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Development of Science Teaching Materials Based on the Scientific Approach to Improve Student Learning Results

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***Abstract*—This study aims to develop teaching materials using a scientific approach to improve student's learning outcomes in the static electricity concepts. This study refers to Research and Development method following the stages of implementation according to Borg and Gall. The trial subjects consisted of theoretical and empirical trials. Theoretical trials involved experts in designing teaching and science learning materials, while the empirical trial comprised of students of grade IX. The instruments used were interviews, questionnaires, and test. The data obtained were analysed descriptively and statistically. The results show that the validation of teaching and learning materials by experts are included in the very strong category with a value of 91 % and 93 % respectively. Moreover, the teaching materials with a scientific approach can improve student learning outcomes.**

Keywords: teaching materials, scientific approach, learning outcomes

I. INTRODUCTION

Learning Natural Science is expected to be a media for students to learn themselves and the natural environment and further to apply it in real-life problem. For the Junior High School level, science learning is expected to have an integrated learning emphasis directed at learning experiences to design and create works through the application of the concept of Natural Science and the competence of scientific work wisely. In order for natural science learning to work as expected, it is better for science learning to be carried out using a scientific approach [1].

The scientific approach invites students to carry out the process of finding knowledge regarding subject matter through various scientific process activities as carried out by scientists in conducting scientific investigations. Therefore, the learners are directed to discover various facts, build concepts, and new values needed for their lives by themselves. The learning process is directed at developing student's skills in processing knowledge, discovering and developing their own facts, concepts, and values [2].

Static electricity is one of the materials in natural science subjects that discuss the electrical phenomenon with a static source charge and some material, namely the electric force or often also called the Coulomb force and electrostatic force, electric fields, electric potential energy, and capacitors. This static electricity material must be mastered by students because it becomes a provision in understanding the use of static electricity which in fact has been widely used in everyday life. How the connection between the various products that we unconsciously use is a contribution of physical knowledge, especially the field of static electricity, including the working principle of capacitors in the camera flash lights, radio tuning, and defibrillators.

In accordance with the characteristics of science, learning science must reflect the competence of scientific attitudes, scientific thinking, and scientific work skills. Learning activities carried out through the process of observing, asking, trying or collecting data, associating or reasoning and communicating. Natural Science is a subject that requires a lot of relatively high intellectuality so that most students have difficulty learning it. This condition is further compounded by the use of inadequate teaching materials. The ability of teachers to design teaching materials becomes a very important role in determining the success of the learning process and learning through a teaching material [3,4].

Learning material in the context of learning is one component that must be present, because learning material is a component that must be studied, examined, and made into material that will be mastered by students and at the same time can provide guidelines for learning it. Without learning material, learning will not produce anything [5,6]. Development of teaching materials that are fun and instil moral values for students is very necessary. This is to improve the quality of students in the realm of knowledge, skills, and attitudes that are at the core of the 2013 curriculum. Based on texts, students are required to actively observe, ask questions, reason, try, and communicate matters relating to the material to

be studied. The text is used by educators to develop quality teaching materials and be able to instil good moral values.

Preliminary research showed that the teaching material was still lacking in the Junior High School in Bitung. Student used only worksheet that contains a summary of the material and exercises that must be done. Teaching materials that use scientific approach to support the implementation of learning have not yet existed so it has an impact on the low student learning outcomes. Therefore, this study focused on development of science teaching materials based on a scientific approach to improve the learning outcomes of students.

II. Research Methods

This study used the "Research and Development" (R & D) method by following the development according to Borg and Gall [7]. The instruments used in this study consist of seven stages as follows:

- Expert Validation Questionnaire: This instrument is used to obtain data on the assessment of experts on the tools and learning materials. The results of this assessment are used as a basis for the improvement of each teaching material.
- Student Response Questionnaire: This questionnaire is used to determine student responses to learning activities. The questionnaire is filled out after the whole learning process ended.
- Learning Outcomes Test: In this study the test is used to obtain data on student learning outcomes in learning before and after using science teaching materials based on a scientific approach to static electricity.
- Interview: The interview instrument is used in taking initial information about the condition of students and schools through science subject teachers.
- Validation: Design validation is a process of activities to assess the design of the product, in this case a new learning approach will obviously have a good effect. Product validation is done through expert validation and field test. In the expert validation stage, the product repairs are carried out by experts. Various input from experts in the framework of the product will be used in research. Media expert validation uses questionnaire to assess the developed media teaching materials. Material expert validation uses questionnaire to assess the developed physical material. In the field test, the product was used by targeted subject. The design used for field testing is quasi-experimental. The subject was 30 students of one of the Islamic Junior High School in Bitung. The data was then analysed using paired sample t-test, using SPSS 22 software. The research hypothesis is:
- Ho: The average learning outcomes after learning using teaching materials based on a scientific approach is smaller or equal to the average learning outcomes before learning.
- H1: The average learning outcomes after learning using teaching materials based on a scientific approach is greater than the average learning outcomes before learning.
- Product Revision Based on Validation Results: This stage is the final revision of the product produced. Products that already exist in this stage are products that can already be defined. The revision is based on field trials.
- Product Dissemination: This stage is the step of reporting products that have been produced at scientific meetings or journals.

III. Results and Discussion

A. Learning Planning

The stages of this development were carried out to produce an initial form of teaching material using the scientific approach. At this stage the material used in learning was determined, as well as the tasks and practicums. Various literature and references, scientific works, and journals were gather to enrich the contents in teaching materials. All input and suggestions from the experts were recorded and then used as evaluation material in an effort to improve research products. The instrument used in the product evaluation stage after field trials were conducted, namely student learning outcomes tests and student responses to the research conducted.

B. Exploration Study

Teaching materials compiled using a scientific approach are preceded by exploratory studies. At this stage, a preliminary study is carried out to observe the place or school to be carried out. Observations made by conducting interviews with science teachers in schools. The results shows that students used worksheet that contains a summary of the material and exercises that must be done. Besides other printed books used in teaching and learning activities contain only a long description of the material with a decrease in a lot of formulas. There was no teaching materials that use scientific approach to support the learning in accordance with the 2013 curriculum.

C. Initial Product Form Development

At this stage literary materials were collected in the form of papers, science textbooks, and various animated images on static electricity material. All literary materials were processed using M-Word 2010 to produce teaching materials using scientific approach. Teaching material was made based on 2013 curriculum which is implemented in the school.

D. Validation of Instructional Material

The instruments used was questionnaires for the instructional material experts. The instructional material design expert assessed whether or not the product is appropriate. The design expert was a doctor in the field of Physics Education and has experienced in designing good teaching materials. After being analysed based on the data obtained, then the

percentage of the count is calculated. The percentage value refers to the location of the category on a continuous line. The percentage is calculated by the number of values achieved divided by the maximum number of results multiplied by 100%. The expert judgment of the material shown by the continuum line is very strong, which stands at 91%, meaning that the teaching material gets a good rating and in general the components of the teaching material are already very good. Seeing from the creativeness the validity and revision of the product are at a valid level and no need to revise again.

E. Validation of Learning Material

The instruments used was questionnaires for the learning materials experts. The learning material expert assessed the suitability of the material with the competency standards, basic competencies, learning objectives, and writing the contents of the material. The validation of the learning material expert was a doctor in the field of Physics Education so it is very feasible to assess Physics material especially static electricity material. After being analysed based on the data obtained, then the percentage is calculated. The percentage value indicates the location of the category in a continuous line. The percentage is calculated by the number of values achieved divided by the maximum number of results multiplied by 100%. On the continuum line shows the expert material assessment is in a very strong category with a rate of 93%, meaning that the material that has been developed gets a good rating so that it can be used in field research. Seeing the validity and revision of product creations are at a valid level and there is no need to revised again.

F. Large Group Trial

Large group trials was performed to determine the effectiveness of the products developed to achieve the expected learning quality. This research was conducted in one of the Islamic Junior High School in Bitung with 30 students on static electricity and held 4 meetings.

The learning outcomes were used to test the hypotheses of the study. Beforehand the data of learning outcomes were tested for normality of the data. If the significance obtained> α 0.05, then the sample comes from a normal distribution population, while if the significance obtained <α, then the sample comes from a population that is not normally distributed. From the data normality test table, it was obtained that all learning outcomes data are at a significance level of more than 0.05, so it can be concluded that the data are normally distributed.

The next step was a comparison test of the average learning outcomes to test the research hypothesis, using comparative analysis (Analyze Compare Means). The data compared were resulted from experimental class, which received the developed teaching materials, and control class, which did not receive the developed teaching materials. Comparison of the significance value obtained in pair 1 of the first meeting of experimental class was 0.885> 0.05 so that H0 is accepted and reject H1. Whilest the significance value of the control class was far above the specified significance value. At second, third and forth meetings, the significance value was far below 0.05, so H0 was rejected and accepted H1. It demonstated that the learning products used can have a significant influence in improving student learning outcomes. The comparison between experimental and control class in pairs 5, 6, and 7 gave significance values below 0.05. The average learning outcomes of experimental class was higher than control class, with the significance value of less than 0.05. While the comparison between learning process of experimental and control class in pairs 8, 9, and 10 did not give any significant effect, with the significance values of above 0.05. This means that the product used provides the same effect, which can improve student learning outcomes. From the data above, it generally showed that 30 students who were the subject of research in large groups gave varied responses to the statements submitted in the student response questionnaire. Based on data above, the students gave a positive response to the learning product.

Further analyses was performed using pretest-posttest data of experimental class (Table 1). It can be seen that at the first meeting there was no significant effect on student learning outcomes. However, different results were observed at 2nd, 3rd, and 4th meeting. The increase obtained occurs at those three meeting even though the increase in learning outcomes experienced was not too large, but with this result shows the influence exerted through the learning products used.

TABLE I. AVERAGE SCORES OF PRE-TEST AND POST-TEST

Meeting order	Pre-test	Post-test
1st	38.57	38.33
2nd	38.47	62.73
3rd	38.20	61.10
4th	43.40	62.80

The application of learning using a scientific approach helps students to explore and discover their own concepts related to the subject matter and create learning conditions that encourage students to find out information from various sources through observation, and not just to be informed. Learning that involves a scientific approach will involves process skills, such as observational activities or observations needed for the submission of hypotheses or data collection. Through direct experience, a person can better appreciate the process or activity carried out so that it will have a positive impact on student learning outcomes. The results of this study were in line with previous research [2].

Students' perception of this electronic module shows the category of very much agree. The average scoring perception of students as a whole is 81.53 and stated modules have very good criteria [1]. Through this research it can be concluded that the quality of products in the form of scientific-based physics modules can help students in the independent learning process. Moreover, it can be one of the alternative teaching materials in learning physics. The results of this study provide products that can direct and guide students in the teaching and learning process so as to improve student learning outcomes.

G. Revision Based on Validation Results

After going through the stages of development and testing in small groups and large groups this learning product has been revised or improved. This final product improvement is needed to perfect the device based on input from reviewers and students. The following are the final development products:

- Teaching materials must focus more on each step of the scientific learning approach and put more emphasis on the purpose of the material used.
- The material in the learning device is deeper and the pictures in the material are clarified so that students will understand more about static electricity.

H. Product Dissemination

The results of the development of this learning product were discussed at a scientific meeting. These development products have a positive impact on the development of the quality of learning including:

- Implementation of development products can improve student learning outcomes. Implementation of learning by using product development an increase in learning outcomes before and after the implementation of learning.
- Assist teachers in implementing learning in the classroom and can encourage teachers to innovate in developing better teaching materials.

IV. CONCLUSION

It can be concluded that the development of science teaching materials using a scientific approach to static electricity is good and appropriate to be used in the implementation of learning. The development of science teaching materials by using a scientific approach to statistical electrical material can improve student learning outcomes

REFERENCES

[1] A. Yadav, D.S. Psychometrician, D.S. Lundeberg, M.A. Bunting, and C.H., "Problem Based Learning Influence on Students Learning in an Electrical Engineering Course" , Journal of Engineering Education, vol. 100, issue 2, pp. 253-281. 2011.

[2] R. Fauziah, A.G. Abdullah and D.L. Hakim, "Pembelajaran Saintifik Elektronika Dasar Berorientasi Pembelajaran Berbasis Masalah", Innovation of Vocational Technology Education, Vol 9, No. 2, pp. 165-178. 2013.

[3] A. Machin, "Implementasi Pendidikan Saintifik Penanaman Karakter dan Konservasi Pada Pembelajaran Materi pertumbuhan, Vol. 3, No. 1, 2014.

[4] M. Abdul and C. Rochman. "Pendekatan Ilmiah Dalam Implementasi Kurikulum2013", Bandung, Remaja Rosdakarya, 2015.

[5] E. Purwaningsih, N. Fadiawati dan N. Kadaritna, "Penggunaan Pendidikan Scientific pada Pembelajaran Kesetimbangan Kimia dalam Meningkatkan Ketrampilan Elaborasi", Jurnal Pendidikan dan Pembelajaran Kimia, Vol 3, No. 1, pp. 1-14, 2014.

[6] W. Syafii and R.M. Yasin, "Problem Solving Skills and Learning Achievements Through Problem Based Module in Teaching and Learning Biology in High School", Asian Social Science Journal, Vol. 9, No. 12, pp. 220-130, 2013.

[7] M.W. Setiyadi, "Pengembangan Modul Pembelajaran Biologi Berbasis Pendekatan Saintifik untuk Meningkatkan Hasil Belajar Siswa", Journal Education Science and Technology, Vol.3, No 2, 2017.