

Development of Instructional Materials Based SETS (Science, Environment, Technology and Society) to Improve Participation and Learning Result Grade Sixth Elementary School in Electrical Energy Materials

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Abstract:- This research aims to produce instructional materials based SETS (Science, Environment, Technology and Society) approach eligible to improve participation and learning results in particular elementary school science materials of electric energy in sixth grade. This study is a research and development, which is a research to develop a product. Development of instructional materials in the form of Learning Implementation Plan (RPP), instructional materials based on SETS approach of electric energy materials, student activity sheets (LKS) and learning result tests. This study was conducted using 4-D models that define, design, develop and disseminate. The subjects were students of sixth grade in SDN Krembangan Selatan I and SDN Moro Krembangan Surabaya. Data collection through device validation sheets, observation, participation and learning result tests. The results showed that 1) is valid, according to the second assessment validator with a valid category, 2) practical, with the level of observers seen from the activity of students increasing at each meeting and implementation of RPP, 3) effective, visible from any significant difference between pretest and posttest results of tests of student learning result and positive participation of students. Based on the results of data analysis, it can be concluded that the development of instructional materials based on SETS (science, environment, technology and society) approach is valid, practical, and effective for improving participation and student learning result for sixth grade elementary school in the material of electric energy.

Keywords: instructional materials, SETS approach, student participation, learning result

I. INTRODUCTION

Natural Sciences (IPA) deals with how to find out about nature systematically, so that science is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles, but also a process of discovery. Science education is expected to be a vehicle for students to learn about themselves and the environment, prospects for further development in applying it in everyday life. Society is demanded by the needs in life, for that we need tools (technology) to facilitate the obtaining needs by considering the carrying capacity of natural resources. Science is needed to know natural phenomena (explanations).

Julianto (2011:5) said that the nature of science consists of three dimensions, namely the process dimension, the product dimension, and the scientific attitude. Science as a process involves the process or way of working to obtain results (products) so students are required to be able to think creatively. Ibrahim (2008: 5) said that developing science learning must be done by integrating aspects of scientific processes and attitudes and producing scientific products. Science learning should also be done by integrating scientific processes and attitudes in various student activities both hands-ons and minds-ons so that students "discover" the concept of science. The formation of scientific attitudes can be developed through science process skills.

Science process skills are very important skills to be trained and mastered by every student. Through science process skills, students will be trained with several indicators that reflect their own learning activities related to information or knowledge, problems, and solutions related to learning material, so that later students are expected to think creatively in dealing with natural phenomena that occur around them.

The importance of process skills to be developed according to Ibrahim (2010: 72) is that with process skills a person will be able to learn independently, develop themselves, and learn for life. Process skills are skills needed in conducting research and problem solving. This problem-solving ability is one of the life skills that students need to have as provisions in continuing their lives.

In Permendiknas number 22 2016 it is also explained that with the Competency Standards of Graduates, learning objectives include the development of the realm of attitudes, knowledge, and skills that are elaborated for each educational year. The three competency domains have different trajectories (psychological processes). Attitudes are obtained through the activities of receiving, running, appreciating, experiencing, and practicing. Knowledge is gained through the activities of remembering, understanding, applying, analyzing, evaluating, creating. Skills are obtained through observing, asking, trying, reasoning, presenting and creating activities. From this it can be seen that in the learning process not only emphasizes the realm of knowledge.

How to teach and invite students to participate in saving electrical energy becomes a problem in learning science, because students have difficulty understanding the concepts and applications of these concepts resulting in low student participation so that it also impacts on the USBN scores of science subjects that are less than optimal. The low participation of students in saving electricity also affects the costs incurred for payment of electricity bills.

In the 21st century, the demands in developing students' potential are higher, one of which is the integration of material (thematic) in one subject or several subjects that make students more creative and skilled which will certainly support their abilities in the future. Thematic also has a weakness that is the lack of involving the environment, technology and society as a source of learning. The application of new approaches in the learning process will eliminate the boredom and boredom of students. This kind of science learning can be improved by the SETS approach (*Science, Environment, Technology, and Society*). SETS learning model is one of the meaningful learning concepts for students, because students are invited to directly study science material from the impact of technology in the surrounding environment. The learning process emphasizes competence in order to explore and understand nature around scientifically. Science education can be directed using SETS (*Science, Environment, Technology, and Society*) so that it can help students to gain a deeper understanding of the natural surroundings.

Teaching material is a book that contains subject matter in the form of certain concepts or understandings that will be constructed to students through the problems in it that are arranged based on the approach. Teaching materials are needed by students as a support for the smooth learning activities, both in class and at home. Besides the availability of teaching materials in learning

activities can trigger students and teachers to foster a spirit of learning and teaching.

In general, schools in Indonesia use teaching materials from the government or 2013 Curriculum student books. The book is a national standard book that is used throughout Indonesia. The teaching material used certainly has to provide more benefits in the effectiveness of learning. In fact, the teaching materials used at SDN Krembangan Selatan I used student books from the government. Student books are books used by students in learning with guidance from the 2013 Curriculum. As for some of the strengths of this book, it is of course already adapted to the 2013 curriculum including Graduates Competency Standards (SKL), Core Competencies (KI), and Basic Competencies (KD). Secondly, in this student book not only contained aspects that develop cognitive, but also affective and psychomotor developed.

In addition to the advantages of student books certainly not escape from shortcomings, as for the shortcomings of existing student books is the lack of depth of material for aspects of student knowledge. The existing material only discusses a small part of the core material, this is due to the use of integrated thematic which combines several materials so that in implementing learning students only know half of the material. Especially in exact material such as Natural Sciences and Mathematics, in student books the material is not too deep and the practice questions are not too complex, in the sense of not involving social elements as reference material even though the book is used in the upper class.

The activities in this student book have developed cognitive, affective, and psychomotor aspects but in its application it cannot be too complex and still lacking in developing students' scientific skills, so students are still having trouble finding understanding of concepts from a material. The obstacle is the lack of teaching material that makes students interested and enthusiastic in learning. Therefore learning materials are needed that can make students not only deep cognitive, but a good affective and psychomotor role to find concepts through the learning activity itself. Therefore it is necessary to develop new teaching materials, namely teaching materials based on SETS (science environment technology and sociology).

This teaching material can direct students to find concepts through their own activities or in work groups. Because in this teaching lesson, not only material can be obtained but it will combine several activities that support students' potential and students' process skills so that students can actively find and understand what they have found through the basic SETS approach that has been adapted to educational goals. In addition to the material and activities, of course, it is equipped with exercises to check the understanding of students.

The results of previous research conducted by Yulistiana (2015) states that SETS can make students know that technology influences the rate of growth of science, and its impact on the environment and society. SETS-based learning requires educators and students to explore all possibilities that can occur in the interrelationship between the concepts being taught and their influence with the learning process. From this research, the results obtained, SETS will be meaningful if treated as scientific work skills that are developed, applied and measured during the learning process. As for the development of this teaching material students' science process skills will also be simultaneously developed the desired attitudes such as creativity, cooperation, responsibility, and discipline in accordance with the emphasis of the relevant field of study and in accordance with science education related to how to find out about nature systematically, so that science is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles, but also is a process of discovery. The learning process emphasizes providing direct experience to develop student participation throughout the learning process.

Ausubel (in Dahar, 2011: 95) argues that learning is meaningful if the information to be learned by students is arranged according to the cognitive structure owned by students so that students can associate new information with the cognitive structure they have. This means that meaningful learning occurs when students can relate teaching material to the knowledge possessed by students. The subject of the lesson must be the same as the skills possessed by students and must be in accordance with the cognitive abilities possessed by students. Furthermore Ausubel said (in Julianto, 2011) there are three virtues of meaningful learning namely; 1) Information learned meaningfully longer can be remembered; 2) information learned meaningfully facilitates subsequent learning processes for similar subject matter; 3) Information learned meaningfully makes it easier to learn things that are similar even though forgetting has happened. The above description explains the link between the use of SETS-based teaching materials with Ausubel theory. The theory emphasizes that by building knowledge by linking real life in every learning, students will get good mastery of the material because the material will be embedded in students' memories for longer and train students' skills to think more creatively. The learning process in using problem based learning will increase student activity in the learning process, students are more active and the teacher's role is as a facilitator for students.

Teachers are required to have the ability qualifications in knowledge, skills, and skills, as well as a more stable and adequate attitude in the effort to create mastery of concepts and problem-solving abilities in learning science. The teacher also needs to learn and consider the problem of the right teaching approach that is appropriate to the level of student development and also pay attention to the purpose of teaching science itself. Considering the above, the writer makes the thesis title "Development of teaching materials based on the SETS (Science, Environment, Technology,

and Society) approach to increase the participation and learning outcomes of Grade VI students in primary schools in the subject of electrical energy"

Based on the background above, the purpose of this study is to utilize the environment, technology and society so that meaningful education is produced as follows: (1) find out the feasibility of teaching materials based on the SETS approach (science, environment, technology, and society) to be able to increase participation and learning outcomes of Grade VI students in electric energy material. (2) increasing the participation of Grade VI students in learning electrical energy materials, after using teaching materials based on the SETS approach (science, environment, technology, and society). (3) improving the learning outcomes of Grade VI students in electric energy material, after using teaching materials based on the SETS approach (science, environment, technology, and society)

II. THEORETICAL FRAMEWORK

➤ *Natural Sciences Learning*

According to HW Fowler, et al (1951) natural science is a systematic and formulated science, which deals with material phenomena and is based primarily on observation and induction. Learning is an active process (Rodriguez, 2001). Children learn by constructing the things they learn based on the knowledge they know, not passively accepting things. This understanding is rooted in a constructivist perspective. Constructivism itself is often found in various fields including psychology, philosophy, sociology, and education, as well as having significant implications in the study of natural science.

Students who are interested in natural science will feel that learning science is fun so that they will be enthusiastic about how natural science lessons impact their daily experiences (Murphy and Beggs, 2003). Effective learning by doing "activities" (learning by doing). Nevertheless, the essence of "activity" in learning natural science is "learning activity" (Fleer, 2007). Placing students at the center of the learning process Traditional teaching methods with expository approaches should begin to be reduced. Teachers who only transmit knowledge do not stimulate students to learn actively. This does not mean that the lecture method is not good, or students do not experience the learning process. Variations in the learning process more trigger students to actively learn (Rodriguez, 2001).

➤ *SETS (Science, Environment, Technology and Society) Approach*

The SETS approach is a real practice of the learning process in which the SETS vision is applied in the learning process (Binadja, 2006:5). The focus of SETS-based learning must be on how to get students to investigate to get knowledge related to science, the environment, technology and society that are interrelated. This means that students in their learning in addition to learning theories about science (science) they also look at their real life related to the theory being studied, so that it will have a positive impact

on students' understanding and daily activities. Asking students to investigate,

Binadja (1999b: 4) explains that the purpose of SETS education is that education can make students understand the main elements of SETS with the interrelationship of these elements when studying science. So it's not just for the benefit of humans. Because if it is only related to human interests, other organisms might not have the opportunity to live together, except those considered beneficial. Especially when dealing with greedy, bad people, bad attitude, and the like (this is the main target of implementing the SETS vision to improve its behavior). Science and technology based curriculum is developed on the basis of the awareness that science, technology that is around students always develops dynamically, and continuously.

Learning is carried out by upholding the five pillars of learning, namely: (a) learning to believe and fear God Almighty, (b) learn to understand and appreciate, (c) learn to be able to carry out and act effectively, (d) learn to live together and be useful for others; and (e) learn to build and find identity, through an active, creative, effective, and enjoyable learning process. Furthermore, in the SETS vision contained a conscious intention to choose or do the best in human efforts to take various actions, so as to create positive things such as good conditions, pleasant, safe, peaceful, mutually beneficial in and for the life of organisms in natural.

III. METHODS

This research is a type of research and development (*research and development*), that is a research to develop a product. The product produced in this study is the teaching material of electrical energy based on the approach of science, environment, technology and society (SETS) to increase participation and learning outcomes of elementary school science. According to Borg and Gall (1983:772) research development (research and development) is a process that is used to develop and also validate a product from being developed. This is also in line with the opinion of Sugiyono (2013:407) that development research is a method used to obtain a particular product, and test the effectiveness of the product.

The research design used in this study was Pretest-Posttest Control Group design. There were two groups chosen randomly, then given a pretest to find out the initial conditions. Was there a difference in initial ability the results of the pretest were good if the scores of the two groups did not differ significantly (Sugiono, 2013:113).

The Pretest-Posttest Control Group design pattern is carried out with replication 3 times with the same number of students, the same grade level, and homogeneous. This research activity aims to assess differences in the influence of SETS-based teaching materials on student participation and learning outcomes in electrical energy material or test hypotheses about the presence or absence of the effect of the treatment given.

Through this development research, the researcher wants to know that the use of teaching materials based on the SETS approach can increase the participation and learning result of Grade sixth students of SDN Krembangan Selatan I and SDN Moro Krembangan Surabaya in electrical energy material. The design of this study was used to test learning tools that have been developed by researchers. The purpose of the research is to produce learning tools that are practical, effective and effective to increase participation and learning outcomes of Grade sixth Elementary School students in electrical energy. The design of this study consisted of the specifications of the learning device and the results of the development of the learning device.

This research was conducted at SDN Krembangan Selatan I and SDN Moro Krembangan Surabaya. The selection this school as a place of research was because the researcher was also a teacher at the school making it easier to conduct research. Data collection techniques used by researchers are by means of tests and observations. Then the data analysis techniques used are student activities during the learning process, observation of student participation and analysis of student learning outcomes.

IV. RESULTS AND DISCUSSION

➤ *Results of Validation of Teaching Materials Developed*

The results of the development of teaching materials for electricity based on the SETS approach to increase participation and learning outcomes of natural science in elementary schools can be said to be feasible which includes valid, practical and effective. The following are the results of the validation of teaching materials, learning implementation plans, and learning test results obtained from the two validators, as follows:

Teaching material developed in this study took the form of printed media and was used as a reference for student learning to learn electrical energy material. Electrical energy teaching materials based on the SETS approach developed were then assessed by the validator and can be used with a few revisions that need to be improved

No	Rated aspect	Validator Rating		Average	Information
		V1	V2		
1	FEASIBILITY OF CONTENTS				
	a. Conformity with Basic Competencies	3	4	3.5	Valid
	b. Content truth (facts, concepts, theories)	4	4	4	Valid
	c. Cultivate curiosity	3	4	3.5	Valid
	d. Cultivate creativity	3	3	3	Quite Valid
	e. Benefits for adding insight into knowledge	3	4	3.5	Valid
	f. BAS can be used for both students and teachers	4	3	3.5	Valid
2	CONJECTION				
	a. Clarity of purpose	3	3	3	Quite Valid
	b. The order of presentation	3	4	3.5	Valid
	c. Completeness of information	3	3	3	Quite Valid
3	LANGUAGE AND READING				
	a. The material is presented in interesting languages	4	4	4	Valid
	b. Clarity of information and instructions	3	3	3	Quite Valid
	c. Conformity with Indonesian rules	3	4	3.5	Valid
	d. The communicative nature of the language used	4	4	4	Valid
	e. The use of language effectively and efficiently	3	4	3.5	Valid
	f. The terms used are precise and can be understood	4	4	4	Valid

Table 1:- Results of Validation of Student Teaching Material Assessment

Source: Data processed by the author, 2020

Based on table 1, the two validators have given a range of scores of 3-4, this shows that the students' teaching materials are feasible as research instruments and can be used in learning

The Learning Implementation Plan (RPP) that is developed illustrates the learning storyline that will be carried out in the classroom as well as student learning experiences based on time allocation as well as learning resources and tools. The developed lesson plans are assessed by the validator and can be used with little revision

No	Rated aspect	Validator Rating		Average	Information
		V1	V2		
	CONSTRUCT VALIDITY				
	Completeness of Rp				
1	Include the identity of the education unit, subjects, classes, semesters, subject matter, number of meetings, and allocation of learning time	5	5	5	Very Valid
2	Include competency standards and basic competencies	5	5	5	Very Valid
	Formulation of Indicators and Learning Objectives				
3	The suitability of indicators and learning objectives with competency standards and basic competencies	4	3	3.5	Valid
4	The suitability of indicators and learning objectives with the level of student development	4	3	3.5	Valid
5	The suitability of learning objectives with the principles of formulating learning objectives	4	3	3.5	Valid
6	Formulation of indicators and learning objectives using operational words that are measurable and or observable	4	4	4	Valid
	Preparation of Learning Materials				
7	The scope of material (breadth and depth) is in accordance with competency standards and basic competencies	4	4	4	Valid
8	Material truth	4	4	4	Valid
9	The suitability of the material with the abilities and needs of students	4	3	3.5	Valid
10	Material Systematics	4	4	4	Valid
	Selection of Learning Approaches				
11	The suitability of the learning approach with the learning objectives, competency standards, basic competencies, indicators, and material	4	4	4	Valid
12	The suitability of the learning strategy is determined by the child's development	4	4	4	Valid

13	The suitability of the learning strategy with the time available	4	4	4	Valid
Preparation of Steps / Learning Activities					
14	The suitability of the description of the activities of students and teachers for each stage of learning with the characteristics of learning objectives, indicators, and basic competencies	4	3	3.5	Valid
15	The suitability of the description of the activities of students and teachers for each stage of learning with the characteristics of approaches, models, strategies, methods / learning techniques used in the lesson plan	4	4	4	Valid
16	Determine the time allocation for each activity (preliminary, core and final learning activities)	5	4	4.5	Very Valid
Selection of Tools / Materials / Learning Resources					
17	Include learning tools / materials / resources	5	4	4.5	Very Valid
18	Alay / materials / learning resources with the characteristics of the learning objectives, indicators, competency standards, and basic competencies to be achieved	4	4	4	Valid
19	The suitability of the tools / materials / learning resources with the characteristics of student development	4	4	4	Valid
Assessment					
20	Write down aspects, techniques and instruments of assessment	4	4	4	Valid
Fill Validity					
21	The lesson plans that have been developed provide fulfillment of student learning outcomes	3	4	3.5	Valid
22	The developed lesson plans are in accordance with the SETS learning model	3	4	3.5	Valid
23	Science materials that are content in the RPP in accordance with the science principles of elementary school	4	4	4	Valid

Table 2:- RPP Assessment Validation Results

Source: Data processed by the author, 2020

Based on table 2, the two validators have given a range of 3-5 scores, this shows that the Learning Implementation Plan (RPP) is feasible as a research instrument and can be used in learning.

Student Activity Sheet (LKPD) developed by researchers is a guide for students to learn and teachers as facilitators and independent practice to understand the subject matter to be learned in a learning activity at school. LKPD developed by researchers has been validated by experts. Validated aspects in this LKPD include construct validity and content validity. Developed student worksheets are assessed by the validator and can be used with little revision.

No	Rated aspect	Validator Rating		Average	Information
		V1	V2		
1	VALIDITY CONTRACT Content Feasibility				
	a. Conformity with Basic Competencies	4	4	4	Valid
	b. Material truth	4	4	4	Valid
	c. Conformity to student needs	4	4	4	Valid
	d. Conformity with the needs of teaching materials	4	4	4	Valid
	e. Conformity with the learning model	4	4	4	Valid
	f. Benefits for adding insight into knowledge	4	4	4	Valid
	Serving				
	a. Clarity of purpose	3	4	3.5	Valid
	b. The order of presentation	3	4	3.5	Valid
	c. Completeness of information	3	4	3.5	Valid
	Language				
	a. Legibility	4	4	4	Valid
	b. Clarity of information and instructions	4	3	3.5	Valid
	c. Conformity with Indonesian rules	4	4	4	Valid
	d. The communicative nature of the language used	4	4	4	Valid
	e. The use of language effectively and efficiently	4	4	4	Valid
2	VALIDITY OF CONTENT				

a.	The developed student worksheets have given learning outcomes	4	4	4	Valid
b.	Worksheets developed in accordance with the SETS learning learning model	3	4	3.5	Valid
c.	The science material that becomes the content in the worksheet is in accordance with the elementary science principles	3	4	3.5	Valid

Table 3:- Result of Validation Student Worksheet

Source: Data processed by the author, 2020

Based on table 3, the two validators have given a range of 3-4 scores, this shows that the Student Worksheet (LKPD) is feasible as a research instrument and can be used in learning

The learning achievement test developed is a multiple choice test, a short answer and a description of the function to measure student learning outcomes. The test results that have been developed are assessed by the validator to find out the feasibility of the questions and can be used with little revision. The revisions are based on the suggestions of the validator

No problem	Fill Validity				Language and writing questions			
	Validator score 1	Validator score 2	Average	Ket	Validator score 1	Validator score 2	Average	Ket
1	4	4	4	V	5	4	4.5	VV
2	5	5	5	SV	5	5	5	VV
3	4	4	4	V	4	5	4.5	VV
4	4	5	4.5	SV	3	4	3.5	V
5	4	3	3.5	V	4	4	4	V
6	3	4	3.5	V	3	4	3.5	V
7	4	5	4	V	5	5	5	VV
8	5	4	4	V	4	3	3.5	V
9	4	3	3.5	V	4	5	4.5	VV
10	5	4	4	V	5	5	5	VV
11	4	4	4	V	4	3	3.5	V
12	4	3	3.5	V	3	4	3.5	V
13	4	4	4	V	3	4	3.5	V
14	3	4	3.5	V	3	4	3.5	V
15	4	3	3.5	V	4	4	4	V
16	4	4	4	V	4	3	3.5	V
17	4	4	4	V	3	4	3.5	V
18	4	5	4.5	SV	4	4	4	V
19	4	4	4	V	4	4	4	V
20	4	3	3.5	V	4	5	4.5	VV
21	3	4	3.5	V	5	5	5	VV
22	3	4	3.5	V	5	4	4.5	VV
23	3	4	3.5	V	3	4	3.5	V
24	4	4	4	V	4	4	4	V
25	4	5	4.5	SV	4	3	3.5	V

Table 4:- Result of Test Validation Learning Result

Source: Data processed by the author, 2020

Information:

VV : Very Valid

V : Valid

Based on the data in table 4, it can be seen that the results of the validator assessment on aspects of content and language validity and the writing of test results of learning outcomes in the form of multiple choice questions, short answers and descriptions that have been developed, obtain a range of 3-5 scores. This shows that the Learning Implementation Plan (RPP) is feasible as a research instrument and can be used in learning

Learning tools are one of the factors that determine the quality of learning to achieve learning goals. The development of learning tools is in accordance with the scaffolding theory proposed by Vygotsky, namely the development of devices that can provide feedback to students to improve their potential abilities.

Before conducting trials, researchers have validated the learning device that will be used. Validation of learning tools includes syllabus, lesson plans, student teaching materials (BAS), student activity sheets (LKS), and tests of critical thinking skills. Validation is carried out by expert

lecturers who are competent in their fields. This is done so that learning tools made are suitable for use in research. The learning kit is said to be valid with little revision if it gets an average score between 3.01 - 4.00 and the device is said to be very valid without revision if it gets an average score between 4.01 - 5.00.

RPP validation results that have been developed by researchers get an average score of 3.97 with a valid category and a slight revision. The matching rate (percentage of agreement) of the two validators is 97%. This can be stated that the lesson plans that have been made are suitable for use as learning tools based on the SETS approach. This developed RPP meets the components of the RPP listed in Permendiknas No. 23 of 2016 concerning general learning guidelines that contain learning objectives, materials, models, learning resources, and assessments.

The lesson plans developed by researchers were then reviewed and validated by two experts in the field of Natural Sciences. From the validation results obtained information that the lesson plans developed by researchers have good quality categories for all aspects of the assessment so that they can be used with little revision. Based on input from the validator, the revisions made in this RPP are (1) Adjusting the indicators and learning objectives with the specified basic competencies (2) The indicators are added about the sub material of the conductor / insulator so that it is more comprehensive. Based on the explanation above, the lesson plans that have been developed and revised can be used in learning for students in grade VI in electrical energy. Furthermore,

Worksheets developed by researchers are based on the SETS approach with the aim of improving student learning outcomes. This worksheet is a guide for students in conducting concept / principle / solution discovery activities in learning activities that hopefully can improve learning outcomes. This worksheet contains an understanding of concepts and observations and is directly related to students' lives so that their expectations with the SETS approach can improve learning outcomes. The worksheets that have been developed by researchers are then reviewed and validated by two experts in the field of Natural Sciences. From the validation results obtained information that the worksheet developed by researchers has good quality categories for all aspects of the assessment, so it can be used with a little revision. LKS validation results that have been developed by researchers get an average score of 3, 5 with a valid category and a slight revision. Based on the explanation above, the LKS that has been developed and revised can be used in learning on electrical energy material. Furthermore, the development of this worksheet can be a reference for teachers / other developers to develop worksheets based on the SETS approach

Results of validation of teaching materials Students who have developed researchers get an average score of 3.5 with a valid category. It can be stated that the students' teaching materials that have been made are valid and

appropriate to be used as learning tools. Development of Teaching Materials Students refer to electrical energy material based on the SETS approach. There are a number of suggestions from the validator needing to elaborate on BAS by adjusting basic competencies, adding discussion of potential energy and kinetic energy and electric power, at the end BAS needs to add a question matter.

The results of validation tests of critical thinking that have been developed by researchers from the aspect of the contents of the average score of 3.7 with a valid category, and aspects of language and writing problems with an average score of 3.8 with a valid category, and aspects of the language score of an average of 4, 1 with a very valid category. There are several suggestions from the validator to make the picture more clearly about the problem, including taking the source of the picture, giving illustrations must be clear by illustrating the purpose of the problem

Research instruments are tools or facilities used by researchers to collect data so that research is easier so that the results are better in the sense of being more thorough, complete, and systematic. With such an instrument with valid validity it will be feasible to use to obtain research data.

➤ *Practical Results of Teaching Materials*

The results of practicality of electric energy teaching materials based on the SETS approach can be seen from the results of the implementation of learning activities and student activities during the learning activities by observing by 2 observers. The results of observations on the implementation of learning activities using electric energy material teaching materials are based on the SETS approach that has been developed at two elementary schools consisting of grade sixth SDN Krembangan Selatan I and SDN Moro Krembangan.

Observation of the implementation of learning refers to the syntax of the SETS approach based on the management of teaching and learning activities, classroom management, and time management. Management of learning activities consists of introduction, core activities, and closing. Class management is related to the class atmosphere that is enthusiastic teachers and students during teaching and learning activities. Time management is related to the suitability of the implementation of teaching and learning activities with the time allocation specified in the RPP.

In this study the implementation of learning consists of 3 meetings. Each meeting is in good criteria with a percentage of more than 75%. This means that teachers can carry out learning with electric energy material teaching materials based on the SETS approach to improve student learning outcomes run well. According to Borich (1994), which states that an instrument is categorized well and can be used for observation activities if the reliability is greater or equal to 75%, thus, the observation instrument for the

implementation of learning activities used in this study is included in the very good category and is suitable for use.

The better syntax of learning at each meeting is supported by the teaching of teachers which is reflected when implementing learning. Teaching patterns or teaching styles that reflect the way teachers teach are influenced by their views about teaching, the psychological concepts used, and the curriculum implemented. Good learning outcomes also occur because students are motivated to search for new information and process the information with the knowledge they already have before through teacher explanations, learning resources, and discovery activities carried out in learning activities.

The implementation of good learning is certainly very close to the quality of learning that has been developed, besides that the readiness of the researchers themselves who act as teachers in applying the basic principles in applying the SETS approach becomes very important, especially the student-centered principle. Piaget explained that every child naturally has a curiosity and tries to continuously understand the world around him. According to Piaget, students of all ages are actively involved in the process of acquiring information and trying to build on the information that has been obtained, so that the knowledge obtained continues to grow and change as students face new experiences that force them to build their initial knowledge.

The syntax that has been implemented by the teacher is in accordance with the learning syntax of the SETS approach proposed by Poedjiadi (2010). This shows the implementation of learning is very important because if one of the stages is not implemented by the teacher will affect the learning activities themselves. The benefits of raising issues or problems at the beginning of learning can trigger students' thoughts so students will try to solve them. This will create interaction between students and teachers and foster the courage of students to speak out to express their opinions.

According to Aunurrahman (2013) through the learning process, teachers are required to be able to guide and facilitate students so they can understand the strengths and abilities they have, to further provide motivation so that students are encouraged to work or learn as best they can to achieve success based on their abilities. The learning process that is expected to occur according to Aunurrahman (2013) is a process that can develop the potential of students as a whole and integrated. The partial development of individual dimensions will not be able to support the optimization of students' potential development as expected. For that, in the learning process the teacher is not only required to deliver the subject matter but must be able to actualize his strategic role in an effort to shape the character of students through the development of personalities and values that apply. This is consistent with the opinion of Smitha & Aruna (2014: 54) that education is considered as a potential instrument for social change and

the quality of education which is determined by the effectiveness of teachers and teaching methods

According to Sardiman (2014: 103) that in learning there needs to be an activity, because in principle learning is doing or learning by doing. Activities are principles or principles that are very important in learning interactions. According to Nur and Wikandari (2000: 1) learning is more than just remembering. A student to truly understand and be able to apply science, they must work hard to solve problems, find something and always be in touch with ideas or ideas. Student intellectual development occurs when students are faced with interesting and challenging experiences in life that occur in the environment. For this reason, it can be concluded that the application of the SETS approach can increase the effectiveness of learning.

➤ *Results of the Effectiveness of Teaching Materials Based on the SETS Approach*

The effectiveness of electric energy teaching materials based on the SETS approach can be seen from the results of tests of learning outcomes and student participation. The effectiveness of electric energy teaching materials based on the SETS approach was assessed during extensive trials conducted from January to February 2020.

Learning outcomes tests are given to students before (pretest) and after (posttest) learning with teaching materials on electrical energy based on the SETS approach. Provision of tests at the beginning of learning aims to determine the initial abilities of students, while to find out the increase or decrease in students' abilities is done posttest which is conducted after learning with electric energy material teaching materials based on the SETS approach.

From the results of the pretest and posttest it can also be seen the completeness of student learning using teaching materials based on the SETS approach has increased learning outcomes from the pretest and posttest scores. The following is explained the recapitulation of N-Gain student learning outcomes based on low, medium and high categories.

No	N-Gain Category	The number of students	Percentage (%)
1	Low	9	9.1%
2	Is	34	34.3%
3	High	56	56.6%

Table 5:- N-Gain Recapitulation of Student Learning Result
Source: Data processed by the author, 2020

The results obtained when looking at table 5 show that student learning outcomes using teaching materials for electrical energy based on the SETS approach of low category there are 9 students with a percentage of 9.1%, moderate category 34 students with a percentage of 34.3% and high category 56 students with a percentage of 56.6%.

The test is conducted to determine the extent to which students can achieve learning objectives. In this study the tests were carried out twice, namely pre-test and post-test. Student learning outcomes are one indicator of the effectiveness of the learning device trials. Student learning outcomes are measured classically. The percentage of classical completeness in one class is said to be effective if the percentage is $> 75\%$.

Mastery learning is used as an indicator to determine the level of mastery of the material that has been taught. Table 4.15 shows that the pretest and posttest analysis results in each group increased. In table 4.15 shows that the average value of the pretest 65.5 increased to 83.2 in the posttest, so it can also be stated that after learning with electric energy teaching materials based on the SETS approach there is an increase in learning completeness that is in the pretest almost all learning is incomplete and there are several objectives of complete learning because at the time of the pretest or to see the initial abilities of students, the teacher did not give any treatment at all so that a very small percentage of completeness was obtained which is reasonable because students have not been treated with electric energy teaching materials based on the SETS approach. However, after students get treatment, students become aware of and can work on the questions given to students so that in the posttest the percentage of completeness is 100%. It can be said that guided inquiry learning is very effective in improving student learning outcomes.

This template supports previous research by Nugraheni (2013) which states that students' cognitive and affective learning achievement in SETS learning is better than learning with conventional approaches. Significant differences were obtained from learning using the SETS approach with non-SETS learning approaches to cognitive learning achievement where learning outcomes are better using the SETS approach. This is because based on the characteristics and stages in the SETS approach it appears that students in the learning process not only learn the concepts of science, but are also introduced to the aspects of technology, and the role of technology in society. SETS approached learning is able to make students who learn it understand the relationship of each element in SETS and tend to take real action. The inseparable relationship between science, environment, technology, and society is a reciprocal relationship that can be assessed the benefits and losses caused.

The characteristics of the SETS approach include identification of problems, active involvement of participants in finding information that is used to solve a problem, and emphasizing the process skills to solve problems. The six realms of the SETS approach include: concepts, processes, creativity, application of concepts, attitudes, and tend to take concrete actions. The SETS (Science, Environment, Technology, Society) approach can be preceded by simple concepts found in the surrounding environment and the daily lives of students. The nature of SETS (Science, Environment, Technology, Society) in

education must reflect how to do and what education can reach. The SETS (Science, Environment, Technology, and Society) approach, not a wishful education or just on paper, but really discuss something tangible that is, can be understood, can be seen and discussed and can be resolved. (Tessarani, 2016). The use of interesting and varied teaching methods, positive student learning behavior, and the use of appropriate learning media in supporting the learning process itself.

The ability to understand the problem will facilitate students in giving arguments to questions in the form of reasoning (Saadah, 2017: 1747). This shows that the ability of students to understand problems in the experimental class or the control class has increased in each meeting. Improvement of the experimental class can be categorized as good. That happens because the teacher's strategy in using problem-based learning with SETS uses contextual problems of environmental problems. This gives students the opportunity to understand the problems given by their teacher. Problems related to students' daily lives that make it easy for them to understand and find solutions for it. Problem solving depends on the determination or understanding of the problem correctly.

According to Yoruk et al (2010: 7) in his journal entitled The effects of science, technology, society, environment (STSE) interactions on teaching chemistry that learning based on the SETS approach has a positive effect on the relationship between students and the real world, encouraging students to be more active, creative, and critical thinking in providing solutions to a problem in the surrounding environment. Students learn to understand a topic more deeply when compared to students who study with conventional methods. It is expected that with this SETS approach students will become more sensitive to the surrounding natural environment, considering that Indonesia is a tropical country with a wealth of natural resources.

Yager (1996: 66) which states that one of the characteristics of the SETS approach is the emphasis on process skills as an effort to solve problems. In addition, learning by using SETS provides learning that is meaningful and relevant to students' lives. Students are also able to recognize problems and issues in the surrounding environment. Learning using the SETS approach is expected: (1) students are accustomed to having a comprehensive (comprehensive) mindset in viewing science material as a science that is integrated with the environment, technology and society; (2) SETS can make students know that technology influences the rate of growth of science, as well as its impact on the environment and society; (3) with SETS students become more interested in learning the material because it is associated with real things in everyday life, so as to gain a deep understanding of the knowledge possessed. (Yulistiani, 2015).

➤ *Learning Participation*

Student participation is the opinion and response of students to the KBM component which includes: subject matter / content, worksheets, the way the teacher teaches, the atmosphere of learning, and the stages directed by the teacher in the learning process. Student participation data obtained describe student responses to the continuity of learning. The percentage of student participation is obtained by dividing the number of students who choose the answer choices on each question divided by the total number of students multiplied by 100% with a minimum positive criterion namely $\geq 75\%$.

The results of student participation in the development of teaching materials based on the SETS approach in the material of electrical energy to improve student learning outcomes in limited trials obtained an average of very good categories. This is in accordance with the principles of Piaget's theory in learning activities that is the active involvement of students in learning. In order for students to learn, learning activities should be able to attract interest and increase student understanding, teachers need to associate new knowledge with the cognitive structure that students have, and subject matter needs to be arranged using certain patterns, from simple material to complex material.

The most prominent component is the aspect of feeling happy when following the learning. Based on this response, it can be seen that there is a connection between aspects of student activity when listening to the teacher's explanation and aspects of designing an experiment that gets categorized well. This is consistent with the statement of Arends (2008) studies of class and teaching showing that student motivation and learning is influenced by the structure created by the teacher in the classroom. In this case, the teacher should try to get their students to feel interested and happy with the material they are presenting and then present it with a compelling and satisfying way of raising students' curiosity about the material itself (Slavin, 2011).

Bloom outlines the types of learning outcomes divided into 3 domains namely cognitive, affective and psychomotor. Cognitive learning outcomes are related to student learning achievement in the form of knowledge, affective emphasizes more on aspects of attitude and psychomotor emphasizes more on aspects of skills. (Supardi, 2015: 2). Based on this view, it can be concluded that learning outcomes do not lead to only one aspect, but rather 3 aspects that each other must consider in the learning process.

Good student participation above can increase and maintain student motivation in participating in a series of teaching and learning processes. Student motivation greatly determines maximum learning outcomes. This is in line with the opinion of Chatib (2012: 96) which states that achievement must be passed with motivation owned by individuals. So, in learning with teaching materials based on the SETS approach this can lead to motivation which

will have a direct impact on student learning outcomes tests.

V. CONCLUSION

Based on the results of the analysis, discussion, and research findings it can be concluded that the teaching materials for electrical energy materials based on the SETS approach developed already have validity, practicality, and effectiveness to increase participation and learning outcomes of Grade VI Elementary School students in electrical energy materials.

Some suggestions that can be put forward by researchers based on the research conducted as follows: (1) in general researchers have succeeded in developing teaching materials that can increase participation and learning outcomes of Grade VI elementary school students in electric energy materials, so it is expected that educators can use them so that classroom learning is more effective. (2) research with the SETS approach requires a long time, researchers should consider the time that is adjusted to the available time allocation. (3) The teaching materials based on the SETS approach developed in this study have been effective for improving student participation and learning outcomes in electrical energy material, so that further similar research is expected on other basic competencies.

Based on the constraints experienced during the research, the authors advise to better prepare more tools and materials so that if there is damage it can be immediately replaced with new tools and materials, improve coordination with the school to pay attention to the lesson schedule and student activities at school so when the research becomes more optimal.

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