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Science Environment Technology And Society Based For Disaster Mitigation

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Abstract

In facing the large number of disasters in Indonesia, efforts to reduce disaster risk have become a strong foundation for joint efforts. One of the disaster mitigation learning methods developed is the Science Environment Technology and Society (SETS) learning model. Therefore, this research aims to develop natural disaster learning tools with a SETS vision that are integrated in science subjects, implement disaster teaching materials with an integrated Science Environment Technology and Society vision in science subjects, increase the understanding and skills of teachers and students regarding concepts, principles and practicing self-rescue in the event of a natural disaster, and increasing collegiality between lecturers and teachers as well as between teachers in teaching disaster material to students. This multi-year development research (R&D) was carried out in collaboration with teachers in primary and secondary education. The research results are in the form of five learning model features such as: Syllabus, lesson plans, learning methods, teaching materials, as well as techniques and types of assessment developed including science material for grades IV, V, VI primary school and VII, VII, IX secondary school. The five features are packaged in a Guidebook for Teaching Natural Disasters Integrated in Science (for Teachers), a Textbook (for Students) and a supplement in the form of a cartoon comic. The dissemination results show that the learning tools developed are worthy of being given to students, and can increase students' understanding in recognizing and dealing with disaster.

Keywords: Mitigation, Disaster, SETS.

INTRODUCTION

The number of disaster-prone areas in Indonesia and the importance of increasing disaster risk reduction efforts is a strong foundation for the Indonesian nation to make these efforts together in an integrated and directed manner. As educators, the research team will contribute to increasing public understanding against disasters, through learning which is integrated in several subjects in primary and secondary education. The natural disaster learning model developed has the Science Environment Technology and Society (SETS) vision. Teachers will transfer the information and knowledge to students and the community. Teachers have a strategic role to prepare the younger generation from an early age to understand natural disasters better. The concept of natural disasters will be easy to understand if it is explained using a model learning with a SETS vision, namely integration between science, environment, technology, and society. This learning model is packaged and integrated into the school curriculum which is implemented starting at the basic education level for the following reasons, such as educational results are durable and long-term, reaching a large population, and instilling socio-moral values in students.

The main objectives in disaster mitigation research are determining the characteristics of learning tools, syllabus and plans for implementing disaster learning landslides and floods have a SETS vision integrated in science subjects, implementing a disaster learning model with the SETS vision integrated in science subjects, and determining the effectiveness of the tools developed in increase students' understanding of natural disasters. In accordance with the objectives to be achieved, literature on concepts is selected natural disasters floods and landslides common and what happened in West Java. This learning model was developed for natural disaster mitigation and management purpose through school. In general, mitigation practices can

be divided into structural mitigation and non-structural mitigation. Structural mitigation is related to physical construction development efforts, while non-structural mitigation includes land use planning, enforcing regulations development, and preparing people to get used to with living with disaster, especially for an environment that has already been built, so that people can feel it security and comfort in their lives. Educational activities have a strategic impact in the short and long term. In short term, it is hoped that the public will gain practical knowledge about natural disasters that are useful for dealing with disasters that can occur at any time. In the long term it is expected to form self-responsiveness and awareness of the surrounding environment which is the disaster-prone area.

This research uses SETS as the selected learning approach. In educational context, SETS carries a message that to use science (S1) to the form of technology (T) in meeting society's needs (S2) requires thinking about the various implications on environment (E) physically and mentally. From there, it is hoped that technological insights from transformation will be obtained science, without having to damage or harm environment and society (Ministry of National Education, 2007).

Next, interconnectedness of the inter-elements of SETS indicates that each elements influence each other in the development process its development. The SETS vision learning model, guide students to link science concepts with other elements in SETS. This method allows students to gain a clearer picture of the relationship between this concept and other elements in SETS, both in the form of advantages and disadvantages (Binadja, 2001). All students have different basic abilities, through the application of participant constructivism. Students can learn from various starting points that they are familiar with and relate to the science concepts they will study. SETS Model visionary and visionary learning with science as a starting point that is tailored to the interests and talents of students is expected to encourage curiosity and strengthen students' initiative to relate to other SETS elements.

RESEARCH METHODS

This research is research and development (R&D) carried out by a collaboration with teachers in primary and secondary schools. In this second year of research, it is carried out the continued dissemination and development activities. Research stage for dissemination includes implementation of dissemination, analysis of dissemination results, and preparation of final model. Advanced development research is implemented in three stages, namely: 1) theoretically explored and evaluated as well as interested parties towards five features of the visionary disaster learning model SETS, namely syllabus and lesson plans, themes and sub-themes, learning methods, techniques and types of cross-cultural assessments, as well as textbooks; 2) empirical test, which aims to validate empirically the five features of the learning natural disaster management model with the SETS vision; 3) implementation stage, which aims to implementing the model, knowing its effectiveness model fitness, and obtain model defenders- a proven horse.

Testing is meant to find out readability of teaching materials, learning scenario ran (in the RPP), and characteristics of evaluation tools the and the question. In addition, to determine the amount of time required to complete each learning theme and test planned. Thus, teacher models and test makers can estimate appropriate amount of time and number of questions. Product development trials are carried out by the individual test and field testing. Types of data obtained from trials namely qualitative and quantitative data. Qualitative data consists of input from experts. Quantitative data is in the form of student responses (scores) to tests which was tested on them.

The instruments used in this trial were observation sheets, questionnaires and test. Observation sheet to determine the implementation of the learning model, teacher activities, and

students. The questionnaire is addressed to teachers to determine the compatibility of the material with student development, readability of scenarios learning, and suitability of tests to learning objectives. Questionnaires are also addressed to students, namely to find out the readability of teaching materials and questions. The test developed is in the form of multiple choice, with 4 answer choices, and description. There are several analytical techniques used to answer research. Analysis of the validity of the model developed using qualitative descriptive. Analysis of empirical test data using percentage descriptive statistics, the effectiveness of the model is analyzed through increasing results student learning uses a normalized gain factor whose significance is tested using a test parametric statistics using t-test.

There are 5 features of developing learning-based natural disaster mitigation models resulting from this research. Quality standards for each feature is determined as follows: 1) The results of the assessment of the syllabus and RPP are at least in the good category; 2) Theme and the minimum learning theme is at good category; 3) Teaching materials and supplements learning-based disaster mitigation tools are easy to understand (readability coefficient >0.3) and easy to use; 4) Evaluation tools must be reliable (with $r \geq 0.7$), valid, has medium level of difficulty (with a difficulty level index between 0.3 to 0.7), and good differential power (with differential power index ≥ 0.3); 5) Effectiveness of the model developed are seen from the significance of increasing student learning outcomes after the model was implemented.

RESULT AND DISCUSSION

Each stage of research produces results output such as dissemination results, integrated natural disaster learning in science with a SETS vision, expert validation results towards the learning tools developed, and increasing understanding teachers and students regarding natural disasters which is integrated in science lesson with the SETS vision. Dissemination of the natural disaster learning model with the SETS vision integrated into science community subjects, which had been obtained in the previous year, was carried out through seminar activities and implementation in schools. Dissemination results in the form of scientific works (papers) and teaching materials which has been validated based on empirical data implementation activities in schools.

The results of giving the questionnaire to primary and secondary school science teachers in West Java Province show that they need it natural disaster learning model integrated in science lesson with the SETS vision. Most of the teachers think that they need natural disaster learning model integrated in science lesson with the SETS vision. Most teachers agree that learning about natural disasters is delivered in an integrated manner in science lessons, because it makes it easier for students in understanding the concept of disaster, without having to add new subjects. They realize they are still experiencing difficulties when teaching natural disasters integrated into science lesson. Therefore, they welcomed the learning tools that can be used to teach disasters integrated in science lesson. Five features of the natural disaster learning model with an integrated SETS vision in science subjects has been produced. This framework includes: (a) SK mapping and science competency standards, (b) Syllabus, (c) study materials, (d) materials or teaching materials, and (e) evaluation tools. This lesson went through a workshop with several primary and secondary school teachers. The five features of the model developed are packaged in the Textbook for Student and Teacher Manual. Products that produced in the second year includes Materials Teaching Elementary School Classes IV and V, and some materials for class VI, and junior high school immediately VII, VIII and IX.

Validation of the learning model features developed was carried out by experts and practitioners in the field. For validation purposes, an assessment tool has been prepared. This

instrument has undergone expert review before being used as a retrieval tool data. Instruments that have been validated ties are then used to assess each the features of the model that has been compiled by the researcher and teachers in the field. Inputs from experts are used as a basis for improving learning tools that have been developed right, and five feature development guidelines models for different themes. All learning tools were evaluated by experts, considering the limitations of time and the volume of the product produced. Some learning tools has been revised and then tested limited to getting input from the researchers and practitioners. The input is used to perform refinement about learning tools. Input from some students focused on readability of teaching materials and test evaluation tools. Device revised learning based on the results of limited trials, then tested on a wide scale in experimental classes.

Data from model testing results is limited to analyze qualitatively. The results of the analysis show that the learning plan is easy to implement, disaster material is provided in proportion the appropriate one, the readability of the teaching materials is in place in the easy-to-understand category. Input from practitioners are aimed at using evaluation techniques, there are still difficulties in directing students to fill in the SETS components, especially those related to society. Results analysis of evaluation tools for themes show that the test is valid and reliable. The implementation results show that the developed model is suitable to understand natural disaster material and can increase teachers' understanding of natural disaster learning which is integrated in science with the SETS vision, as well as increasing students' understanding of natural disaster. Improved learning outcomes showed significant results. This can be seen from the magnitude of the normalized gain student learning outcomes.

Achievement of learning objectives is determined by the score obtained by each individual ≥ 65 and percentage of completeness in class is ≥ 85% of students have achieved the score ≥ 65. Results of analysis of learning outcomes data shows that student learning outcomes have been achieved a minimum score of 65 and the number of students who have achieved this score as many as 85%. Distribution of research's result will be broader and faster to the target, as most of the participants seminars are students, teachers and education practitioners. The school where the dissemination is selected which location is very familiar with disasters landslides and floods. Based on the results of curriculum analysis and mapping the material, the conclusion was obtained that primary school's science material has more opportunities to include disaster material. On this occasion, features of the integrated disaster learning model were developed SETS vision science subjects taught.

Based on the mapping results, it appears that almost all science material in primary school can be loaded with natural disaster material. This matter is very strategic to invest children's concern for the environment and natural disasters. At secondary school level material on natural disasters can also be included some of the material or subjects in between the classes. Providing material for natural disasters as far as possible does not require extra time outside of the allocated time for science subjects. It is hoped that the SETS approach will achieve science and disaster learning objectives simultaneously. This can explore students' abilities further in discovering the concepts of science, the environment, technology, and society. Besides, students can express their work through displays in class and being able to present the results of discussions in front their classmate.

Kumar & Altschuld (2000) stated that the SETS problem should be presented in learning so that students can see the positive and negative aspects of science knowledge and technology in relation to problems that arise in society. Task materials are also provided to guide students to do discussion and understanding the material. The results of the lesson plan have been revised based on validation by experts and test results for practitioners (teachers). Validation results, limited trials, and test-try a broad scale showing that matter teaching has a readability level that is easy to understand. Only for natural disaster material in relation to growth and human

development has levels moderate readability. This is also reflected in final test results on each chapter taught. Ernst & Monroe (2004) concluded that learning-based environment can improve students' ability to critical thinking and help them become more precise in solving environmental problems. Kim & Roth Research (2008) shows that the application of learning by linking science, technology, the environment and society will make students better, namely student attitudes to pay more attention to the environment.

Frank & Barzilai (2006) in their research shows that 95% of students think that the concept SETS is incorporated into the learning process, thus providing opportunities for them to gain knowledge and heighten their understanding of between branches of science. Lee & Erdogan (2007) show that there is an increase in interest in learning in class which applied the STS approach. Research by Masfuah, et al (2011) concluded that learning about natural disasters with SETS vision partner swapping model can develop critical thinking skills and students' caring attitude towards disasters. Thus, in general the learning model of natural disasters are integrated in developed SETS vision science lessons in this research is suitable to be applied in schools both in primary and secondary school. It is hoped that this will contribute to mitigating natural disasters through education.

CONCLUSION

Syllabus device characteristics, teaching plan, and teaching materials are developed referring to the SETS model. In this model, science/disaster materials are linked to the environment, technology and society. Formats and systematic syllabus are prepared based on the principles which is oriented towards achieving competence. In the interests of developing lesson that has the vision of SETS, standard for the science lesson need to be supplemented with basic competency for natural disaster. Achievement competency's indicators are automatically need to be added, according to the basic competency that has been taught. Learning products can be human resource or non-human resource. In terms of human resource, the products produced are marketing students' understanding of natural disaster mitigation. Non-human resource products can be seen from the work students about the disaster material taught and learnt. The analysis results show that the developed teaching lesson is easy to implement and disaster material is provided in the appropriate proportion. Teaching materials can be obtained from various sources, internet, books, environmental journal, and so on.

The test results show that the reading teaching materials developed are located in the easy-to-understand category. Engineering form assessment used to determine landslide disaster and floods in the form of objective questions and descriptions. About the description, students are given a related picture with disasters, students are asked to analysis in accordance with SETS demands. The developed device is valid and effective for increasing the students' understanding towards disasters. This can be seen from the test results obtained by students. In general, the learning model for natural disaster that are integrated in science courses with the SETS vision developed from this research is suitable for application in primary and secondary schools. This learning model is expected to contribute to natural disasters mitigation through education. For schools located in the disaster-prone areas, it's best to give insight into natural disasters to the students. Disaster material does not have to be subject matter in itself, but enough integrated into other subjects, such as science. Teachers are expected can be more creative and innovative in creating teaching environment about natural disasters, not just integrate it in science subjects but can also be done through other subjects, such as social science, religion, and civics.

REFERENCES

Binadja, A. (2001). Pembelajaran Sains Berwawasan SETS (Science, Environment, Technology, and Society) untuk Pendidikan Dasar. Research.

Binadja, A. (2005). Pedoman Praktis Pengembangan Bahan Pembelajaran Bervisi SETS. Semarang: Laboratorium SETS UNNES.

Depdiknas. (2007a). Model Kurikulum Pendidikan yang Menerapkan Visi SETS (Science, Environment, Technologi, and Society. Jakarta: Pusat Kurikulum Balitbang Depdiknas.

Ernst, J. & Monroe, M. (2004). The effect of Environtment-Based Education on Student's Critical Thinking Skills and Disposition toward Critical Thinking. Environmental Educational Research, (10) 4: 507-522.

Frank, M. & Barzilai, A. (2006). Project-Based Technology: Instructional Strategy for Developing Technological Literacy, 18 (1): 39-53.

Kim, M. & Roth, W.M. (2008). Rethinking the Ethics of Scientific Knowledge: A Case Study of Teaching the Environment in Science Classroom, Asian Journal of Environment, 9 (4): 516-528.

Kumar, D.D. & Altschuld, J.W. (2000). Science, Technology and Society: Policy Implications. Bulletin of Science, Technology, and Society, 20(2), 133-138.

Lee, M.K. & Erdogan, I. (2007). The Effect of Science-Technology-Society on Students Attitudes Toward Science and Certain Aspects of Creativity, International Journal of Science Education, 29(11): 1316-1323.

Masfuah, S., Ani Rusilowati & Sarwi. (2011). Pembelajaran Kebencanaan Alam Dengan Model Bertukar Pasangan Bervisi Sets Untuk Menumbuhkan Berpikir Kritis Siswa. JPFI, 7(2)