Reconstruction of Teaching Materials with Socio-Scientific Issues Context on Source of Energy Content

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Reconstruction of Teaching Materials with Socio-Scientific Issues Context on Source of Energy Content

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Abstract. One innovation that can be done to improve the quality of science learning is through the development of teaching materials. In this study teaching material was developed through a reconstruction process, where regard to educational goals, carefully described, and related to the context in real life. One of the science contents that is very close to the context in real life is a source of energy. Source of energy content can be used in science learning as a controversial Socio-Scientific Issues (SSI). This study used a modified R&D in two mains steps, research and initial information collection, as well as planning and development of products that adopt model of educational reconstruction (MER). Teaching material with SSI context on source of energy content that had been developed has several characteristics including, designed based on SSI learning, each description in theme is packaged by context, consisting of a cover page, introduction structure, end section, and additional reading lists. The teaching materials are validated and given an evaluation by experts to determine the feasibility of the teaching materials. In addition, students collected responses to determine the level of understanding and expectations of students towards teaching material that had been produced.

1. Introduction

Teaching material is one important component in determining the success of education system, so that, an educator is required to make a quality teaching material. Based on this, we need a reconstruction of teaching materials. A content structure for teaching cannot be taken directly from structure of science content, but must be specifically rebuilt with attention to educational goals as well as cognitive aspects and affective perspectives of students. Therefore, a science content must be carefully described and then linked to context in real life [1] . One of science content that is very close to context in real life is sources of energy, especially about renewable energy. The development of time and technology today, causing use of energy sources on a large scale this causes scarcity of energy sources and need for discovery of new energy sources [2]. The issues related to scarcity of energy sources are socio-scientific issues which are very potential to be used as a basis for learning science [3].

Teaching materials in the context socio-scientific issues (SSI) which includes controversial social issues of contemporary arising from advances in science and technology [4]. Learning using SSI is learning that presents controversial social issues related to science [5 - 6]. Research that is relevant to SSI-based learning has been carried out in several developing countries such as Malaysia [7], Nigeria [8], India [9], Afghanistan [10], and Turkey [11 - 12]. The findings of all of these studies, show that

SSI-based learning is able to promote students' scientific literacy. The steps of SSI-based learning developed through the Socio Critical and Problem Oriented Lesson Plan by Eilks et al. [13], which consists of, 1) problem approach and analysis, 2) clarification of problems through practicum activities, 3) continuing issues of social problems, 4) discussion and evaluation, and 5) metareflection. Overall the use of Socio Critical and Problem Oriented Lesson Plans in learning promises in terms of promoting high-level cognitive skills such as communicating, reflecting and evaluating controversial issues [14 - 15]. Teaching materials and learning resources are seen as important factors in determining [16]Besides this, the use of Socio Critical and Problem Oriented Lesson Plans in learning enables teachers to innovate in science classes and direct students to have higher motivation and perception in connecting science to everyday life [17]

Based on the background that has been stated, socio-scientific problems can be used as links to real issues in society and a foundation by students to explore science content. With social-scientific problems applied in science learning, it is expected to provide a more meaningful learning experience. The authors' search results show that studies relating to the use of SSI in science learning are still limited. The problems to be answered through this research are formulated as follows: "How is the feasibility of teaching materials based on socio-scientific issues context in the energy source material in facilitating the ability to understand students' concepts?"

This study describes how the development process and feasibility of teaching materials based on socio-scientific issues context on energy source material and how students respond to the use of teaching materials in understanding the concept of energy sources.

2. Method

The method used in this research was research and development. The development model adopted from Borg & Gall [17 – 19], with several main steps: (1) preliminary research and information gathering, (2) planning, (3) initial product development, (4) initial trials, (5) product revisions, (6) field trials, (7) operational product revisions, (8) field testing, (9) final review, (10) dissemination and implementation [21]. Not all steps done because there are limitations. The research steps divided into two main steps, namely a preliminary study (initial research and information gathering) and product planning and development [22].

This research conducted at the Faculty of Teacher Training and Education Untirta and SMAN 1 Waringinkurung. The instruments used included the validation sheet of teaching materials, evaluation sheets of teaching materials, and student response questionnaires. Analysis of the validity of the contents of the instrument using the Lawshe formula, namely Content Validity Ratio (CVR) [23]. With the equation (1).

$$CVR = \frac{\left(n_e - \frac{N}{2} \right)}{\frac{N}{2}} \tag{1}$$

Information:
ne : Number of panellists who gave a rating of important/relevant
N : The sum of all panellists

The total number of panellists used was 5 people. the criterion for concluding the level of validity is that if half the panellists answer essential or CVR> 0, then the conclusion is valid.

Scores obtained from the feasibility assessment by expert tests will be calculated using the equation (2):

$$NP = \frac{R}{SM} \text{x}100\% \tag{2}$$

Information:

NP : Average value in percent (%) given
R : Scores obtained from every aspect
SM : Maximum score from all aspects [24]

The interpretation of equation (2) can be seen in Table 1.

Table 1. Interpretation of teaching materials feasibility test results

Score (%)	Interpretation
<20	Very less
21 - 40	Less
41 - 60	Enough
61 - 80	Well
81 - 100	Very good

3. Result and Discussion

This study aimed to develop teaching materials based on socio-scientific issues context in the content of energy sources and to see the feasibility of the teaching materials developed. After going through the initial research process, product planning and development involving data analysis, text solemnization, and text construction and considering the results of empirical studies of students' pre-conceptions and teacher perspectives, teaching materials with SSI context about energy sources have produced. Teaching materials provided consist of three main chapters, namely renewable and non-renewable energy, electricity generation, and the impact of exploration of energy sources on the environment. Each chapter contains material descriptions, additional reading lists, and exercises. The other reading list intended in the teaching material is related sections such as additional knowledge or information that will support students' insights about energy source content. In the material and training description section, the socio-scientific context issues added as the basis for learning. The examples of content and context contained in the book can be seen in Figure 1.

After teaching materials have developed, then proceed with expert evaluation. This evaluation is carried out in two stages, namely validation based on general criteria and evaluation based on the criteria of "National Education Standards Agency (BSNP)." Five panellists conducted each test. The results of the first stage show that for each criterion, a valid value obtained. This is because CVR = 0.2 or CVR> 0.

The second part is the evaluation of teaching materials based on BSNP criteria, and these criteria consist of content and suitability of presentation, linguistics, and graphics. The result obtained a percentage score for each aspect> 80% with a top category. Overall evaluation results show SSI teaching materials with appropriate energy source material based on general criteria and BSNP so that they can use as teaching materials in the physics learning process in class XII.

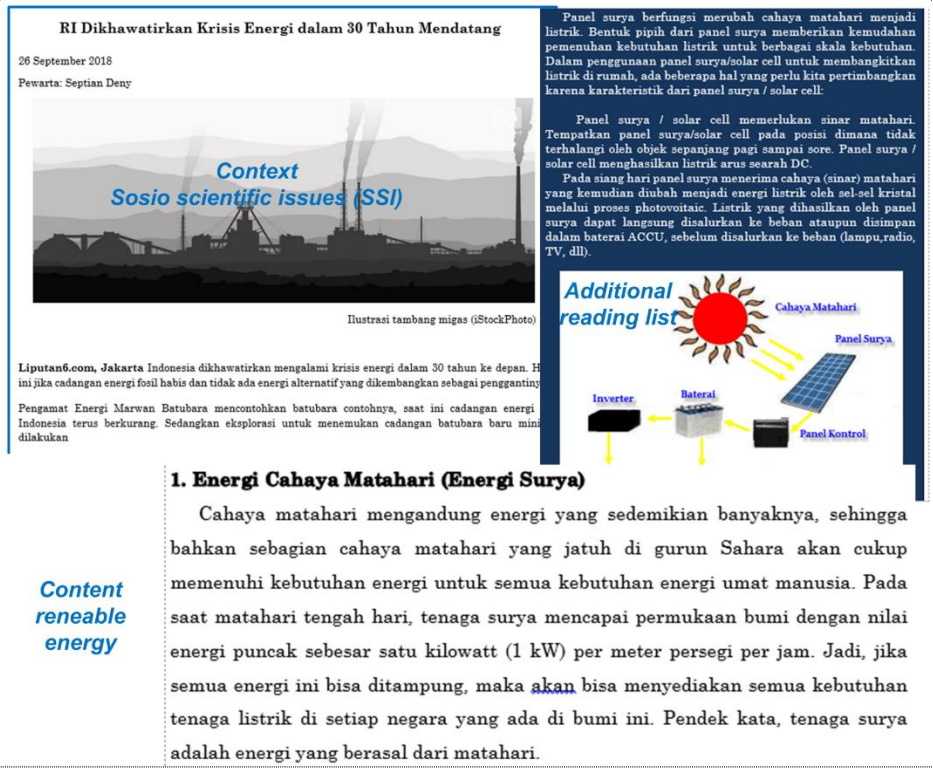

Figure 1. Examples of content and context contained in the book

The results of students' responses to teaching materials indicate that most students expressed pleased in using teaching materials in the context of Social-Scientific Issues in energy source material. Therefore, it can be said that most students give positive responses related to the teaching material developed. In general, students have understood the contents of teaching materials and stated teaching materials in the context of SSI on energy sources have met student learning expectations. These results are consistent with the study Sadler [25]. In general, students have understood the contents of teaching materials and stated teaching materials in the context of SSI on energy content sources have fulfilled students' learning expectations. The results showed that the teaching materials have several advantages. So the recommendation is given that the reconstruction of teaching materials with the SSI context needs to developed in other physics content. This is because there are still many physics content that are strictly related and appear as social problems in society and daily life. The reconstruction process carried out must be followed by trials to find out how much influence the use of teaching materials on students' scientific literacy. The test must be carried out on a large scale and in a very long time.

4. Conclusion

Based on the results of the study obtained several conclusions, namely, the teaching material produced has several characteristics including, designed based on SSI learning, each description in the theme (chapter) packaged according to context, consisting of the front page and introductory structure (table of contents), macrostructure, and learning objectives), end sections (exercises, summaries, glossary and bibliography), and additional reading lists. The results of the validation and evaluation of teaching materials produced indicate that teaching materials are suitable for use in learning physics in energy source material and can facilitate the understanding of student concepts.

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