Analysis of the combination aspects of creativity level in product design for physics students in basic physics learning

S S Edie and Z Krismonika*

Department of Physics, Faculty Mathematics and Natural Science, Universitas Negeri Semarang, Indonesia

*Corresponding author: zulianakrismonika@student.unnes.ac.id

Abstract. The 21st Century skills that need to be reached at the top of the learning process according to the revised Bloom Taxonomy is creativity. Creativity can be reviewed through the 4P approach of Person, Press, Process, and Product. The analysis of product creativity can be categorized into five aspects, it is imitation, variation, combination, transformation, and original creation. This research only looks at the combination aspect. Combination is taking two existing works and then combining them. The method of this research is quantitative with descriptive approach. The research was conducted by giving an assignment to make a combination product design from the LCC bell. Design was assessed by 35 college student participants and researchers uses instruments that have been validated and relia bel. The results of the assessment were analyzed using simple descriptive statistics in the form of means. The results of the analysis show that the combination creativity of products design Unnes Physics students is in the very high category. The assessment obtained was 5.7 in the score range 1-7.

1. Introduction
The 21st century is closely related to the era of globalization, which means that humans must experience fundamental changes in life. The 21st century very concerned about quality in various aspects of life, including products of human work [1]. To achieve this, qualified human resources who have superior competence are needed. Education should produce a generation that has complete competence, known as 21st century skills. The 21st century skills and attitude categorized into; ways to thinking (knowledge, critical and creative thinking), ways to learning (literacy and softskills), and ways to learning with other (personal, social, and civic responsibilities) [2]. Other opinions expressed in “21st Century Knowledge-Skills Rainbow” which states that 21st century skills include; life and career skills, learning and innovation skills, and information media and technology skills [3]. That learning and innovation skills consists of creativity, critical thinking, communication and collaboration [4]. The formulation of educational goals in the national education system adheres to the revised Bloom Taxonomy. Revised Bloom's Taxonomy to reveal student learning outcomes in a creative direction, among others; remember-C1, understand-C2, apply-C3, analyse-C4, evaluate-C5, and create-C6. The highest goal is creation, which requires creativity to achieve it [5].

The basis of this research is the creativity design theory which divides product creativity into five aspects, as follows; imitation, variation, combination, transformation and originality [6]. Creativity appears as a result of creative thinking processes carried by creative individuals. Creativity comes from
the combination of things that are usually not related to each other [7]. Creativity is a form of creative process that has properties; novel, useful, and understandable [8]. Creativity can be viewed through four aspects as follows; person, press, process, and product [9]. To reach the top goal of the Bloom Taxonomy, that is create requires product creativity. A product can be said to be creative if according to the judgment of an expert or observer who is competent in his field, he says that the product is creative [10]. Product creativity is creating new products or combining existing products, so these products will get a good response when introduced.

Based on the description above, it can be concluded that creativity is very important to be developed, especially among student collages. Because in the 21st century, there are many jobs that require quality human resources where one of the indicators is having creativity. In addition, the issue of creativity is still an interesting issue in research circles. The level of creativity of UNNES Physics Education students has entered the category of combined creativity with the quality of product design in the medium category [11]. Based on this research, it shows that the creativity of UNNES Physics students is superior in the combination aspect, but there is no research that specifically looks at creativity in the combination aspect. In research, the focus is creativity in combination aspect. Combined creativity is the form of design sketches, which is significantly increased compared to the initial sketch [12]. A Combination is generated by taking two existing products and combining them. The combination in this research is to combine speaker and LED in terms of form and function. Research is needed to reveal the creativity of the combined aspect of the Physics student Universitas Negeri Semarang in making product designs.

2. Methods

Based on the research goals, it can be stated that this research is included in quantitative research using a descriptive approach. In this research, a quantitative analysis was carried out then the results were described to get an overview of the creativity of the combination aspects from physics students in making LCC bel product designs.

Determination of the right sample is needed to represent the population that will serve as research subjects. A good sample size used in research is between 30 to 500 [11]. In this research the sample was determined using purposive sampling. The 2019 batch of Physics student respondents were obtained as many as 35 students.

The instrument used in this research was a non-test instrument. The form of instrument design order sheet and as assessment sheet in the form of a closed questionnaire. The closed questionnaire has 29 points of assessment indicators with an assessment scale using a Likert Scale of 1-7 from very bad to very good. The rating scale is then categorized into four categories, which is very low, low, high, and very high as shown in Table 1.

| Categories   | Assessment Score Ranges |
|--------------|--------------------------|
| Very low     | $1 \leq x < 2.5$         |
| Low          | $2.5 \leq x < 4$         |
| High         | $4 \leq x < 5.5$         |
| Very high    | $5.5 \leq x < 7$         |

The instrument tested first using validity and reliability tests. The validity test carried out is the construct and content validity test. The construct validity in this research used the expert judgment method by a team of expert lecturers. Content validity and reliability tests were carried out by giving design instructions to one of the Physics students, the the design was assessed by 30 other Physics students. The content validity test is processed using the moment product correlation. T count with t table was compared and it is found that all indicator items made are valid. The reliability test was processed using the alpha Cronbach method. The results of the calculations are then adjusted to the reliability criteria as shown in Table 2.
Table 2. Reliability Criteria [14]

| Score       | Information       |
|-------------|-------------------|
| $r_{11} < 0.20$ | Very low         |
| $0.20 \leq r_{11} < 0.40$ | Low               |
| $0.40 \leq r_{11} < 0.70$ | Moderate         |
| $0.70 \leq r_{11} < 0.90$ | High             |
| $0.90 \leq r_{11} < 1.00$ | Very high        |

Calculations using a significant level $\alpha = 0.05$ get results $r_{11} = 0.89$. Based on Table 2, it states that all items in the instrument are reliable and all questionaires consistently have high reliability. The validated and reliable instruments were then distributed to 35 students of Physics UNNES class 2019. The data analysis technique used in this research is quantitative descriptive statistics in the form of means values.

2.1. Means
Means are used to find the average value of the total score assessment given by respondents and researchers, with the following formula:

$$\bar{X} = \frac{\sum x}{\sum f}$$

$\bar{X}$ = average (means)
$\sum x$ = total assessment score
$\sum f$ = number of respondents

3. ResultS and Discussion
Data on creativity aspects of product design combination obtained from student and researcher assessments were combined and analyzed using the means method. The results of the means analysis on the creativity of the combination aspects of the student LCC bell design are presented in a graph which can be seen in Figure 1.

Figure 1. Graph on the combined aspects of product design creativity

The results of the research found that 35 LCC bell designs have variety of; shapes, sizes, components, arrangements, and working principles. It is still paying attention to the combination of speakers and
LED. It can be seen in Figure 1 that there is a product design with the highest rating, namely design number 34 with a score of 6.5. The design can be seen in Figure 2.

Figure 2. LCC Bell Design D34

The LCC bell product design with code D34 has an attractive, stunning shape and shows its novelty. The design of the D34 shows evolution in a completely new form. There are two forces at work in the combination process. The first is suitability: individuals create works by combining previously provided work features. The second is augmentation: individuals modify features that exist in previously provided works or add features that do not exist in previous works [12]. The design of the D34 uses the first combination process, namely conformity.

The design of the LCC bell is very beneficial for various groups including people with disabilities. As can be seen in Figure 2, the design of the D34 has shown a combination both in terms of form and function of its constituent components. The design that is made has combined the functions of the speaker and LED well. This is indicated by LED lights on the fingers and siren bells as sound producers. Between the speaker and the LED they are blended in the same space with a different shape from the original form of the two. Combination is combining two works in terms of form and function into a work that combines two product or that are completely new [15].

The LCC D34 buzzer has demonstrated an excellent connection between components and represents a practical and compact construction. Each component is united and occupies the smallest space. If one component dies, the other components will also be affected. In the working system, the D34 bell design shows a good blend of each component. If the button on the thumb is pressed, the bell will show a light on the finger and produce a siren sound as a sign that it has pressed the bell. At that time, other bells will not ring because it locks automatically.

The design has a protective system which indicates good safety. There are not many exposed cables outside which can cause a short circuit. Because each participant uses this bell, the risk of damage to the bell from scrambling to press the button will be reduced. This makes the LCC D34 bell design durable and reliable. In addition, this bell design looks flexible, can be moved easily, and doesn't take up much space to store it. There are 10 aspects that are contained in a good design is innovative, useful, aesthetic, understandable, unobtrusive, honest, long-lasting, thorough down to the last detail, environmentally friendly, and possible [16]. The level of product creativity is based on four categories called "Creative Product Analysis Matrix" (CPAM). There is novelty, originality, resolution, and elaboration [17]. Based on this, the design quality of the LCC D21 bell is very good.
The results of the overall data analysis obtained by calculating the means from the four aspects of product design quality obtained a score of 5.7 in the score range 1-7. Based on the range of creativity scores for the combination aspects of product, it shows that the combined creativity of students is in the very high category. This shows that the Physics students of Semarang State University already have a combination of creativity in creating works in the form of product designs.

4. Conclusion
Based on the results of simple statistical data analysis, the assessment score was 5.7 on a scale range of 1-7. Based on the range of scores on the creativity of the combination aspects of student product design, it is in the very high category. This shows that the Physics students of Semarang State University already have a combination of creative aspects in creating works in the form of product designs. For this reason, a follow-up is needed in Basic Physics learning in the form of realization of product designs that have been made. Students need to be trained to carry out activities that can develop product creativity in combination aspects.

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