Analysis of the Level of Understanding of Physics Education Students on the Concept of Visible Light on Electromagnetic Wave Spectrum Material Using Descriptive Method

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ABSTRACT

The electromagnetic wave spectrum is electromagnetic radiation sequentially and indicates the type of wave based on frequency and wavelength. One type of electromagnetic wave spectrum is visible light. On the concept of physics of matter the spectrum of electromagnetic waves is very important to study because itsera is closely related in life. This study aims to determine the level of students' understanding of the concept of visible light on the electromagnetic wave spectrum material. This research was conducted through a survey with respondents of physics education students. The sample used was 46 physics education students at the University of Jember. Data analysis uses a descriptive methodin the form of persentase. Based on the results of the study, it showed that the average score obtainedby students in physics education was 67.61. Thus, physics education students' understanding of the concept of visible light on the electromagnetic wave spectrum is quite good.

Keywords: Electromagnetic Wave Spectrum; Visible Light; Physics Concepts

INTRODUCTION

Gelectromagnetic balance on its propagation based on the spectrum of electromagnetic waves and wavelengths. The electromagnetic wave spectrum consists of radio waves, microwaves, infrared rays, visible light, UV rays, X-rays, and gamma rays. [1].

Light is the part of electromagnetic waves that can be seen by the eye and its components include red, orange, yellow, and purple light. The wavelength of light ranges from 0.2-0.5 which adjusts to the frequency, which is between 6 x μm $\mu m 10^{15}$ Hz to 20 x 10^{15} Hz. The color of the light has a relationship with the frequency or wavelength [2].

Visible light is one of the electromagnetic waves that has a wavelength of 375 nm - 700 nm in udara. The difference in the length of gelombang is interpreted by the human brain in the form of color. The longest wavelength with the lowest frequency is found in red and the shortest wavelength with high frequency is owned by violet color [3].

The use of *visible light is* used for the medium of conveying information. The utilization of visible light in the field of technology is used for communication media [4].

On the spectrum can be known its frequency, wavelength or energy. Electromagneticwave pectrums include: Purple color has a frequency of 668-789 THz, blue has a frequency of about 606-668 THz, green has a frequency of about 526-606 THz, yellow has a frequency of about 508-526 THz, orange color has a frequency of about 484-508 THz, and red color has a frequency of about 400-484 THz [5].

Based on the explanation above about the concept of visible light, it must be understood especially by seorang physics education

students. The condition of the level of understanding of physics education students can be seen in the value data obtained from the research. Thus, this study aims to determine the level of understanding of physics education students towards the concept of visible light on the material of the electromagnetic wave spectrum.

RESEARCH METHODS

This research method uses the descryptive method. Descriptivemethods are a method of purposefulness to systematically create descriptions and descriptions and facts [6]. Quantitative research is the process of finding knowledge using numbers for analysisor information [7].

1. Sample

Ampel is the sum of the shares in a population [8]. The research sample of this study was a physics fish pendid student at the University of Jember. After distributing the questionnaire, 46 respondents were obtained.

2. Research Instruments

Researchinstruments are tools for collecting data used by researchers [9]. This study used 10 questions about visible light in the form of multiple choices. The value obtained by each correct question is 10, while if the answer is wrong, it gets a value of 0.

3. Data Sources

A data source is the source from which the data is obtained. Primary data is data obtained directly [10]. Sumber data of this research is the filling out of a questionnaire by physics education students of the University of Jember.

4. Data Collection Techniques

Thetechnicality of data collection is an important step in the study. This is because the main purpose of the study wasto obtain data [11]. Thisresearch uses data collection techniques with a survey method in the form of a questionnaire design using *google form*.

5. Data Analysis

Analysis of data is a way to mencari as well as organize the results of research systematically [12].

This study uses data analysis with a descriptive method in the form of percentage values and calculates the average, median, mode, range, variance, and standard deviation. The calculation of such data uses *microsoft excel*.

a. Mean *(Mean)*

$$Mean = \frac{Jumlah\ data}{Banyak\ data} \quad [13]$$

b. Median

The method of determining the median is to compile a series of numbers in a data which will later determine the value in the middle [14].

c. Mode

Mode is a value that often appears.

d. *Range*

A range is the difference between data from the largest value and data of small value [15].

e. Variance

$$S^2 = \frac{\Sigma(Xi - X)^2}{n}$$

f. Standard Deviation

$$SD = \sqrt{\frac{\Sigma(Xi-X)^2}{n}}$$

RESULTS AND DISCUSSION

Table 1. Grouping Questions By Percentage and Category

No	Question Categories	Correct Frequency Of Answers	Percentage (%)
1	Easy	40	87
2	Easy	38	82.6
3	Easy	35	76.1
4	Easy	34	73.9
5	Keep	33	71.7

6	Keep	29	63
7	Keep	27	58.7
8	Difficult	26	56.5
9	Difficult	25	54.3
10	Difficult	24	52.2
Mean (Mean)		31	67.6

Table 1 is the data of research results that have filled out a questionnaire on the percentage of the number of frequencies that answer correctly each question based on the question categories, namely easy, medium, and difficult. Based on the table at number 1, it is included in the category of easy questions with a frequency of 40 correct answers and a percentage of 87%. Question number 2 is included in the easy category with a frequency of 38 correct answers and a percentage of 82.6%. In question number 3, the frequency that answered correctly was 35 with a percentage of 76.1%. Question number 4 is included in the easy category with the frequency of answering the correct question is 34 and the percentage is 73.9%. Question number 5 belongs to the category of medium questions with the frequency of answering correct questions is 33 and a percentage of 71.7%. Question number 6 is included in the category of medium questions with those who answer the correct questions are 29 and a percentage of 63%. Question number 7 belongs to the category of medium questions with the frequency of answering the correct questions is 27 and the percentage is 58.7%. Question number 8 is included in the category of difficult questions with the frequency of answering the correct questions is 26 and the percentage is 56.5%. Question number 9 is included in the category of difficult questions with a frequency of answering correct questions of 25 and a percentage of 54.3%. Question number 10 is included in the category of difficult questions with the correct number of 24 and a percentage

of 52.2%. From these data, the average frequency of those who answered correctly each question was 31 and the percentage was 67.6%.
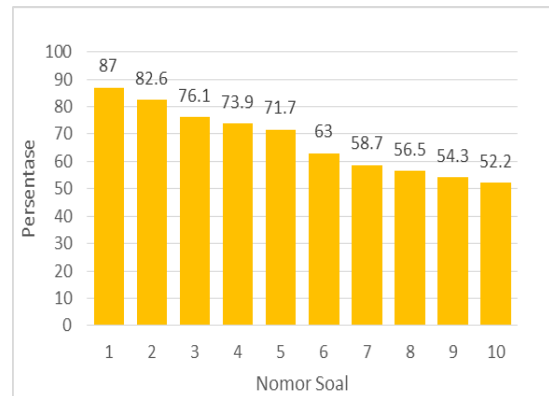
Figure 1. Grafik grouping questions by percentage and category

Figure 1 is a graph of grouping questions by percentage and category. The graph data obtained from the results of filling out the questionnaire and presented is also as in table 1. The graph states the relationship of each number to the size of the percentage. The graph shows that the larger the question number, the smaller the percentage value. Conversely, the smaller the question number, the greater the percentage value. This means that questions number 1-4 include easy question types, questions number 5-7 are classified as medium questions, and questions number 8-10 include difficult question types. The percentage value in a row in questions numbers 1-10 is 87%; 82,6%; 76,1%; 73,9%; 71,7%; 63%; 58.7%; 56.5%; 54.3%; and 52.2%.

Table 2. Grouping of Student Learning Outcomes Assessment

Value	Value Categories	Letter
≥80	Special	A
$75 \leq AB < 80$	Excellent	Off
$70 \leq B < 75$	Good	B
$65 \leq BC < 70$	Good Enough	BC
$60 \leq C < 65$	Enough	C

| 55≤ *CD* < 60	Less	CD
50≤ *D* < 55	Less	D
45≤ *DE* < 50	Very Lacking	Of
< 45	Very Lacking	And

Table 2 is a grouping of assessments of student learning outcomes. Values that indicate numbers get a special category and are denoted by the letter A. Values that are at the number 75 belong to the excellent category and are symbolized by the letter AB. Students who obtained a score of 70 belonged to the good category with the letter B. In the score obtained between 65, they were included in the category of quite good and denoted by the letter BC. Students who get a score of 60 are included in the sufficient category and are symbolized by C. Grades that are between 55 and 50 are included in the less category and are successively symbolized by CD and D. Students who obtain grades 45 and <45 are included in the very less category and are symbolized by DE and E. $\geq 80 \leq AB < 80 \leq B < 75 \leq BC < 70 \leq C < 65 \leq CD < 60 \leq D < 55 \leq DE < 50$

Tabel 3. Grouping Values by Percentage and Category

No	Value	Frequency (people)	Percentage (%)	Category Value
1	20	1	2.17%	Very Lacking
2	30	2	4.35%	Very Lacking
3	40	6	13.04%	Very Lacking
4	50	5	10.87%	Less
5	60	3	6.52%	Enough
6	70	10	21.74%	Good
7	80	9	19.57%	Special
8	90	6	13.04%	Special
9	100	4	8.70%	Special

Table 3 is a grouping of values by percentage and category. Based on the results of

filling out the questionnaire, students who scored 20 totaled 1 person with a percentage of 2.17% and the category was very lacking. At a value of 30 it was obtained by 2 people with a percentage of 4.35% and a category of very lacking. The value of 40 was obtained by 6 people with a percentage of 13.04% and the category was very lacking. The score of 50 was obtained by 5 students and a percentage of 10.87% and included in the less category. The value of 60 was obtained by 3 people and a percentage of 6.25% and included in the sufficient category. A score of 70 was obtained by 10 students, a percentage score of 21.74% and a good category. There were 9 students who scored 80, a percentage score of 19.57%, and a special category. The score of 90 was obtained by 6 students with a percentage of 13.04% and a special category. Students who obtained a score of 100 with a total of 4 people and a percentage of 8.70% and a special category.
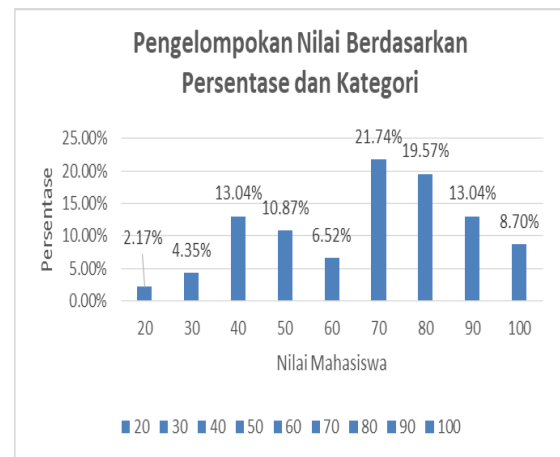
Figure 2. Graph of Grouping Values By Percentage and Category

Figure 2 is a graph of grouping values by percentage and category. The graph shows the highest score obtained by physics education students, which is 70 with a percentage of 21.74% as many as 10 people. The smallest score obtained by physics education students is 20 people with a percentage of 2.17% with a total frequency of 1 person.

Table 4. Statistical Calculations Using

Microsoft Excel

Statistical Calculation	
Mean	67.61
Median	70.00
Mode	70.00
Range	80.00
Variance	435.59
Standard Deviation	20.87

Table 4 is the result of statistical calculations using *Microsoft Excel.* Based on the results obtained the values of mean, median, mode, range, variance, and standard deviation. The average obtained by students is 67.61, which means that it is included in the category of quite good. The median magnitude or middle value obtained is 70. The acquired mode value is 70. The obtained range is 80. The variance value obtained was 435.59 and the standard deviation was 20.87.

CONCLUSION

Based on the results of this study, it can be concluded that the average understanding of physics education students towards the concept of visible light on the electromagnetic wave spectrum is quite good. The average score obtained by physics education students with a sample of 46 respondents was 67.61. In the results of this study, the same mode and median values of 70 were obtained. The most questions with the correct answers are found in number 1 as many as 40 students answered correctly with the easy category and a percentage of 87%. The questions with the least correct answers are found in number 10 with 24 students answering correctly including the category of difficult questions and a percentage of 52.2%. The lowest score obtained by physics education students was 20 as many as 1 person with a percentage of 2.17% with a very lacking category. The highest score obtained by physics

education students was 100 as many as 4 people with a percentage of 8.70% and classified as a special type of category.

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