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Student Concepts' Mastery:

Teaching Materials Based Learning with SETS Integrated Inquiry

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***Abstract*—Concept mastery is an important ability that needs to be developed for students as a base of their higher-order thinking skills. However, this has not been well facilitated in the process of learning science in Madrasah Tsanawiyah (MTs) due to the lack of teaching materials. This study aims to develop science teaching material based on SETS integrated inquiry to improve concepts mastery of student. This R&D research adapted the Dick and Carey model. The product was then used in science learning and tested for its feasibility on using students in one of the MTs in Mataram City, Indonesia, as subjects. The results show that teaching material have a goof feasibility, high category in practicality, and effective for improving student's mastery of concepts. In conclusion, learning using science teaching materials based on SETS-integrated inquiry was proven to improve students' mastery of concepts.**

Keywords—concept mastery, science teaching materials, inquiry, SETS

I. INTRODUCTION

The development of teaching materials is one of the processes that must be considered. Teaching material is a tool that can support the learning implementation [1]. The implementation of learning at every level of education is required to provide teaching materials that can facilitate student learning activities [2].

Teaching materials are sources of learning, which lead students easier to obtain information, knowledge, experience, and how to perform skills in the teaching and learning process [3]. The arrangement of teaching materials influences the complexity of the teaching material obtained by students in each lesson [4]. Therefore, the qualified teaching materials can make the learning process more effective, efficient, and can improve the quality of learning [5].

One of the problems that still become obstacles at schools is the availability of teaching materials for students to learn independently. Students tend to wait for the teacher to find concepts because have not opportunity for students to learn actively and independently [6].

Based on the preliminary study conducted at Madrasah Tsanawiyah (MTs) in Mataram City, Lombok, it is found that: (1) teaching materials used by students for learning activities are printed teaching materials from some publishers; (2) teaching materials used by teacher in teaching activities are in the form of printed textbooks developed by Science teacher council (MGMP), and textbooks consists of core competencies, basic competencies, competency achievement indicators, perceptions, material summaries and evaluation; (3) teaching materials used by teachers and students are arranged based on the 2013 curriculum.

Based on the analysis of the structure and content of the teaching materials used by the teacher and students, it shows that: (1) the material has not been packaged and adapted to the student's learning environment; (2) the material has not been packaged based on a learning approach or model that can train students to be active and independent in learning activities.

Based on the results of observations related to the learning process, it shows that: (1) the learning process has not been able to improve the students' mastery of concepts, this is based on the results of class IX final semester exams (UAS) in science class IX. Only 25 students out of 58 students achieved the standard criteria (KKM); (2) the learning process has not been facilitated by empowering thinking, that is led to the low students' mastery of concepts. the average concept mastery score is 25.50% (max score: 100%) in low category. This is in accordance with the research of Putri [7] and Nugraha et al [8].

Learning that is oriented towards empowering thinking can be an alternative improvement for students to understand science material. In the process of achieving the learning objectives, there are many aspects that should be considered by the teacher to make student have the better understanding toward knowledge [9]. Concept mastery will be contributed to the training of student to become critical thinkers who always think in applying an internal motivation [10].

In this case, the use of teaching materials and learning models is an important thing that must always be considered in teaching and learning activities so that it will affect learning activities, independence, learning activeness, empowerment of thinking and mastery of students' concepts. Therefore, one learning model that encourages students to actively discover

and build their knowledge is the inquiry learning model with Science, Environment, Technology, Society (SETS) [11].

The inquiry learning model is a learning model designed to provide students with experience in applying scientific methods that emphasize the activities of asking questions, developing hypotheses to answer questions and testing hypotheses using data from the results of investigations [12].

The inquiry learning model is a series of learning activities that emphasize the critical thinking process to find their own answers to the problem in question so that they can gain an understanding of the material being studied and students can be directly involved in the scientific process [13,14]. In addition, inquiry learning provides benefits in teaching diverse classes consisting of students with various skills, interests, needs and abilities [15]. Learning and the use of inquiry-based teaching materials are effective for improving learning outcomes, generic science skills, mastery of concepts and involving students actively in finding learning concepts [16,17].

One approach that has relevance to inquiry learning is Science, Environment, Technology, Society (SETS). SETS is a combination of conceptual approaches, process skills, CBSA, inquiry, discussion, and environmental approaches [18]. Teaching with SETS is a way to enable students to carry out investigations to gain knowledge related to science, environment, technology, and society [19]. Learning and using teaching materials with SETS vision are effective in improving learning outcomes, critical thinking skills and students' mastery of concepts [20,21].

II. METHODS

This research and development method was applied on using the Dick & Carey model development procedure [22]. The Dick & Carey model has ten stages, but in this study, it is limited to the ninth stage, namely formative evaluation. According to Sugiyono [23] the research has produced a learning program and has tested for the effectiveness. The product of the research is science teaching materials based on SETS integrated inquiry to improve students' concept mastery abilities.

To measure the effectiveness of the product, the experimental method was used. The two classes were involved, the experimental and the control classes. The experimental class was taught using science teaching materials based on SETS integrated inquiry, while the control class was taught using the ordinary teaching, materials. Which are often used in schools.

The population of this study were students of class VII in one of the MTS in Mataram, Lombok, Indonesia. The number of students involved as subjects in this study were 60 students.

The instrument used to determine the feasibility of developing teaching materials was the validation sheet of teaching materials on material aspects and product aspects. Teaching material validation were carried out by three experts in the field of education and science. The data obtained were analysed by quantitative methods through percentage techniques to determine the feasibility of the science teaching materials.

The instrument used to determine practicality was a questionnaire on teacher and student responses to the use of the teaching materials developed. The conceptual mastery instrument used multiple choice questions. The analysis of the students' concept mastery data is divided into 2 parts, the analysis of the mastery of concepts on each indicator and the analysis of the overall concept mastery. The concept mastery test refers to six indicators according to Anderson and Kratwhol [24], from C1 (remembering) to C6 (creating).

III. RESULTS AND DISCUSSION

SETS integrated inquiry-based teaching materials were developed as a learning aid, especially in science learning. Teaching materials are made to be used independently by students supporting by other learning resources. This SETS integrated inquiry-based teaching material is used in science learning to improve students' mastery of concepts.

The validation of the products resulting from the development of science teaching materials was carried out by three experts who were competent in their fields. The result of expert validation obtained is listed in Table 1.

TABLE I. VALIDATION RESULTS OF TEACHING MATERIALS

Components are rated	Average value	Category
Theory	81.20%	Well worth it
Product	79.50%	Well worth it
Average	**80.35** %	**Well worth it**

Table 1 shows that the average percentage of the validation/eligibility results of teaching materials obtained an average value of 80.35% with appropriate criteria. This indicates that science teaching materials based on SETS integrated inquiry can be implemented in learning.

Practicality testing was tested based on student and teacher response questionnaires to the use of science teaching materials based on SETS integrated inquiry. The results of the practicality test are shown in Table 2.

TABLE II. STUDENT AND TEACHER RESPONSE RESULTS

Respondents	Average value	Category
Students	80.05	can be Practicaly used
Teacher	80.00	can be Practicaly used
Average	80.02	can be Practicaly used

Based on Table 2 shows the responses of students and teachers after learning using the teaching materials developed obtained an average score of 80.02% in the category can be practically used. This shows that the use of teaching materials that are applied with the integrated and integrated learning

stages of SETS is very easy for students and teachers to use in science learning.

Umami and Jatmiko [11] suggested that the learning process with inquiry and SETS provides more opportunities for students to see knowledge from several meaningful contexts, encourages students to be actively involved in learning, students feel happier and more motivated by all activities which is done during the learning process.

The SETS integrated inquiry-based science teaching materials aimed at training and developing concept mastery have positive points and are very well used in the learning process. This is because students are required to learn directly or independently in finding a concept through scientific work procedures using scientific method steps so that they can train and develop an understanding of the scientific process [25,26] and indirectly train and develop critical thinking skills. and creative students in solving a given problem [27,28].

The experimental class and the control class were used in this study with the aim of obtaining a comparison between the results of the application of the product developed by the researcher with conventional teaching materials that are often used in schools. Furthermore, the results obtained are tested for effectiveness. The effectiveness data was obtained through the N-Gain test by looking at the increase in student acquisition at the pretest and posttest.

The test of the effectiveness of the application of science teaching materials based on SETS integrated inquiry in improving students' mastery of concepts after the application of teaching materials is presented in Table 3.

TABLE III. CONCEPT MASTERY TEST RESULTS

Class	Pre-test	Post-test	N-gain	Category
Control	22.22	41.60	0.22	Low
Experiment	27.50	62.50	0.46	Moderate

Based on the results of the concept mastery test presented in Table 3, it shows that the results of students' concept mastery tests in the experimental and control classes show a significant difference. The results of the students' conceptual mastery test in the experimental class showed an increase in the moderate category compared to the control class with the low category. This shows that the use of science teaching materials in SETS integrated inquiry-based learning in the experimental class in general can improve students' mastery of concepts.

In addition, using science teaching materials using inquiry models are effective in improving students' higher order thinking skills. Students' mastery of concepts becomes a provision for students to practice higher order thinking skills [29].

Through learning using science teaching materials based on SETS integrated inquiry, students and groups discuss problems in a scientific way with the aim of knowing the benefits and impacts that occur in the environment and society related to the application of science and technology. There is an interaction between students that allows them to exchange thoughts and opinions with each other through research or scientific work procedures before they find answers and the results can train students' metacognitive awareness. Learning activities with the SETS approach can improve students' problem-solving skills because learning activities begin with problems. Students are required to solve problems in their environment. In the final stage of learning, students are expected to be able to master science learning material and solve problems [30]. This is consistent with the research conducted by Nuray and Morgil [31] which states that science learning using the SETS approach in the experimental class can improve learning outcomes compared to learning using conventional models in the control class.

The advantages and challenges of inquiry learning compared to conventional learning are that inquiry learning relates phenomena to students, whereas conventional learning is learning that creates passive and boring learning for students [32]. The teacher encourages and guides students to develop questions, seek information, analyse data, and communicate their findings. This helps students to construct new knowledge and participate actively in class.

Inquiry-based learning is more successful in developing knowledge integration in students [33]. While the use of conventional models of the learning process emphasizes the delivery of material verbally from the teacher to students with the intention that students can master the learning material optimally [34].

Leonor [35] stated that the guided inquiry model can improve students' mastery of concepts so that it is believed to show better concept mastery results [36]. The same statement stated that the guided inquiry model is one way to develop knowledge by constructing concepts

The application of guided inquiry learning models can provide a positive response to the learning activities undertaken and can increase student understanding in learning. Inquiry learning can also help students build knowledge through the process of thinking and asking questions and the combination of games can improve student cognitive learning outcomes [33].

Furthermore, an analysis of the students' concept mastery per indicator was carried out. The analysis results are presented in Figure 2.

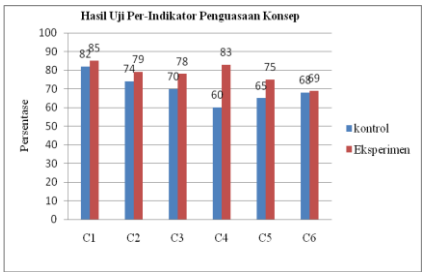

Fig. 1. Test results per indicator of concept mastery.

Based on the results of the per-indicator concept mastery test presented in Figure 2 shows that the results of the per-indicator concept mastery test of students in the experimental and control classes show a significant difference. The C1 indicator scores higher than the other indicators, namely C2, C3, C4. C5, and C6. Meanwhile, indicators C5 and C6 score lower than other indicators.

This is because the C5-C6 questions are more complex and require a deeper level of analysis. Students still have difficulty with questions that require analysis. In line with the description above, the level of cognitive domains proposed by Bloom is depicted in the form of a pyramid which indicates that higher levels require more complex thinking skills [37].

Kaniawati et al. [29] stated that in the C1 and C2 aspects the questions in this aspect emphasize a relatively simple and easy understanding of the concept. So that student can answer questions in the aspect of understanding (C1 and C2) without difficulty.

In the application of aspects (C5 and C6) which are higher than aspects of understanding (C2), the concepts that must be understood by students are also more complex. is the highest aspect in this research and involves Higher Level Thinking Skills. The concept asked in this aspect is more complex than the application aspect (C3).

This is in line with research conducted by Yustiqvar, et al [38]; Febriyani et al. [32] stated that the indicator of concept mastery at the HOTS C4-C6 level obtained the lowest score compared to LOTS C1-C3.

Reza et al. [36] concluded that the inquiry-based science teaching materials developed were valid, practical, and effective to improve conceptual understanding and train students' critical thinking skills. The results of research by Yeritia et al [34] students are happy with inquiry learning because they get direct experience in the learning process. Guided inquiry puts more emphasis on activities maximally through experimental activities to find and find their own concepts so that students find it easier to understand complex and abstract concepts accompanied by real experiences and avoid learning to memorize.

IV. CONCLUSIONS

The science teaching materials based on SETS integrated inquiry are feasible, practical, and effective to improve students' conceptual mastery. The results of the students' conceptual mastery test in the experimental class showed an increase in the moderate category compared to the control class with the low category. This means that the use of science teaching materials in SETS integrated inquiry-based learning in the experimental class can generally improve students' mastery of concepts compared to the control class which is taught using conventional teaching materials. Students' mastery of concepts in the first indicator, namely C1, received a higher score than other indicators, such as C2, C3, C4, C5 and C6. The C5-C6 indicator scores lower than the other indicators.

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