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Students' Scientific Attitude on the Experimental Respiratory System of Physics Material

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Abstract. This study aims to determine the scientific attitude of junior high school students on the experimental in respiratory system of physics material. This research is a Research and Development (R and D) type. The development model used contains procedures from define, design, develop, and disseminate.The data collection technique was carried out using a scientific attitude questionnaire. The scientific attitude questionnaire contains 11 positive and negative questions. The questionnaire was prepared using a Likert scale with the answers TS (Disagree), KS (Disagree), S (Agree) and SS (Strongly Agree).The sample was selected using purposive sampling method, with a total of 10 students of class VIII SMP Negeri 1 Mantewe.Based on the research, results each aspect of scientific attitude are 79.83% for curiosity in a good category, 85.63% for Open-mindedness in a very good category and the last 80% for Honesty in a good category. That can conclude that all percentage for scientific attitude of students is 81.82% in the good category.

INTRODUCTION

Education is a process of transformation or change in human development to become more qualified so that it can meet personal, community and state needs. Currently, science learning is carried out in an integrated manner. Not only one subject but integrating objects such as Chemistry, physics and biology [1]. This learning is expected to be able to answer the challenges of the 2013 curriculum to produce students who are skilled at thinking critically, innovative and sensitive to changing times.

The challenge of learning with the 2013 curriculum is to produce students who not only excel in science, but also have a good attitude like a scientist. According to [2] The focus of science learning is generally in the realm of knowledge and processes. In addition, at this time, the focus of several teachers was later developed into the realm of attitude and creativity. Science learning should stimulate students to apply and combine concepts and process skills with reality through a scientific attitude. The current scientific attitude of students is still not maximized; it is necessary to continue to be trained in learning designed using a scientific or scientific approach [3,4].

The government's effort to answer the existing problems is by developing the curriculum. The 2013 curriculum which is currently used in Indonesia is one of the curricula that is expected to be able to provide students with a meaningful learning experience. Meaningful learning refers to the goal of knowledge transfer. Knowledge transfer means applying the transfer of knowledge concepts from teachers to students through learning that involves students. When transfer occurs the concept of knowledge will enter into long-term memory [5]. The 2013

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curriculum gives teachers the freedom to determine everything needed in the learning process as well as the selection of teaching materials.

Teaching materials are all tools or materials used by teachers or instructors to assist the process of teaching and learning activities. Some forms of teaching materials include visual teaching materials. Visual teaching materials can be in the form of handbooks, books, modules, student worksheets, student books, brochures, leaflets and so on [6]. Student worksheets are teaching materials that contain instructions as well as steps in solving problems through scientific investigations or activities that refer to basic competencies.

Student worksheets has functions such as being used for teaching materials, activating students, being a medium to facilitate understanding concepts, student worksheetsare also used to train students to use scientific methods to make students accustomed to having scientific attitude skills [7]. Therefore, the researchers developed the student worksheets Material Physics in the respiratory system. This material contains the relationship between the laws of physics that apply in the mechanism of the respiratory system. The product is prepared prioritizing scientific principles in order to train students to behave like a scientist. This learning is a cognitive learning method which according to the teacher is more creative in creating situations that can make students learn to actively find their own knowledge [8]. The purpose of this study is to describe how the scientific attitude of students in student worksheets which contains experiments on physics material in the respiratory system.

RESEARCH METHODE

This research is a Research and Development research. The development model used contains procedures from define, design, develop, and disseminate. The first stage define starts from making observations related to needs analysis for both students and teachers. During the pandemic, learning is carried out online, so in this study the needs of teachers and students obtained are a medium that can facilitate experiments in science learning. After obtaining the needs of students and teachers. The researcher continued in the second stage, namely design, which made the Draft I product, namely LKPD which contained material as well as Experimental Physics material in the respiratory system. The third stage, develop, is to carry out product feasibility tests by experts and readability tests by conducting limited trials. In the third stage, a revision of Draft II was obtained from the results of expert input and a limited test. The fourth stage of disseminate is the dissemination of the product. Dissemination is done by conducting field tests.

The purpose of this study is to analyze the scientific attitude of students by using student worksheets material physics in the respiratory system. In the fourth stage, namely disseminate, a field test of product use in learning is conducted. Learning is carried out remotely so that students use the student worksheets equipped with the video to conduct experiments independently or in groups of 2 people. The experiment was carried out by making a model of the lungs and the mechanism of action of the lungs related to the laws of physics. The data collection technique was carried out using a scientific attitude questionnaire or questionnaire. The scientific attitude questionnaire contains 11 positive and negative questions. The questionnaire was prepared using a Likert scale with the answers TS (Disagree), KS (Less Agree), S (Agree) and SS (Strongly Agree). The score for each answer choice depends on the positive or negative statement. If the positive statement scores Strongly Agree 4, Agree 3, Less Agree 2 and Disagree 1. As for the positive statement the score Strongly agrees at 1, Agree 2, Less Agree 3 and Disagree 4. The sample was selected using purposive sampling method, with a total of 10 students of 8th Student in Junior High School.

Data from the results of filling out questionnaires by students will then be analyzed quantitatively using the following equation:

$$Percentage = \frac{Score}{Score\ Max} \times 100\% \quad (1)$$

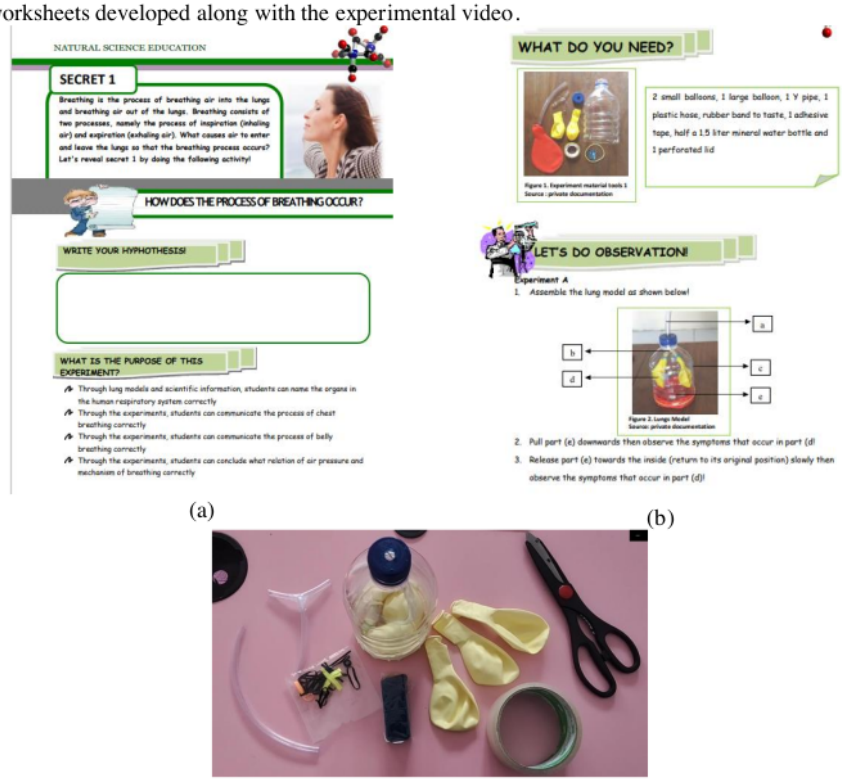
Then the results are categorized by Table 1 [9]:

TABLE 1. Criteria for response and science attitude

Interval	Criteria
84%-100%	Very good
68%-83%	Good
52%-67%	Enough
36%-51%	Less
≤35%	Not Good

RESULT AND DISCUSSION

Student worksheets which is a tool used by teachers as a scientific-based learning media [10]. Student worksheets contains experimental objectives, materials, experimental steps, discussion sheets and practice questions. In this study, the product developed was not only Student worksheets but also equipped with videos. This is so that students can understand the experiment to be carried out. This convenience must be provided because at this time learning is carried out boldly or remotely. According to [11]. During the pandemic, the experiment can be carried out independently using various tools that have been prepared in advance by the teacher. The following is a picture of student worksheets developed along with the experimental video.



(a) (b)

(c)

FIGURE 1. a) shows the initial part of the LKPD regarding the practicum theme and objectives, b) the material tools section is also experimental steps, c) this section is one part of the video regarding the tools and materials needed

Student worksheets is used by students to study independently. One of the goals of education is to carry out meaningful learning. Meaningful learning will help students remember the concept of the material. Remembering concepts not only in short-term memory but long-term memory. This is in accordance with what was stated by [5]

that learning must occur in a transfer process so that concepts can be embedded in memory. In addition, a meaningful learning process can also be referred to as learning by doing. Learning by doing will help students become more independent and have the attitudes that must exist in a researcher or scientific attitude in accordance with the objectives of the 2013 curriculum.

Scientific attitude is one of the attitudes that must be a student. Scientific attitude is defined as an attitude that is based on scientific thinking, where a person has a high curiosity, thinks rationally, thinks openly, thinks critically, objectively, and humbly [12,13]. This study only reviews aspects of scientific attitude, namely curiosity, Open-Mindedness, and honesty. This aspect was chosen because it is in accordance with the objectives contained in the objectives of the science lesson in the 2013 curriculum. The results of the student scientific attitude questionnaire analysis, obtained the percentage of each aspect in Table 2.

TABLE 2. Results of Students' Scientific Attitude

Aspect	Percentage	Criteria
Curiosity	79.83%	Good
Open-mindedness	85.63%	Very Good
Honest/Objective	80.00%	Very Good
Rata-rata	81.82%	Good

Table 2 shows that the results of the scientific attitude of students on average have a percentage of 81.82% in the good category. These results show that the behavior of students is in a good category in applying the scientific method in a lesson. Scientific attitudes must be presented in learning because scientific attitudes are related to a habit. If students are accustomed to doing scientific learning, it will lead to a scientific attitude in student [14]. Each aspect of science attitude can be explained as follow:

Curiosity

Curiosity is a feeling of curiosity about an event/event/phenomenon [15]. One of these aspects is very important in learning, high curiosity will give a thirst to learn something. This study shows the percentage of curiosity is 79.83%. The curiosity aspect explains in the Table 3.

TABLE 3. Curiosity Result Data

Statement	Percentage	Criteria
I am enthusiastic in participating in the ongoing learning activities	75.00%	Good
I am active in asking about the material being studied to friends or teachers	62.50%	Enough
I am looking for information or answers regarding the material being studied	85.00%	Very Good
I seek answers to each question honestly (don't cheat)	95.00%	Very Good
Average	79.38%	Good

The results in table 3. show that the second statement related to the activeness of students in asking questions is still in the sufficient category with a percentage of 62.5%. This is due to several things, the LKPD that is given online makes students less able to interact with the teacher and do not even know the teacher at school directly. This reluctance causes students to be reluctant or less in asking questions. According to [16] one of the factors that fosters curiosity is asking questions. However, due to environmental or instrumental factors such as learning design, the ability of the teacher, or the stimulus provided will affect the desire of students to ask questions.

Open-Mindedness

The next aspect of the scientific attitude is open-mindedness. Open-mindedness is also called the ability to accept argue from other people [17]. The results as shown in the Table 4.

TABLE 4. Open-Mindedness Result Data

Statement	Percentage	Criteria
I do not doubt the findings that the group mates got	90.00%	Very Good
I interact and work well with group friends	80.00%	Good
I feel not arrogant with my opinion about the material being studied	85.00%	Very Good
I have discussions with group friends in determining the outcome decisions based on the facts obtained	87.50%	Very Good
Average	85.65%	Very Good

Based on Table 4, the data regarding aspects of open-mindedness in scientific attitudes show results in the very good category, the percentage is 85.65%. Scientific attitude really requires the ability to open-mindedness when do working together with team. Student with open-minded attitude can bring the team to evaluate the activities. Those who try to be open-minded must steer clear of bias, prejudice, doctrinaire beliefs, hasty conclusions, fear of the truth, and pressure to conform, all of which undermine attempts to examine evidence seriously [18]. By being treated like scientists, students are trained to be diligent, curious in seeking information, honest in processing data, open to accepting opinions from others, and thorough in order to obtain as valid information as possible.

Honest

The next scientific attitude is honest and objective. This attitude is related to the behavior of a scientist who must make decision based on data and not making it up [8]. The results of research on honest and objective aspects of scientific attitudes can be seen in Table 5.

TABLE 5. Honest and objective data

Statement	Percentage	Criteria
I do the right steps when doing learning activities	85%	Very Good
I seek answers to each question honestly (don't cheat)	80%	Good
I changed the experimental data I obtained	75%	Good
Average	80%	Good

Honesty aspects on average obtained results with a very good category of 80%. This shows that students have good objectivity and honesty. This is required by a scientist. The objective nature will bring students to be open-minded and accept facts and circumstances [19]. Based on research conducted [3] learning science that uses practicum and experiments can help students to practice doing something based on the scientific method. This means that the student worksheet which contains experimental physics material in the respiratory system can familiarize students with a scientific attitude.

Overall, the results of the research on scientific attitudes possessed by students are in the good category. Scientific attitude is the dominant and important attitude that students have to support the 2013 curriculum. The ability to systematically follow scientific steps in solving problems helps students quickly master material concepts. This scientific attitude needs to be trained regularly to become a habit [20]. Lessons must be packaged creatively, attractively, and stimulate the ability of students to think [21]. One form of innovation carried out in this research is developing a product in the form of student worksheets which contains experiments on physics material in the respiratory system. The student worksheetshave helped students to learn although currently learning is done online.

CONCLUSION

Based on the research conducted, results each aspect of scientific attitude are 79.83% for curiosity in a good category, 85.63% for Open-mindedness in a very good category and the last 80% for Honesty in a good category. That can conclude that all percentage for scientific attitude of students is 81.82% in the good category. The data shows that students have ability to scientific attitude.Scientific attitude is one of the goals in the 2013 curriculum that must be achieved together. Therefore, the 2013 curriculum has given teachers the freedom to innovate in learning, so that teaching and learning activities run pleasantly in accordance with scientific principles.

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