Identification of creative imaginations of biology education students based on the wartegg test

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Abstract. The purpose of this study is to identify the level of the creative imagination of biology education students in detail based on the components of creative imagination on the wartegg test. The study was conducted with a descriptive method at one of the state universities in Bandung. The research sample was 86 of 121 undergraduate students in biology education in the 7th semester of 2019/2020 who took the bio entrepreneur course. The instrument used was the wartegg test which has a high-reliability score (0.74) and high validity. The results showed that 48% of students had creative imagination in the low category, 28% in the very low category, 17% in the medium category, 5% in the high category, and 2% in the very high category. The components that dominate the score of creative imagination are expansion components (31%), fancy (19%), and symbolism (13%). High scores obtained by students are 20% in the dark shading component. In general, the category of students' creative imagination is in a low category. Students' creative imagination is dominated by sensitivity and openness, healthy creative imagination, beyond the environment, still realistic, and balanced with the values of life. Most students have a strong and consistent creative imagination.

1. Introduction

Uncertainty causes us to not know what will happen when we act or not act [1]. Uncertainty can occur in many life situations [2]. Such conditions will be bad when we cannot solve problems that arise from uncertainty. Creativity is needed to solve problems that arise from uncertainty [3]–[5]. Therefore creativity becomes an important component for global life in the 21st century [6] which is characterized by uncertainty [5]. Creativity which has an important role in problem-solving must be included in every learning. Education has an important role to facilitate the development of student creativity. So students can gain success in their future [7] and ensure the longevity of working in a smart economy [8]. Creativity can also be useful when solving problems and combining new knowledge [9]. For teachers, creativity can play a role in the learning process to visualize and integrate complex learning concepts [1].

Education today has the challenge of developing a more creative generation. The development of a person's creativity can be influenced by environmental factors around him and can be fostered through the learning process [10]. It takes innovation in learning to form a more creative generation [6]. The
teacher has an important role to make an innovative learning process and integrate creativity in the process [3].

In the learning process, student creativity can be increased through several ways, namely applying a case study teaching approach or open discussion [7], maximizing curiosity and respecting students' creative thinking [10], and making learning safe for risk-taking, learning from mistakes, collaborate, and follow students' interests [8]. Besides the education system must also facilitate the existence of teaching, assessment, and policies that support the integration of creativity in learning [3]. Cultural factors that are endemic in various regions can inhibit the formation of creativity. Some inhibiting factors of creativity are lack of freedom to explore, lack of questions, physical punishment, strict rules, requests for compliance, and lack of motivation [11]. As an important role in creating learning that supports creativity, teachers must have creativity in designing learning.

Based on the results of the study of the Global Creativity Index (GCI) in 2015, Indonesia is in a weak position, which is 115th out of 139 countries with an index of 0.202 [12]. Another study revealed that biology education students' creative thinking skills are generally in the quite creative category, based on observations from written tests conducted by students [13]. In another study, the creative thinking skills of biology education students were in a good category (81.3) based on written tests conducted by students [14]. Based on the results of previous studies, GCI Indonesia is still in the weak category, while its creative thinking skills are in the quite creative category.

Creativity can not only be observed from creative thinking skills or general creativity but can also be observed from his creative imagination. Creative imagination is the ability to change knowledge, sensing, and memory to describe the meaning, emotions, and possibilities into new perceptions [15], [16]. Creative imagination can influence aspects of creativity and modify creativity [17].

Based on some creativity research and the influence of creative imagination on creativity, I as a researcher are interested in identifying the creative imagination of biology education students based on the wartegg test. The purpose of this study was to identify the level of creative imagination of biology education students in detail based on the components of creative imagination on the wartegg test.

2. Methods
The method used in this research is a descriptive method, which aims to describe facts about students' creative imagination levels. The population in this study were 121 undergraduate students in biology education in the 7th semester who took the Bio entrepreneur course in the 2019/2020 academic year. The number of samples used was 86 undergraduate students. The study was conducted at one of the State Universities in Bandung. Creative imagination is measured using the Wartegg Test. The wartegg test is a drawing test that has eight 4 cm x 4 cm squares arranged in two lines [18]. This wartegg test has a high-reliability score (0.74) and has high validity [19]. Data collection was carried out using quantitative techniques in the Wartegg test with content analysis and execution. The score given in the analysis is between ½ to 3. A score of 1 is given if the character appears in the picture, but not too strong, a score of 2 is given if the character looks strong, and a score of 3 is given if the character looks strong and dominant, a score of ½ represents an intermediate score [20]. The scores obtained are analyzed descriptively. The categories of creative imagination are divided into 5 categories. Classification is done by dividing the total score range into 5 ranges, and then each score obtained is grouped according to the range formed.

3. Result and Discussion

3.1. Level of Student Creative Imagination
Measurement of students' creative imagination levels is done using the Wartegg test tool. This wartegg test can be used as an instrument of personality evaluation which is not bound by language [19]. This test is based on the ability of the content and qualitative aspects of the image to describe a person's personality [18]. One component of personality that can be evaluated through the Wartegg test is creative imagination. Based on the results of research on 86 biology education students, it was found
that 48% of students were in a low category, 28% were in the very low category, 17% were in the medium category, 5% in the high category, and 2% in the very high category. The frequency of students in each category can be seen in Table 1.

| Creative Imagination Category | Number of students | (%)  |
|------------------------------|--------------------|------|
| Very high                    | 2                  | 2    |
| High                         | 4                  | 5    |
| Medium                       | 15                 | 17   |
| Low                          | 41                 | 48   |
| Very low                     | 24                 | 28   |

Table 1 shows that the number of students who had the lowest creative imagination category had the highest percentage. The distribution of creative imagination categories tends to be at a low level. Low creative imagination scores illustrate that students' ability to form new and unusual perceptions based on knowledge and sense that is held in the low category [15], [16]. Low creative imagination will affect certain creative aspects, such as narration and graphic improvisation, and modify creativity [17]. Examples of images at each level can be seen in Figure 1-5.
Figure 1 show examples of images of students who are at a very low level of creative imagination. In the picture, only the dark shading component is visible on the windshield image. Figure 2 shows examples of images of students who are at a low level of creative imagination. The expansion component and the asymmetrical abstraction component are not visible in the picture. The fancy component can be seen in the picture of the shield which is a picture of a tool from the past or does not come from direct experience, this picture contains past cultural patterns. The phantasm component can be seen from images of the mouth with a protruding tongue long and containing negative emotion. Symbolism components appear in the form of shields and pencils. The dark shading component appears in the beaded image on the necklace. The originality component can be seen in the image of the plant inside the bottle and protruding tongue. The theme of the picture, including those that rarely appear in the picture.

Figure 3 shows examples of images of students who are at a moderate level of creative imagination. The symbolism component and the asymmetrical abstraction component are not visible in the picture. The originality component can be seen in pictures of people who have smiling expressions with additional accessories on the head and images of buffalo or horned cows. The fancy component appears in the form of a smiling cat image, and a picture of someone who has a smiling expression with an additional accessory on his head. Phantasm component images can be seen in the image of a buffalo or horned cow that looks strange and creepy. The dark shading component can be seen in a picture of someone with an umbrella, a picture of someone who has a smiling expression with additional accessories on the head, a bicycle picture, and a picture of a buffalo or horned cow. The expansion component can be seen in several pictures on a square, for example a picture of a house with a yard accompanied by a tree, a picture of someone looking at a boat in the distance, and a picture of three trees accompanied by a stream of water.

Figure 4 shows examples of images of students who have a high level of creative imagination. The phantasm components and symbolism are not visible in the picture. This fancy component can be seen in the mushroom image. The dark shading component can be seen in the image of small dots between the lines v, and small dots that form the flower stalk. The expansion component can be seen in images of clouds, tall buildings, and flowers in flower vases. The originality component can be seen in the flower image with four large petals, the picture with lines arranged v, and the flower picture arranged in a square shape. The asymmetrical abstraction component can be seen in the figure with lines v arranged, and flower images arranged in a square.

Figure 5 shows examples of images of students who are at a very high level of creative imagination. In the picture there is only one component that does not appear, it is an asymmetric-abstraction component. The dark shading component can be seen in images of monsters such as dinosaurs and pictures of one eye. The phantasm component can be seen in pictures of two different expression masks, images of monsters such as lizards, pictures of pistol and pictures of eye. The fancy component can be seen in images of the solar system, images of masks with smile expressions, and images of rocket. The symbolism component can be seen in images of the solar system, images of masks with different expressions, and images of rocket. The expansion component can be seen in images of the solar system, images of masks with different expressions, images of monsters such as lizards, pictures of rockets, and images of footprints near water.

The level of creative imagination students have can be influenced by many factors. Students' creative imagination can be influenced by complex relationships with their environment, diversity of behaviour, and level of maturity. The complexity of the relationship with the environment, diversity of behaviour, and the development of maturity can affect one's creative imagination [21]. The complexity of the relationship with the environment is obtained along with the development of experience in dealing with the environment. A person's experience that is formed gradually can affect the imagination. a person's imagination develops along with its development [16]. The relationship of students with their environment, different behaviours, and student development can provide a different experience for each student. These experiences can shape the workings of one's imagination [21].
3.2. Profile of Students' Creative Imaginations

The profile of a student's creative imagination can be seen from the dominant component that forms the score of his creative imagination, and the percentage of the creative imagination component in the high and low categories. In detail, creative imagination consists of components of expansion, originality, fancy, phantasm, symbolism, asymmetric abstraction, and dark shading. The score of creative imagination obtained can be dominated by certain components. The score of domination of students' creative imagination is shown in Table 2.

| Components of creative imagination | Frequency | (%) |
|-----------------------------------|-----------|-----|
| Expansion                         | 27        | 31  |
| Fancy                             | 16        | 19  |
| Symbolism                         | 11        | 13  |
| Total                             | 54        | 63  |

Table 2 illustrates that as many as 31% of students have creative imagination scores dominated by the expansion component, 19% of students get creative imagination scores dominated by fancy components, 13% of students have creative imagination scores dominated by symbolism components. The expansion component can be observed from images which implicitly show the expansion of dimensions. This expanded dimension can be a landscape image that shows unlimited expansion or fragmentation of the image presentation. The dominance of expansion scores generally illustrates good sensitivity and the ability to maintain enthusiasm subtly, so that it does not look conspicuous, and illustrates openness and acceptance [22]. Creative imagination that leads to sensitivity and openness can help detect a change and respond to change.

The fancy component can be observed through fictional images that still contain a side of reality or fictional characters with pleasant characters [22]. Pictures can be antiques that are not from direct experience, a smiling moon near a comet, a legendary figure, or a guitar player with wings. This fancy component illustrates the existence of basic contact with reality, a healthy imagination, and interests that go beyond the surrounding environment [22]. This fancy component illustrates a healthy creative imagination that transcends its environment and is still realistic.

The component of symbolism can be observed from images that show values, ideas, and ideals [22]. However, it must be distinguished from intellectual symbols or mathematical symbols, which are included in the abstraction criteria. The symbolism component can be in the form of religious, political, organizational, or national symbols. The symbolism component can reveal directly the basic elements of personality such as values, life goals, and problems that are considered by the subject [22]. This symbolism component shows a creative imagination that is balanced with the values of life.

Creative imagination can also be observed from the percentage of students who have high scores on the creative imagination component. Table 3 illustrates that of all the high values obtained, 20% are in the dark shading component. This shows that the highest frequency of high values is in the dark shading component. However, the frequency of students who have high scores on the dark shading component is less than those who have low scores. The dark shading component can be observed from the implementation of the image which shows the intensity of the strong shade. This dark shading component describes warm emotions, curiosity, and excitement [22]. Based on this, it can be said that students who have high scores in dark shading component have a strong impetus for creative imagination, so the imagined creative imagination is the basic personality they have and will consistently survive.

The percentage of students who score high and low on the creative imagination component can be seen in Table 3.
Table 3. Comparison of the percentage components of students' creative imagination

| Components of creative imagination | Frequency | Percentage |
|-----------------------------------|-----------|------------|
|                                   | High      | Low        | Σ frequency | High | Low |
| Expansion                         | 32        | 54         | 86          | 16   | 14  |
| Originality                       | 28        | 58         | 86          | 14   | 15  |
| Fancy                             | 33        | 53         | 86          | 16   | 13  |
| Phantasm                          | 16        | 70         | 86          | 8    | 18  |
| Symbolism                         | 34        | 52         | 86          | 17   | 13  |
| Asymmetric abstraction            | 20        | 66         | 86          | 10   | 17  |
| Dark shading                      | 41        | 45         | 86          | 20   | 11  |
| Total                             | 100       | 100        |             |      |     |

The phantasm component becomes the low grade that has the most frequency in students. This can be seen from the low percentage value which reaches 18%. This shows that only a few students who get creative imagination scores come from the phantasm component. The phantasm component can be seen from the image content that ignores reality in extreme ways, shows negative emotions, and displays gloomy, cruel, and terrible images [22]. Themes that fit the phantasm component are images of monsters, strange and creepy humans, or sharp weapons. The phantasm component describes individuals who have difficulty adjusting, ignoring reality, feeling anxious, and depressed [22]. Based on this, it can be said that some students are indicated to have a creative imagination that leads to neglect of reality, and are less able to adjust to their environment.

4. Conclusion

Creative imagination is the ability to project meaning, emotions, and possibilities into new perceptions based on knowledge, sensing, and memory. As many as 48% of students have creative imagination in the low category, 28% in the very low category, 17% in the medium category, 5% in the high category, and 2% in the very high category. This shows that the score distribution of creative imagination tends to be in a low category. The score of creative imagination obtained by biology education students is dominated by expansion components (31% students), fancy (19% students), and symbolism (13% students). The score of creative imagination dominated by the expansion component illustrates creative imagination that has sensitivity and openness so that it can be used to detect changes and respond well to these changes. Scores of creative imagination dominated by fancy components illustrate that creative imagination is healthy and transcends the environment, and is still realistic. Scores of creative imagination dominated by symbolism components illustrate that the existence of creative imagination is balanced with the values of student life. 20% of the high scores obtained by students are in the dark shading component, and 18% of the low scores obtained are in the fantasy component. This shows that many students have a strong drive for creative imagination and that it will persist consistently. Phantasm scores are low and only a few students get it, showing that only a few students are indicated to have a creative imagination that ignores reality, and is less able to adjust to the surrounding environment.

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