

# Science Sets – Based Teaching Material Development For Character Building Reinforcement

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**Abstract—**This research is aimed to develop a science SETS – visionary teaching material fulfilling the valid criteria for character building reinforcement. The research method used in this study was the Research and Development (R&D) which from four stages was simplified into three, consisting of (1) defining, (2) designing, and (3) development. The subjects of this research were fourth grade students of SDN Kalibanteng Kidul 03, a public elementary school in Semarang. The data was collected using interviews, tests, observations, and questionnaires. The data analysis used the descriptive qualitative and quantitative techniques. The result of the development of the printed teaching material was valid. The validity score also met the excellent category. According to the result and discussion on the research of the science SETS-based teaching material development for character building reinforcement, it is advised that the printed version of science SETS – based teaching material, which has been developed with a valid result within the competence of natural resources, need to be tested in a wider scale so that teachers are able to utilize the printed science SETS – visionary teaching material as a supplement for the learning process in the attempt of character building reinforcement.

**Keywords—**Valid, the development of elementary school level teaching material, science approach, environment, technology and society, character building reinforcement

## I. INTRODUCTION

In order to embody a culturally oriented nation through the reinforcement of religious values, including honesty, tolerance, discipline, hard work, creativity, independence, democratic attitude, curiosity, spirit of nationality, love to the homeland, achievement appreciation, communicativeness, love of peace, reading passion, environmental and social concern, and responsibility, there should be a reinforcement of character building program. The statement is in line with the presidential decree of Republic Indonesia number 87 year 2017 about character building reinforcement [1]. The Character Building Reinforcement (CBR) or *Penguatan Pendidikan Karakter (PPK)* is an educational movement under the responsibility of the education units to strengthen the students' character through the harmonization of the heart, feeling, thought, and body with the involvement and cooperation between the education units, family, and the society as parts of the National Movement of Mental Revolution (NMMR) or

*Gerakan Nasional Revolusi Mental (GNRM)*. One of the lesson subjects in the elementary school that is given as a form of the implementation of character building reinforcement is the science subject.

The world of education nowadays is demanded to face the challenge of the current development which tends to increase qualitatively. The science education as a part of a general education holds an important role in sustaining and improving the quality of education, especially in generating qualified students. The psychological principles of education is that teachers should not merely deliver the knowledge to the students. The students should also actively build up the knowledge within their minds [2]. The teaching and learning activities from the teachers in elementary schools should adjust to the learning materials based on the curriculum.

Science in elementary schools is aimed for the students to gain the capacity as follows; (1) Earning the faith towards the Almighty God based on the existence, beauty, and harmony of His creation, (2) Elaborating the knowledge and understanding of science concepts which are beneficial and applicable to everyday life, (3) Developing curiosity, positive attitude, and awareness towards the existence of interconnected relationship between science, environment, technology, and society, (4) Improving the processing capability to investigate the surrounding nature, solve problems, and make decisions, (5) Generating the awareness to take part in preserving, taking care of, and conserving the natural environment, (6) Raising the awareness to appreciate the nature and its regular phenomena as one of God's creation, (7) Gaining the knowledge of both the concepts and skills of science as the basis to continue pursuing a higher level of education in junior high school (SMP/MTs) [3].

Basically in human's life, science elements, environment, technology, and the society are interconnected to one another. Thus, it strengthens the statement that students learn as a provision of life within the society. The students have to live socially and as a part of the society, they have to interact with the nature. From the learning process that the students experience where they get to know the concept of nature, which later on is known as science, they can make use of the knowledge to fulfill their needs in

terms of technology to obtain the ease or benefit in their individual living process or within the society.

Science is interconnected with the way someone looks for information about nature systematically. Thus, science is not merely about the mastery of a systematic collection, nor the mastery of factual knowledge, concepts, or principles, but also about a discovery process [4]. Science is an entity which studies about the phenomena happening in the nature [5]. Science is a specific knowledge which through observations, experiments, inference, theoretical framing, and so on are interrelated between one way and another [6]. Therefore, it can be concluded that science is an entity studying about the surrounding nature and its contents which does not stop on the theoretical level, but also involves observation, experiments, and inference.

Learning is a process of transferring knowledge, conducted by delivering the knowledge to the students [7]. Learning is an interaction process between the students, the educator, and the learning source in a particular learning platform [8]. Learning can be defined as every systematic and conscious effort to create an educative interaction between two sides, which are the students (learners) and the educator (source of knowledge), carrying out the learning activities [9]. From the statements of the experts above, it can be inferred that learning is a systematic and planned process of transferring knowledge between two sides, which are the educator and the students.

Considering the characteristics, the elementary school students (*Sekolah Dasar (SD) / Madrasah Ibtidaiyah (MI)*), have extra curiosity and quality of investigators, inventors, and learners. In relation to that, the students should be given the chance to actively interact with objects, people, and the other learning sources. Science learning may develop the involvement process of the students' mental, physic, and emotion. Besides that, science learning should also be complemented with fun learning activities and appropriate learning materials. The appropriate learning materials is hoped to be able to direct the students into the process of gaining, developing, and implementing a particular concept. In a way, the students will be able to discover and develop for themselves the facts and concepts, as well as to cultivate the character building values.

Learning materials are all the things which can be utilized to deliver the message (materials of the lesson) and stimulate thoughts, feelings, attentions, and capabilities of the students so that they will support the learning process [10]. Learning materials which are too technical with too many detailed terms to memorize will be boring for the students. Books or other learning sources which are not interesting may affect the learning process in a way that it becomes tiresome. The books should better relate the learning to contextual concepts. In other words, the books as learning materials should be connected to the concept of science and the environment. Moreover, it should be supported with images and interesting templates arranged in such a way for an effective learning process [11]. The incompatible collaboration between the material substances

and the environment will influence the true meaning of the lesson for the students. The collaboration between the material that is not in accordance to the environment may significantly affect the meaning of learning in the process, and influence the cognitive and metacognitive characteristics of the process itself [12].

Learning material is one of the learning sources, in which they are all the things that ease the students to obtain some information about knowledge, experiences, and skills in the teaching and learning process. While on the other hand, the choice of learning materials with *SETS* approach is based on the factor of the need of learning materials which are still lacking and less various to support the character building reinforcement according to the presidential decree from the year 2017. By using *SETS* – based learning materials, it is expected that the students will understand the concept delivered in class, as well as be aware of the impact of the process learned, both for the environment and for the students themselves to apply the knowledge in everyday life. The making of the learning materials will influence the complexity of the materials obtained by the students in each of the lesson, so there should be an appropriate material development based on the contextualized standard content.

Specifically in science, it is important to always relate the lesson with the surrounding environment, the society, and technology in order for the students not to merely understand the science, but also to apply it in their everyday life. The linkage is better known as science learning which is based on Science, Environment, Technology, and Society (SETS). SETS opens up the chance to learn the nature of science, technology, and their relation with the environment and society. On the basis, it is safe to say that SETS approach expects the students to have the capability to view something as an integrated entity by considering the four elements of SETS, so that the students will obtain a more profound understanding about the knowledge that they have [13].

Learning materials include all the things, consisting of information, instruments, and/or texts which are systematically arranged, presenting the whole part of the intended competence to be mastered by the students which are used in the learning process with the aim of planning and review of learning implementation [14]. Learning materials hold an important role in the learning process. There are several things to be considered, including; (1) the view order should be organized from the easiest ones, the title should be concise and clear, there should be table of content, the framework should be clear, the materials should meet the principles of learning materials, there should be reflection and assignment; (2) the language used should be understandable with simplified vocabulary, the sentences should be unambiguous, the interconnectedness of each of the ideas on every paragraph and sentence should be concise; (3) there should be stimulus of thought with sentences that encourage the readers to think and test the stimulus; (4) the materials should be ethically and esthetically appropriate by not breaking the writing rules,

while at the same time are easy to see and read; (5) the materials should be instructional in relation to the text choices, the review material, and worksheet; (6) there should be decision upon which material will be made, and (7) the materials should know the readers' target [15].

A good learning material should fulfill the predetermined elements based on the needs of the students. There are six components related to the elements in arranging the learning materials, including; (1) learning instruction, (2) competence to be achieved, (3) supporting information, (4) exercises, (5) working instruction or worksheet, (6) evaluation [16].

Learning materials are supporting means for the students to enhance the smoothness of the learning process both in class and at home, including the science material which encourages the students to a science learning with the approach of Science, Environment, Technology, and Society (SETS) [17].

The theories supporting the SETS learning model are as follows: (1) Gagne stated that in order for learning activities to be conducted to the students, there should be learning condition, both internal condition and external condition. Gagne represented five groups, which are intellectual skill, cognitive strategy, verbal information, motor skill, and attitude. (2) Dahar, classified the learning theories of the 20<sup>th</sup> century a large class, which is the behaviorism theory, for instance, the response-stimulus and learning theory of Gestalt-feald, which is the cognitive theory. (3) Yager (2009) proposed four stages of strategy in learning focusing on constructivism, which include (a) invitation; (b) exploration; (c) proposal of explanation and solution; (d) step determination [18].

The SETS vision is a point of view declaring that everything that we know about the nature consists of four elements, which are Science, Environment, Technology, and Society [19]. SETS – based education is the one which brings the education system to generate graduates who will be able to apply the knowledge they have gained in order to improve the quality of life of human beings (Binadja) [20].

The characteristics of SETS – based science learning are as follows: 1) the concept of science learning is still given; 2) the students are invited to situations in order to observe the related technology; 3) the students are asked to explain the interconnectedness between the discussed science elements and the other elements on SETS [21].

For future citizens in a democratic society, being aware of the reciprocal relationship between the science, technology, and society is as essential as understanding the concept and process of science [22].

Through this study, it is expected that the learning about the natural resource materials may help the students apply their understanding of the concepts in the real world, as well as really comprehend the phenomena happening in the surrounding environment. Also, it is hoped that they are able to appreciate the environment where the students live as a beneficial surrounding for their lives, while they are still under the supervision and guidance of their teacher.

Through the learning activities, it is expected that the students can learn to think critically from earlier stage and in any form of situation, while at the same time the activities may support the reinforcement of character building.

Based on the problems above, a solution is needed to minimize the problems that appear during the learning process, one of the ways is by developing SETS – based science learning materials. The developed learning materials for the fourth grade of elementary school will be an essential source and reference for the students. According to the background which has been explained above, the researcher is interested to conduct a research with the title of "The Validity of SETS – based Science Learning Materials for Character Building Reinforcement". The purpose of this research is to generate valid SETS – based printed science learning materials within the natural resource competence in order to reinforce the character building program of the fourth grade students in elementary schools.

## II. RESEARCH METHODS

The methods used in this research was the Research and Development (R&D). The products that were developed and tested in this research are text books of printed learning materials consisting of SETS – based science learning materials for fourth grader students of elementary school for the second semester. The procedure of the research used the 3 – D model. The 3 – D model consists of three stages, which are: (1) defining, (2) designing, and (3) development.

## III. FINDINGS AND DISCUSSIONS

This research and development is aimed at generating valid SETS – based printed science learning materials on the natural resource materials for the reinforcement of character building program.

### *A. The Defining Stage*

The result of the defining stage was based on the interviews showing that the learning results of the students were low. Another problematic situation was the lacking of the teacher's awareness to develop good learning materials for the reinforcement of character building program with character building values on them. The result of the analytical observations of the needs towards the development of SETS – based printed science learning materials within the natural resource competence for fourth graders of elementary school, showed that the teachers had not used the syllabus, lesson plans, learners' worksheet, and learning materials which were based on SETS and contained character building values.

### *B. The Designing Stage*

The initial analysis result presented that there was no printed learning materials which implemented the SETS elements. The steps in designing learning materials were as

follows; 1) defining the title, 2) designing the learning instructions, 3) deciding the core competence and indicator, 4) designing the contents of the learning material, 5) designing the supporting contents, 6) composing exercises, 7) designing the work instructions, 8) constructing glossary, and 9) working out with the evaluation. The next step was compiling the validity instruments of printed learning materials. The printed learning materials which had been designed should be in accordance to the validity sheet. Then, the researcher decided the person doing the validation.

### *C. The Development Stage*

The development stage consisted of; 1) a validation of printed learning materials by the experts followed by revisions, 2) a limited trial which results became the basis for revisions, and 3) a further trial on a real classroom.

This research, according to its aim generated valid SETS – based printed science learning materials in the natural resource competence for fourth grade students of elementary school in order to reinforce the character building program. The learning materials which were developed strived to implement the vision of SETS (Science, Environment, Technology, and Society). In the designing stage, the researcher designed a learning strategy and arranged the needed instruments for the research. The learning strategies used were those implementing the SETS visions. The printed learning materials were compiled in such a way that the students would be able to understand and apply the science they had learned in their everyday lives. The information and contents of the materials were made interesting, easy to understand, and effortless to learn. There was also manual on how to use the book so that the students would find it easy to read. At the end of the learning materials, there was also a mini dictionary or glossary containing important terms. The size of the printed learning materials was designed in such a way that the students would find it easy to carry and put inside their bags. The learning materials were printed using B5 paper (17.6cm x 25cm) containing 73 pages.

### *D. The Validity of SETS – based Printed Science Learning Materials*

The validity of the SETS – based printed science learning materials was seen from the validity result based on the experts and the practicality. The practicality of the printed learning materials was obtained from the response and reactions of the students. The developed printed learning materials were validated and tried in order to find out how valid the printed learning materials had been developed. The validity results of the printed learning materials conducted by three academics and one practitioner showed that the validity scores were 45; 44; 43; and 45, and if consulted to the table of validity criteria for the printed learning materials, the results were considered really good.

The average result of the four validity scores of the printed learning materials was 44 which was considered very good. From the result of the initial development of printed learning materials, there were some inputs from the experts doing the validity test, some of them are: 1) some of the letters still seem small, 2) the tables should be given numbers, 3) the editorial stuff should be based on the predetermined spelling, 4) the pictures should be made clearer, 5) the aim and indicator need to be fixed and presented at the beginning, 6) each of the unfamiliar words should be given the translation in Bahasa Indonesia.

The final result of the validity test showed the score in a very good category. Then, the printed learning materials were tested in a trial class and an experiment class. The trial class was for the researcher to find out how valid and reliable the instruments in the research were. The results of the trial towards the test instruments showed that 30 questions were valid and reliable that they could be used in the research. The field trial towards the printed learning materials was conducted by teaching the material of natural resources using SETS – based printed learning materials, based on the study previously conducted by Binadja (1999a) on how: 1) the concepts of science were still given; 2) the students were brought to the situations to observe the related technology; 3) the students were asked to explain the interconnectedness between the discussed science elements and the other elements on SETS.

The practicality of the printed learning materials could be seen from the response or reactions of the students, as well as the response of the teacher. The instruments used to find out the practicality were the students' and teacher's response questionnaires. The results of the teacher's response towards the printed learning materials showed an excellent result of 18, because there were only two negative responses out of 20 indicators. In other words, the score 18 was on the excellent range ( $15 \leq Sa \leq 20$ ).

The responses of the students generated three categories. 25 students were on the excellent category, 3 students were on the good category, and 2 students were on the sufficient category. If the students' responses were consulted to the indicator of success of the research, the result were categorized as a successful one because there were 25 students who gave really good responses towards the development of the SETS – based printed science learning materials in relation to the natural resource competence of the second semester of fourth graders. The result of the response analysis showed that there were two scores under the minimum mastery criteria which are indicator 19 with good category and indicator 15 with sufficient category. The amount of indicators in the excellent category was 24. The result of the SETS – based printed science learning material development was also considered practical. The research results were in line with the previous research conducted by Wijayama on the instrument development of SETS – based science learning with SAVI approach in order to improve the learning effectiveness and the students' character building in elementary school. The result of the research showed that the

responses from the teacher and students were 96% and 93% with an excellent category. The result of the research proved that the role of SETS vision in developing learning materials was significant. The SETS vision had proven to give ease for the teacher in teaching, which was shown with a very good response from the teacher and a good response from the students [23].

#### IV. CONCLUSION

The development of SETS – based printed science learning materials in the natural resource competence for grade four of elementary school to reinforce the character building program could be considered valid because of the following reasons: 1) The characteristics of SETS – based printed science learning materials were relating the science concepts of natural resources with SETS elements. Besides that, there was a manual of how to use the book which was complemented with a mind map, standard competence, core competence, indicator, aim, information of meeting order in the learning materials, SETS information, SETS diagrams, summary, evaluation, and glossary to ease the students in finding out what would be learned next. 2) The validity scores were 45, 44,43, and 45 which were included in an excellent category if consulted to the table of validity criteria of printed learning materials. The average of the four validity scores of the printed learning materials was 44 which was considered in an excellent category. The practicality score, seen from the response of the teacher towards the printed materials showed the score of 18, which was considered very good, because there were only two negative responses out of 20 indicators. In other words, the score 18 was on the range of ( $15 \leq Sa \leq 20$ ) which was included in a very good category. From overall response results of the students, there were three categories. There were 25 students of excellent category, 3 students of good category, and 2 students of sufficient category. The students' responses, if consulted to the indicator of success of the research showed that they had succeed because there were 25 students giving very good responses.

#### V. SUGGESTIONS

Based on the findings and discussions in this research of the development of SETS – based elementary school science learning, it is suggested that as the SETS – based printed science learning materials within the natural resource competence for the reinforcement of character building has been developed with a valid result, another trial with a wider scope should be conducted so that more teachers are able to make use of the SETS – based printed science learning material as a supplement for the learning process in order to reinforce the character building program according to the presidential decree which has been set.

#### REFERENCES

- [1] Peraturan Presiden RI, 2017, no.87.
- [2] Baharuddin dan Esa Nur Wahyuni. *Teori Belajar & Pembelajaran*. Jogjakarta: Ar-Ruzz Media. 2010.
- [3] Depdiknas. *Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: National Education Department. 2006.
- [4] Sulistyorini, Sri. *Model Pembelajaran IPA Sekolah Dasar dan Penerapannya Dalam KTSP*. Semarang: Tiara Wacana. 2007.
- [5] Iskandar. *Pendidikan Ilmu Pengetahuan alam*. IKIP Malang. 2001.
- [6] Abdullah. *Pendidikan Sains Yang Humanistik*. Surabaya: Kanisius. 1998.
- [7] Hamalik, Oemar. *Kurikulum dan Pembelajaran*. Jakarta: Sinar Grafika. 2008.
- [8] UU No. 20. Tentang Sisdiknas Pasal 1 Ayat 20. 2003.
- [9] Sudjana, Nana. *Dasar-dasar Proses Belajar Mengajar*. Bandung: Sinar Baru Algensido Offset. 2004.
- [10] Rusman. *Model-Model Pembelajaran*. Jakarta: Rajawali Press. 2010.
- [11] Rosario, B.I, *Science, Technology, Society, and Environment (STSE) Approach in Environment Science For Non Science Student in a local Culture*. ISSN: 20994-1064 CHED Accredited Research Journal, CategoryB. 2009. 6 (1).
- [12] Viola, S. R., giretti, A., & leo, T. Detecting Differences in "Meaningful Learning" Behaviours and their Evaluation: a Data Driven Approach. *International Journal of Computing & Information Science*. 2007. 5 (2) : 63-73.
- [13] Binadja, Achmad. *Hakekat dan Tujuan Pada SETS (Science, Environment, Technology, And Society) Dalam Konteks Kehidupan Pendidikan Yang Ada*. Semarang: UNNES. 1999.
- [14] Prastowo, Andi. *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Jogjakarta: DIVA Press. 2014.
- [15] Kurniasih, Imas. *Panduan Membuat Bahan Ajar Buku Teks Pelajaran Sesuai Dengan Kurikulum 2013*. Surabaya: Kata Pena. 2014.
- [16] Prastowo, Andi. *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Jogjakarta: DIVA Press. 2014.
- [17] Binadja, Achmad. *Hakekat dan Tujuan Pada SETS (Science, Environment, Technology, And Society) Dalam Konteks Kehidupan Pendidikan Yang Ada*. Makalah Seminar Lokakarya Pendidikan SETS 14-15 Desember 1999. Semarang: UNNES. 1999.
- [18] Eka, & Wisudawati. *Metodologi Pembelajaran IPA*. Jakarta: Bumi Aksara. 2014. 2013.
- [19] Depdiknas, Puskar Balitbang. *Draft Panduan Penyusunan Kurikulum dan Silabus Bervisi SETS (Salintemas) Tingkat Satuan Pendidikan Dasar dan Menengah*. Jakarta: Puskar Balitbang Depdiknas. 2006. P.4.
- [20] Binadja, Achmad. *Pemikiran dalam SETS (Science, Environment, Technology, and Society)*. Semarang: SETS Laboratory-Universitas Negeri Semarang. 2007. p.127.
- [21] Binadja, Achmad. *Hakekat dan Tujuan Pada SETS (Science, Environment, Technology, And Society) Dalam Konteks Kehidupan Pendidikan Yang Ada*. Makalah Seminar Lokakarya Pendidikan SETS 14-15 Desember 1999. Semarang: UNNES.1999.
- [22] Aikenhead, G., S. AvisionFor Science Education: Responding to the Work of Peter J. Fensham. *International Journal of STS Education*. 2003.
- [23] Wijayama, B. "Pengembangan Perangkat Pembelajaran IPA Bervisi SETS dengan Pendekatan SAVI untuk Meningkatkan Keefektifan Pembelajaran dan Pembentukan Karakter Peserta Didik Sekolah Dasar" Tesis. Semarang: Program Pascasarjana Unnes.