

COMPONENT ANALYSIS OF CREATIVE THINKING ABILITY ON STATIC FLUID MATERIALS, TEMPERATURE, HEAT AND OPTICAL TOOLS IN SMA BOOK IN CLASS XI IN WEST SUMATERA

Septi Putri Dewi¹, Hufri^{1*}, Hidayati¹, Silvi Yulia Sari¹, Fanny Rahmatina Rahim¹

¹ Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia
Corresponding author. Email: hufri@fmipa.unp.ac.id

ABSTRACT

Higher thinking skills must be possessed by students in facing 21st century education. Creative thinking skills are needed in various ways, especially in learning to improve student learning outcomes in class. So that text books are needed as a support for the learning process. For this reason, it is necessary to pay attention to whether the textbooks used are in accordance with the demands of the current 2013 curriculum. One of the curricula in the 2013 curriculum is the use of texts that can facilitate students' creative thinking skills. So it is necessary to analyze physics learning textbooks for class XI on static fluid, temperature and heat materials as well as optical devices to find out whether the presentation of physics textbooks for class XI facilitates creative thinking skills. The population in this study were all textbooks for physics class XI published in Indonesia and used in West Sumatra. The samples used in this study were MK-ER textbooks and MR-TS textbooks. The results of the analysis show that the MR-TS physics textbook is a physics textbook with the highest level of availability of creative thinking indicators with a percentage of 38.69% in the less available category. While the MK-ER physical textbook has the lowest level of availability of creative thinking indicators with 37.68% results being in the less available category. This shows that the MR-TS physics textbook and MK-ER physics textbook have not been perfect in facilitating students creative thinking skills.

Keywords : *Analysis; Creative Thinking Ability; Textbook.*



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I. INTRODUCTION

Higher order thinking skills must be present in students in facing the demands of 21st century education. 21st century learning is learning that requires competencies and skills including creative thinking skills [1]. The 21st century demands a generation that is skilled, qualified and able to compete with the demands of the times. 4C skills are applying 21st century skills. Where 4C skills consist of collaboration or cooperation, communication, critical thinking, and creative thinking. Creative thinking skills are needed in many ways, especially in learning to improve student learning outcomes in the classroom.

Creative thinking is a type of ability that refers to the acquisition of new approaches, new insights, new perspectives, and new solutions in solving things [2]. Creative people are generally able to see problems well and can create new ideas in finding solutions to a problem. Creative thinking is characterized by four skill components, namely fluency, flexibility, originality (new ideas generated), and elaboration [3]. In physics learning, students often have difficulty understanding the concepts being taught. So with the ability to think creatively in learning activities, it is easier for students to learn physics material so that they can improve the quality of learning.

Creative thinking skills need to be developed in the physics learning process, because learning activities facilitate the development of creative thinking skills that can make students more innovative in understanding and developing physics concepts. In the process of solving the desired problem in physics subjects creative thinking skill are needed [4]. Students creative thinking can be obtained through understanding a concept when solving problems [5].

It should be realized that so far students creative thinking skills are still very low. This can be seen from the results of the creative thinking ability test for the aspect are fluency 31%, the aspect is flexibility 28.6%, the aspect is originality 19% and the aspect is elaboration 23.4%. The average percentage achieved is only 25,5%, this value is in the less creative category [6]. If the percentage < 33%, the creative thinking ability is said to be low [7]. The low ability to think creatively occurs because learning still tends to be teacher-centered, the teacher is still very dominant and students tend to be monotonous [8]. and make students less flexible to build their thinking skills [9].

The Indonesian government has taken many ways to improve the quality of education, including by updating the curriculum to become the 2013 curriculum. The context of learning in the 2013 curriculum is the ability to think creatively. In order for learning to be achieved as expected in the 2013 curriculum, learning resources are needed to facilitate the learning process. The learning resources used are textbooks.

Textbooks are teaching materials that contain learning materials and as a source of knowledge used in the learning process. A good textbook is a textbook that can facilitate and stimulate students to think creatively and critically [10][11][12][13] regarding teaching materials, modules and multimedia physics based on inquiry learning in improving students' creative thinking skills. said that the use of teaching materials, modules and multimedia was effective in learning to increase students' knowledge, especially on creative thinking skills. Because teaching materials such as textbooks have an important role, it is necessary to conduct an analysis related to the availability of creative thinking indicators for high school physics textbooks for class XI semester 2 on Static Fluids, Temperature and Heat, as well as Optical Instruments to find out textbooks can facilitate the implementation of skills. creative thinking in the learning process.

Previously, similar research has been carried out in connection with the analysis of creative thinking skills, [14][15][16]. The research conducted is different from several previous studies but the same analysis. The difference lies in the aspects studied, where relevant research examines module validation on creative thinking skills. Meanwhile, the researchers conducted a research "Analysis of the Components of Creative Thinking Ability in Static Fluids, Temperature, Heat, and Optical Tools in High School Books in Class XI in West Sumatra".

II. METHOD

This research uses qualitative methods to descriptive research. The purpose of this study was to determine the ability to think creatively on static fluid materials, temperature, heat, and optical devices in high school textbooks in class XI in West Sumatra. This research produces a report on the object under study based on the facts found and describes the writing of the Physics textbook for class XI used.

The population in this study was a class XI physics textbook recommended by the government and used in West Sumatra. The sample of schools in this study were 38 public schools in West Sumatra, which were taken using the proportional stratified random sampling technique. The samples taken were 2 physics textbooks which were most widely used by several high schools in West Sumatra. The most widely used physics textbooks for class XI are physics textbooks by Marthen Kanginan (MK-ER) and physics textbooks by Muhammad Farchani Rosyid, et al (MR-TS).

The instrument used was an assessment sheet which was compiled based on the assessment instrument of the Physics textbook for class XI by determining the components of creative thinking and instrument items. The components of creative thinking and instrument items are derived from theoretical studies on creative thinking abilities. The overall validity value of the instrument is searched using the equation to get the total average value for all criteria:

$$V_a = \frac{\sum_{i=1}^m A_i}{n} \quad (1)$$

description:

V_a = Average value of allcriteria

A_i = Value for criteria

n = Maximum number of values [17]

The instrument validity categories are listed in Table 1.

Table 1. Instrument Validity Category

Criteria	Category
0,8 – 1,0	Very Valid
0,6 – 0,79	Valid
0,4 – 0,59	Fairly Valid
0,2 – 0,39	Less Valid
0,0 – 0,19	Invalid

(Source: Ref [18])

This research instrument was validated by three expert lecturers. The average value obtained from the results of the three validators is 0.81 which belongs to the very valid category. The value of instrument validation is presented in Table 2.

Table 2. Value of Instrument Validation by Three Expert

Experts	Value	Category
Experts 1	0,77	Valid
Experts 2	0,85	Very Valid
Experts 3	0,812	Very Valid

(Source: Ref [18])

The data collection techniques in this study are interviews and documentation. The documents used in this study is a textbook teaching high school physics class XI. Data were analyzed using content analysis (*content analysis*). The stages of analysis in this study are as follows:

1. Summing up the appearance of the items of the creative thinking ability instrument in each of the textbooks analyzed.
2. Calculate the percentage of indicators that appear in the creative thinking aspect for each criterion in the book being analyzed

$$\frac{\sum \text{Instruments of emerging creative thinking skills}}{\sum \text{Creative thinking instrument}} \times 100\% \quad (2)$$

3. Determining the criteria for the availability of creative thinking skills in high school physics textbooks for class XI, these criteria are presented in Table 3.

Table 3. Criteria for creative thinking abilities in high school physics books for class XI.

Criteria	Category
81% – 100%	Very available
>>61% – 80%	Available
41% – 60%	Sufficiently Available
21% – 40%	Less Available
>>0% – <<<20%	Not Available

(Source: Ref [18])

4. Draw conclusions from the data that has been obtained.

III. RESULTS AND DISCUSSION

From the research that has been done regarding the analysis related to the availability of creative thinking indicators in the second semester of XI class XI high school physics books, especially on the material of Static Fluids, Temperature and Heat, and Optical Tools. Where the textbooks that have been analyzed are the book by Marthen Kanginan (MK-ER) and the book by Muhammad Farchani Rosyid, et al (MR-TS) published in 2016.

The following is a discussion of the results of the research based on the main material analyzed. First, the availability of creative thinking skills in Static Fluida material in physics textbooks for class XI, namely physics textbooks written by Marthen Kanginan (MK-ER) and physics lesson texts written by Muhammad Farchani Rosyid, et al (MR-TS) published in 2016 can be seen in Figure 1.

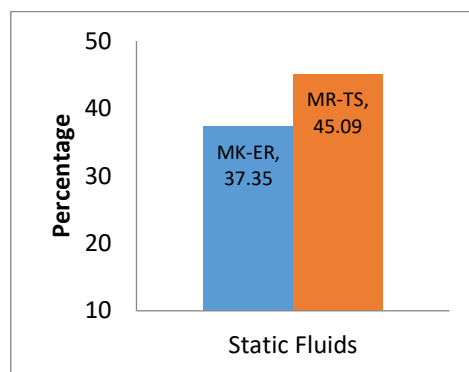


Fig 1. Graph of Percentase of Analysis Results of Creative Thinking Ability in Static Fluids

Figure 1 shows the percentage of the results obtained from the analysis of the components of creative thinking skills in static fluid material contained in the presentation of the physics textbook by Marthen Kanginan (MK ER). Rosyid, et al (MR-TS) obtained a percentage of 45.09% with a fairly available category. Based on the two physics textbooks for class XI which have been analyzed, the average percentage is 41.22% with the category quite available.

In each of the physics textbooks for class XI, especially on the material of Static Fluids, each has its own advantages and disadvantages. The MR-TS physics textbook has advantages in the component, *Fluency* namely the book has guided students in expressing many ideas in problems so that the MR-TS Physics textbook has a percentage of 87.5% and is categorized as Very Available. This is indicated by the appearance of seven instrument items out of eight instrument items in the indicator *Fluency*. In component *Fluency* this, one of the instrument items is "Textbooks facilitate to generate ideas that can improve understanding". It is found in the MR-TS Physics Lesson textbook page 72, namely: "Why do dam walls always go down getting thicker While the shortcomings of the MR-TS physics textbook are in the component *Originality* so that the MR-TS physics textbook has a percentage of 16.67% and is categorized as Not Available. This is indicated by the appearance of one instrument item out of six instrument items on the indicator *Originality*.

The MK-ER physics textbook has advantages in the component, *Fluency* namely the book has guided students in expressing many ideas in problems so that the MK-ER Physics textbook has a percentage of 87.5% and is categorized as Very Available. This is indicated by the appearance of seven instrument items out of eight instrument items in the indicator *Fluency*. In component *Fluency* this, one of the instrument items is "Textbooks ask students to analyze pictures and label the parts". It is contained in the MK-ER Physics Lesson textbook on page 142, namely: "See picture 3.49, then explain the events shown by each of the pictures that are related with capillary symptoms. While the shortcomings of the MK-ER physics textbook are in the component *Flexibility* and the component, *Originality* so that the MK-ER physics textbook has a percentage of 16.67% and is categorized as Not Available. This is indicated by the appearance of one instrument item out of six instrument items on the indicators *Flexibility* and *Originality*.

Second, the availability of creative thinking skills on the material Temperature and Heat in physics textbooks for class XI, namely physics textbooks written by Marthen Kanginan (MK-ER) and physics lesson texts written by Muhammad Farchani Rosyid, et al. (MR-TS) published in 2016 can be seen in Figure 2.

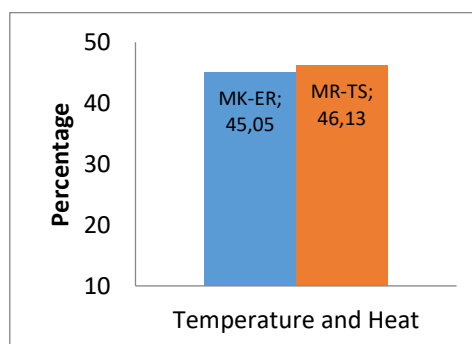


Fig 2. Graph of Percentage Result Analysis of Creative thinking Ability on Temperature and Heat Materials

Figure 2 shows the percentage of the results obtained from the analysis of the components of creative thinking skills on the Temperature and Heat material contained in the presentation of the physics textbook by Marthen Kanginan (MK-ER). Muhammad Farchani Rosyid, et al (MR-TS) obtained a percentage of 46.13% with a fairly available category. Based on the two physics textbooks for class XI which have been analyzed, the average percentage is 45.59% with the category quite available.

In each of the physics textbooks for class XI especially on the temperature and heat material, each has its own advantages and disadvantages. The MR-TS physics textbook has advantages in the component, *Fluency* namely the book has guided students in expressing many ideas in problems so that in the MR-TS Physics textbook the percentage is 75% and can be categorized as Available. This is indicated by the appearance of six instrument items out of eight instrument items on the indicator *Fluency*. In component *Fluency* this, one of the instrument items is "Textbooks ask students to compare". It is contained in the MR-TS Physics Lesson textbook on page 109, namely: "Determine the thermal conductivity of the experimental results and compare the results with table 5.2". While the shortcomings of the MR-TS physics textbook are in the *Flexibility* component and the component *Originality* so that in the MR-TS physics textbook the percentage is 33.33% and is categorized as Less available. This is indicated by the appearance of two instruments out of six instrument items on the indicators *Flexibility and Originality*.

The MK-ER physics textbook has advantages in the component, *Fluency* namely the book has guided students in expressing many ideas in problems so that the MK-ER Physics textbook has a percentage of 87.5% and is categorized as Very Available. This is indicated by the appearance of seven instrument items out of eight instrument items in the indicator *Fluency*. In component *Fluency* this, one of the instrument items is "Textbooks ask students to generate ideas for solving problems or answering various questions". There is a lesson in physics textbooks MK-ER 212 pages, namely: "Give an example in everyday life that prove that the liquid expands more than solid sesar". While the shortcomings of the MK-ER physics textbook are found in the component *Flexibility* so that the MK-ER physics textbook is obtained the percentage is 16.67% and is categorized as Not Available. This is indicated by the appearance of one instrument item out of six instrument items on the indicator *Flexibility*.

Third, the availability of creative thinking skills on the material of Optical Tools in physics textbooks for class XI, namely physics textbooks written by Marthen Kanginan (MK-ER) and physics lesson texts written by Muhammad Farchani Rosyid, et al (MR-TS) published in 2016 can be seen in Figure 3.

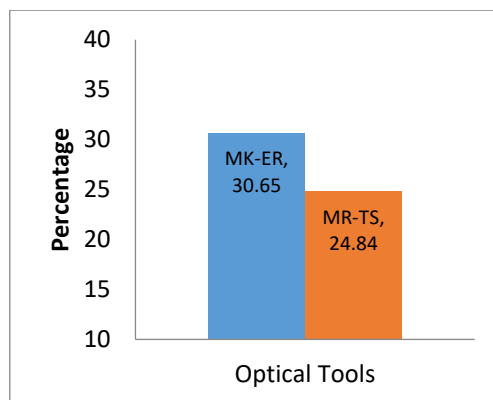


Fig 3. Percentage Graph Analysis Results Creative Thinking Ability in Creative Optical Tools

Figure 3 shows the percentage of the results of the analysis of the components of creative thinking skills in the Optical Tools material contained in the presentation of the physics textbook by Marthen Kanginan (MK-ER) obtained a percentage of 30.65% with the category less available and Physics textbooks written by Muhammad Farchani Rosyid, et al (MR-TS) obtained a percentage of 24.85% with the less available category. Based on two physics textbooks for class XI which have been analyzed, the average percentage is 27.75% with the category less available.

In each of the physics textbooks for class XI, especially in the material for Optical Tools, each has its own advantages and disadvantages. The MR-TS physics textbook has advantages in the component, *Fluency* namely the book has guided students in expressing many ideas in problems so that in the MR-TS Physics textbook the percentage is 37.5% and is categorized as Less available. This is indicated by the appearance of three instrument items out of eight instrument items on the indicator *Fluency*. In component *Fluency* this, one of the instrument items is "Textbooks ask students to analyze pictures and label their parts". It is contained in the MR-TS Physics Lesson textbook on page 296, namely: "Discuss with your colleagues whether equation (11.15) also applies to two mediums bounded by a half cylinder of radius R (See fig beside)". While the shortcomings of the MR-TS

physics textbook are in the component *Flexibility* and the component *Originality* so that the MR-TS physics textbook has a percentage of 16.67% and is categorized as Not Available. This is indicated by the appearance of one instrument item out of six instrument items on the indicators *Flexibility and Originality*.

The MK-ER physics textbook has advantages in the component, *Fluency* namely the book has guided students in expressing many ideas in problems so that the MK-ER Physics textbook has a 75% percentage and is categorized as Available. This is indicated by the appearance of six instrument items out of eight instrument items on the indicator *Fluency*. In component *Fluency* this, one of the instrument items is "Textbooks facilitate students to identify facts, concepts, principles, and laws". It is found in the MK-ER Physics Lesson textbook on page 567, namely: "If the distance the focus of the loop is 5 cm, where can the object be placed? While the shortcomings of the MK-ER physics textbook are found in the component *Elaboration* so that the MK-ER physics textbook is obtained the percentage is 14.29% and is categorized as Not Available. This is indicated by the appearance of one instrument item out of seven instrument items on the indicator *Elaboration*.

To see the accuracy of the results of this study, an analysis of the components of this creative thinking ability was carried out by two observers, one of which was the researcher himself. The agreement index obtained in the Marthen Kanginan (MK-ER) textbook on static fluid material is 92.59, temperature and heat is 96.30 and optical tools is 100.00 which is categorized as very good. The index of agreement obtained in the book of Muhammad Farchani Rosyid, et al (MR-TS) on static fluid material is 96.30, temperature and heat is 96.30, and optical tools is 100.00 are categorized as very good. So that the results of the analysis of the textbooks of Marthen Kanginan (MK-ER) and the textbooks of Muhammad Farchani Rosyid, et al (MR-TS) are said to be accurate.

IV. CONCLUSION

Physics textbooks written by Muhammad Farchani Rosyid, et al (MR-TS) have the highest level of availability of creative thinking indicators with 38.69% percentage results in the Less available category. While the physics textbook written by Marthen Kanginan (MK-ER) has the lowest level of availability of creative thinking indicators with 37.68% percentage results in the Less available category. This shows that the MR-TS physics textbook and MK-ER physics textbook have not been maximal in facilitating students' creative thinking skills.

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