female, where one had criteria that the other group did not have. The focus of this research is to determine students' creative thinking abilities regarding the concept of environmental pollution in terms of gender differences. This research design uses causal-comparative research which is shown in Table 1.

Table 1. Causal-Comparative Research Design

| Group | Independent Variable                         | Dependent Variable        |
|-------|----------------------------------------------|---------------------------|
| I     | C1 ( <i>Group possesses characteristic</i> ) | O ( <i>Measureme nt</i> ) |
| II    | C2 ( <i>Group possesses characteristic</i> ) | O ( <i>Measureme nt</i> ) |

The population of this research is all students in class XI of SMA Negeri 4 Sidrap for the 2023/2024 academic year. The sample consisted of 30 class XI students, 15 male students and 15 female students. The research time required takes place from February 2024 to May 2024. The research sample was determined by random sampling. The instruments in this research are: 1). test sheet for students' creative thinking abilities to find out the extent of students' creative thinking abilities. The test sheet consists of a description of six questions according to four aspects of indicators of creative thinking ability, namely 1 question on fluency, 1 question on flexibility, 2 questions on originality and 2 questions on elaboration. 2). questionnaire sheet to determine student responses to creative thinking abilities. This sheet is filled in by providing a checklist of the 25 statements provided. The test instrument was adapted from (Jatnika et al., 2020) Test of Scientific Creativity. The data collection technique in this research was 1).

The test method is used to determine the results of students' creative thinking abilities regarding environmental pollution material, including: water, land and pollution air and its impacts and prevention. The data collected was obtained using a triangulation technique, which involves observing the results of test answers based on indicators of cognitive creative thinking abilities. 2). The questionnaire method aims to determine male and female students' responses to creative thinking abilities. The test technique used in this research is a set of tests in the form of essays which are used to measure creative thinking abilities. The assessment of creative thinking abilities includes 4 indicators, namely thinking fluency, flexibility, originality and elaboration. The criteria for the level of creative thinking ability are as follows:

Table 2. Criteria for Students' Creative Thinking Ability Level

| Level of Creative Thinking Ability (TKBK) | Criteria       |
|-------------------------------------------|----------------|
| 4                                         | Very creative  |
| 3                                         | Creative       |
| 2                                         | Quite creative |
| 1                                         | Less creative  |
| 0                                         | Not creative   |

This instrument is used to determine students' creative thinking abilities on environmental pollution material. This test is in the form of essay questions. The purpose of preparing these questions is to measure students' creative thinking abilities, with 4 indicators of fluency, flexibility, originality and elaboration. The analysis is carried out by checking the correctness of the answers made by students, to see aspects of fluency, flexibility, originality and elaboration of problem solving. The results of the analysis are categorized according to the level of creative thinking ability. To obtain data on creative thinking abilities, students' answers were scored for each question item. The scoring criteria for the creative thinking ability test used in this research refer to the rubric scores developed by (Nufus et al., 2024) Students' creative thinking abilities are analyzed through the answers students give. The data obtained is then analyzed by giving codes to student answers, and giving a score to each answer that students give based on the assessment rubric, then calculating the total test score for each aspect of creative thinking and determining the percentage value of creative thinking ability for each aspect that appears throughout. student. The percentage is calculated using the following formula:

$$NP = \frac{\text{Creative score} \times \text{question weight}}{SM} \times 100\%$$

SM

**Information:**

NP: Percentage Value SM: Maximum Score

After giving a score based on the students' answers given by looking at the achievement of four aspects of creative thinking. Next, add up the scores obtained by students from all the questions they have worked on and convert the scores obtained into percentages and categorize students' creative thinking abilities as in the table below.

Table 3. Percentage of Assessment Criteria

| Percentage   | Criteria           |
|--------------|--------------------|
| 81 % – 100 % | Very creative      |
| 61 % – 80 %  | Creative           |
| 41 % – 60 %  | Quite Creative     |
| 21 % – 40 %  | Less Creative      |
| 0 % – 20 %   | Very Less Creative |

From the four indicators, after obtaining the percentage results of students' creative thinking abilities, to obtain completeness for each indicator, it is calculated using the formula:

$$\text{Completeness per indicator} = \frac{\sum \text{Indicator scores obtained for certain sub-indicators}}{\sum \text{Maximum score of the indicator}}$$

After obtaining the results of completing the indicators of students' creative thinking abilities, they are then categorized using the following criteria:

Table 4. Percentage of Completion of Creative Thinking Indicators

| Score        | Criteria  |
|--------------|-----------|
| 89 % – 100 % | Very high |
| 78 % – 89 %  | Tall      |
| 64 % – 78 %  | Currently |
| 55 % – 64 %  | Low       |
| 0 % – 55 %   | Very low  |

Analysis techniques. data from questionnaire responses uses a Holistic Scoring scale, namely giving checklist marks in the zero, one, two and three value columns. The data that has been processed and collected will later be presented in the form of diagrams and tables to make it easier to analyze the level of ability of each student based on gender and draw conclusions based on the results obtained by students regarding creative thinking abilities in terms of gender differences.

**Results And Discussion***Students' Creative Thinking Ability*

Based on the research results, it can be analyzed that 30 Sidrap 4 State High School students have a percentage score of creative thinking ability in the fluency indicator aspect of 65.52% and in the original thinking indicator aspect of 71.97%. The flexible thinking indicator aspect (flexibility) has a percentage of 69.97% and the detailed thinking indicator (elaboration) has a percentage of 73.64%. The indicator aspect of creative thinking ability at the highest percentage is elaboration at 73.64%. From the data results it can be seen that some students have creative elaboration abilities. Students are able to submit various detailed explanations in answering questions with their own abilities. As with environmental problems that occur, they are packaged with various story lines for each student's thinking patterns in detail. This can certainly reflect the extent of students' understanding of elaboration abilities. Elaboration skills, if carried out well, can provide students with the skills to develop detailed and detailed work results (Darling-Hammond et al., 2020).

The answer results on the fluency indicator were 65.52%, showing that students were able to write answers to environmental pollution problems. Students who have good fluency skills are able to express a number of answers and ideas fluently in answering problems. Fluency creative thinking abilities can develop according to imagination and ideas formed in a matter, so that students tend to be obliged to solve learning problems. is also in accordance with the opinion of (Mustafa et al., 2022), the fluency aspect requires students to provide many ideas or answers. The more answers you have, the higher the level of fluency ability. The next indicator with a percentage score is flexibility of 69.97%. Achieving flexibility abilities provides an illustration of students' ability to consider things considered creative. Students' flexibility abilities show that students are able to produce ideas which can ultimately categorize their respective answers. This is in line with research by (Orakcı, 2021) that flexibility emphasizes students' ability to produce ideas that are categorized differently from various points of view.

Meanwhile, the highest percentage score was seen in the aspect of originality (newness) at 73.64%. This originality ability can be said to be quite creative. This is because the originality aspect is included in the category of high-level creative thinking. Students have the ability to be original when they are able to produce innovative ideas and find solutions to problems by having to think of new things and create combinations of parts of the idea. This is in accordance with (Walter, 2024) who said that students can achieve the aspect of originality when they can create various combinations of new ideas and things that have not been thought of before. Therefore, the aspect of originality is the achievement of the highest ability to think creatively. The ability aspect of originality essentially plays a role in determining a person's level of creativity. The essence of enriching the idea of the originality aspect is also very closely related to the fluency and flexibility aspects. If these two aspects are developed well, then in solving answers a person's originality ability will be easy to possess. This agrees with research (Sukestiyarno et al., 2021); (Wijayati et al., 2019) that the aspect of originality appears when educators are able to develop aspects of fluency and flexibility in classroom learning, so that students can easily solve problems that occur.

**Creative Thinking Ability Judging from Gender Differences** The results of the calculation analysis data show that of the four indicators of creative thinking, each gender obtained almost the same results in the aspects of fluency and originality. The fluency aspect of male and female students is 87.14% and 88.13% respectively. Indicators of originality between male and female students. consecutive. as big as 53.57% and 50.63%. On the other hand, the results obtained between male and female students on the flexibility and elaboration indicators obtained different results. Aspects of student flexibility. men and women respectively amounted to 63.52% and 72.81%. Meanwhile, the elaboration indicators for male and female students were respectively 70% and 64.38%. This is because there are several factors that influence differences in students' creative thinking ability mindset results. These differences are influenced by gender development factors in thinking including: behavioral factors, social factors in student development, and student

gender cognitive factors (Mubuuke et al., 2017). The achievement of students' creative thinking abilities resulted in the overall average results of women having superior scores than men. This is because when women think, they involve psychological aspects.

When female students think about fluency, flexibility, originality, and elaboration about an idea, they tend to describe psychological experiences based on feelings experienced. According to (Brundin et al., 2022); (Du et al., 2021) women are more likely to think with negative and positive emotions related to responding to what they feel, such as: self-awareness, stable emotions, anxiety, and anger which can produce higher creative thinking abilities compared to men. Even though it is known that women have higher percentage scores, women's self-confidence levels are weaker than men. Male students actually have a higher level of confidence. It was proven by the results of the response questionnaire that male students scored a higher percentage overall than female students. This is because women tend to have greater concerns regarding academic knowledge.

If viewed from a psychological perspective, female students tend to view learning outcomes as an effort to satisfy their family or teachers, so that when they experience failure, women will feel disappointed. This is different from men who tend to enjoy the results of their learning with the consequences that come with putting it first acceptance. This agrees with (Sanger, 2020) that women maintain a greater level of worry and tender feelings than men. Men maintain more assertiveness, risk taking and aggressiveness. (Carbone et al., 2024) also said that women maintain more complex and sensitive anxiety, while men are more relaxed and explorative when expressing things they like or dislike. From this it can be seen that a pattern of thinking can give birth to a new pattern according to the involvement of factors that influence the ability to think creatively. Based on these factors, the ability to think creatively is essentially a systematic and structured set of abilities. This research explains the relationship between some of the variables described in a limited scope. The study of other factors as well as data is a more complex and important part of this research to be used as the subject of further research.

## Conclusion

Based on. results of data analysis. And discussion regarding capability analysis. think. students' creativity regarding environmental pollution material in terms of gender differences, it was concluded that the highest percentage score for creative thinking was seen in the elaboration indicator aspect. Other aspects of creative thinking ability indicators with the second and third highest percentages respectively are originality (novelty) and flexibility (flexibility). Meanwhile, the fluency thinking ability aspect shows the lowest percentage results. Judging from gender differences, female students' fluency and flexibility indicators are higher than male students. The originality and elaboration indicators for male students are higher than female students. On the other hand, the results of the response questionnaire for each student's creative thinking ability, in general, most of the students gave good responses, where the response was for the creative thinking ability of male students. higher. compared to female students.

## Conflicts of Interest

The author declares no conflict of interest. The funders had no role in the design of the study in the collection, analyses, or interpretation of data in the writing of the manuscript, or in the decision to publish the results.

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