

Characteristics of textbooks based on the sets(science, environment, technology, and society) of the respiratory system to improve the ability of junior high school students to multi-representations

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Abstract. This research is the development of a SETS-Based Respiratory Textbook, using a mixed method of the investigation model, which collects qualitative data, then constructs a SETS-Based Respiratory Book design that is ready to be validated. The subject in this study was a SETS-Based Respiratory Textbook that could improve the representation ability of eighth grade students of junior high school. Whereas the respondents were Science Subjects (IPA) teachers who were incorporated in the Consultative Assembly for Science Subjects (MGMP) in Central District of Jember Regency and students of class VIII of SMP. Data collection techniques using observation, questionnaires, tests, and documentation. Research data explained qualitatively. The purpose of this study is to find out whether SETS-based books can be validated from the appropriateness of their contents. The results showed that the SETS-Based Respiratory Textbook contained the phenomenon of the Respiratory System; and has a specific writing pattern, which has a sequence of chapter titles, sub-chapter titles, description of material, sample questions, and ability test questions, and bibliography.

1. Introduction

Based on the Ministry of Education and Culture of Republic of Indonesia No. 32 year 2013 Article 43 paragraph 6 states that each education unit has the right to develop learning resources in accordance with the needs and characteristics of the education unit. The role of the teacher as a facilitator in learning has greater tasks and challenges, one of which is the ability of the teacher to develop teaching materials that are suitable to the needs of the learning process for the achievement of learning objectives. Development of teaching materials conducted by teachers can consist of Student Worksheets (LKPD), Modules, Handouts, or Textbooks.

Textbooks are classified as one of the teaching materials that play an important role in the success of the learning process. Textbooks are a unit of learning unit that contains information, discussion, and evaluation, [1]. Textbooks as teaching materials are books that contain a knowledge of the results of analysis of the curriculum in written form [2]. The material in the textbook is a realization of the



material listed in the curriculum. Increasingly varied textbooks can help students broaden their knowledge in understanding each learning material, one of which is in the Natural Sciences (IPA) material.

Science learning in junior high schools (SMP) was developed as an integrative science subject where science can be linked to environmental, technological, social or cultural conditions. Based on the Ministry of Education and Culture Regulation Republic of Indonesia No. 32 year 2013 Article 19 which states the learning process in the education unit is held interactively, inspirational, fun, challenging, and motivates students to participate actively so that it will foster creative attitudes, and independence in accordance with the talents, interests and physical and psychological development of students. The science learning process is application oriented, the development of thinking skills, learning abilities, curiosity, and the development of caring and responsible attitudes towards the natural and social environment [3]. According to Liliarsari in [4] the way to study science has 4 dimensions, namely science as a way of thinking, science as a way to investigate, science as knowledge, science and its interaction with technology and society.

Educational products in the current generation pay less attention to the surrounding environment, products produced both technology and human resources are competing to explore the riches of the earth and less attention to the consequences caused in the future. Only after the various problems in life caused by damage to the earth are so widespread, only then are some countries, several nongovernmental organizations and environmentalists who speak out [5]. The introduction of environmentally friendly education will be able to create environmentally friendly people and with an environmentally friendly approach can also foster a sense of concern for the importance of the environment and an attitude of protecting the environment.

The success of the learning process in order to realize educational goals is greatly influenced by many factors. Both technically and non-technically. Not only teachers and students play a role in the success of education but more than that also must be supported by other aspects. One very important aspect in order to achieve educational goals is the approach in learning. The learning approach is a framework of the concept of learning that teachers do to guide students so that learning objectives are easily accepted by students. One of the breakthroughs in learning science can be done by applying the SETS approach. The SETS approach is an integrated learning that is expected to be able to teach students to have the ability to see things in an integrated manner by paying attention to four elements namely, science, environment, technology, and society [6].

The ability of students to process information needs to be translated in various ways such as verbal, drawing, graph or mathematics or often called Multirepresentation. According to Waldrup in [7] multi-representation presentations can be grouped specifically as knowledge about: drawings, table models, graphs and diagrams. The representations used to understand the concepts of science learning, especially Respiratory System material are verbal representations, drawings, and mathematics. Multirepresentations can assist students in learning and building concepts and overcoming problems. According to [8] states that teaching involving multi-representation provides a rich context for students to understand concepts. According to [9] [10] learning with many presentations makes it easy for students to understand concepts in various ways. Students have specific abilities that are more prominent than other abilities. There are students who have more verbal ability than their spatial and quantitative abilities, but there are also the opposite.

Based on the results of a survey conducted, that 87% of the teachers in the field of Natural Sciences in the MGMP IPA Central Region of Jember, did not know what the SETS approach was, and the other 13% had only heard of it and did not know the full concept of the SETS approach. The development of textbooks is rarely done by teachers, as evidenced by the results of observations made 90% of teachers prefer to make a Student Worksheet (LKPD) compared to textbooks, due to the limited time they have, most teachers prefer textbooks from the government alone. need an innovation in the development of textbooks oriented to technology, the environment and society. Based on these problems, the researchers wanted to develop textbooks based on SETS.

2. Research Method

This research was a survey research, with the emphasis of the study on: 1) the initial reference source books; 2) description of science learning materials; 3) the initial conditions of teaching materials; and 4) previous research results related to SETS, representation, and those related to the development of teaching materials. Based on the study activities carried out in the study, the study data tend to be descriptive qualitative data. The data were obtained by observation techniques, questionnaires, documents and literature studies on various sources, such as: books, scientific journals, articles, research reports and so on as secondary data. To obtain the results and conclusions of the study, the data obtained were analyzed by descriptive analysis. The subject in this study was a SETS-based respiratory system textbook to improve the ability of the multi-representation of SMP / MTs students. Respondents in this study were Science Teachers who were members of the Science MGMP in the middle of the district of Jember and students who in class VIII SMP / Mts.

3. Results and Discussion

3.1 The results of a theoretical study

- The study related to the use of the SETS approach in Learning
The results of previous studies related to the use of the SETS approach or model, obtained from scientific journals, articles, and research reports show that the SETS approach can have a positive impact on students, can improve student learning outcomes. Some research results are shown in Table 1.

Table 1. Research Study Results Regarding the Use of the SETS Approach or Model

Years	Products and Researchers
1	2
2013	Development of integrated Science materials Bebasis Salingtemas with the theme of renewable alternative energy sources. Oni Arlitasari, Pujayanto, Rini Budiharti
2013	Development of the Integrated Science module A Vision Sets (Science, Environment, Technology, And Society) in the ecosystem theme. Esmiyati, Sri Haryani, Eling Purwantoyo
2013	SETS (Science, Environmental, Technology And Society) as a Modern IPA learning approach to curriculum 2013. Nur Khasanah
2015	To What Extent do Biology Textbooks Contribute to Scientific Literacy? Criteria for Analysing Science-Technology-Society-Environment Issues. Florbela M Calado, Franz-Josef Scharfenberg, Franz X Bogner
2015	Science-based learning tool development Sets to improve Scientific Literacy and Foundational Knowledge. Indras Kurnia Setiawati, Senam
2015	Application of Sets approach (Science, Environment, Technology, Society) in Imtaq based biology learning to improve students' learning outcomes in environmental pollution concept at Sma Negeri 8 Cirebon City. Siti Komariah, Nurul Azmi, Ria Yulia Gloria
2016	The Science-Technology-Society Framework for Achieving Scientific Literacy: an overview of the existing literature. Steven M Autieri, Aidin Amirshokoochi, Mahsa Kazempour
2016	The Integration of Science-Technology-Society/Science-Technology-Society-Environment and Socio-Scientific-Issues for Effective Science Education and Science Teaching. Mohammad Anisuzzaman Chowdhury
2017	Using Learning Science, Environment, Technology and Society (SETS) Local Wisdom and based Colloids Teaching Material. Hairida
2018	Development of IPA Module integrated SMP/Mts class VIII based SETS to improve student critical thinking ability in food and body health theme. Asmuri, Sarwanto, M Masykuri

(Source: author)

- The study related to the development of teaching materials to measure representation
The results of previous studies related to the development of teaching materials, that the study of teaching materials that emphasize the development of teaching materials that lead to increasing the ability of multi-representation or increase the ability of verbal, picture and

mathematical representation. From the results of the study, it was found that the research emphases on the development of teaching materials as presented in table 2.

Table 2. Research Study Relating to Development of Teaching Materials to measure representation

Years	Products and Researchers
1	2
2011	Implementation of Multi-representation based learning for enhanced quantum physics concept mastery. Abdurrahman, Liliyasi, A Rusli, Bruce Waldrup
2012	Multi-representation approach in energy-learning and impact on student concept understanding. A Suhandi, F C Wibowo
2013	Student book development based on Multirepresentation in rotational dynamics materials. Kadek Milawati Devi, Nengah Maharta, Wayan Suana
2016	Readability and feasibility of the content of elasticity module and Hooke-based multirepresentation to high school class X. Maike Sepnila Nurdiana, I Ketut Mahardika, Alex Hariyanto
2017	Influence of representation ability in mathematics learning. Nanda Yulia, Edy Surya
2017	Potential Multi-representation approach to enhance student reasoning ability in mechanical wave material. Dyah Ayu Lestyaningtyas, Sutopo, Hari Wisodo

(Source: author)

3.2 Survey results, documentation and field observations

Survey results that researchers do at the teacher discussion of Teachers natural science Central Region Jember District. Showing the results 67 teachers out of 90 Natural Sciences MGMP teachers or 87% of teachers stated that during learning they still often used the Scientific approach, where this approach aims to direct students to be able to build their own knowledge or often referred to as 5M (Observing, Asking, Trying, Associating, and Communicating). Shown in figure 1:

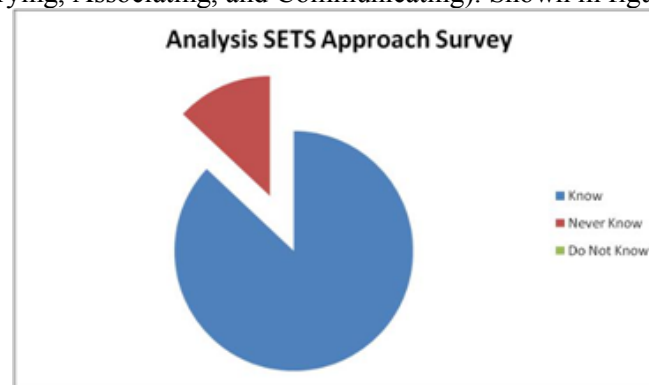


Figure 1. Analysis SETS Approach Survey

Approach used by teachers was still less diverse, the need for approaches that can facilitate students to develop their understanding of learning materials with environmental conditions. Other results from the survey also showed that 87% of the teachers in the field of Natural Sciences in the MGMP IPA Middle Area in Jember did not know what the SETS approach was, and another 13% had heard and did not know the full concept of the SETS approach.

Book development is also still very rarely done, this can be known from the results of the questionnaire analysis, as in figure 2.

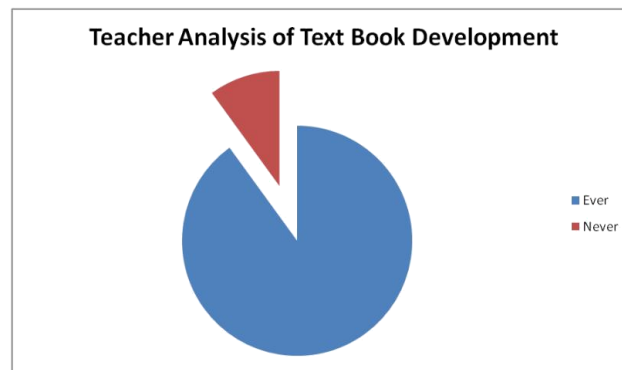


Figure 2. Teacher Analysis of the text book development

About 90% of teachers prefer to develop Student Worksheets (LKPD) to other teaching materials, it is because of their limited time, so most teachers prefer to use learning resources from the government, and other learning resources from the internet or other books. Textbooks that had been used by teachers and students do not provide an environmental approach, so that the students even still find it is difficult to link the learning material with the issues that is in the environment.

3.3 Solutions

The development of a teaching book that contains a SETS-based approach, in which the book is complemented by a variety of facts relating to the breathing system material, has a clear image, so that it is easy to understand, and uses Simple language. SETS approach is a way of looking forward that leads to the understanding that everything that is encountered in life contains aspects of science, environment, technology, and society as a whole and mutually influencing each other [4]. Learning to use SETS can encourage students to be more active and creative in dealing with problems in the community [10]. This book provides evaluation questions of which measures the extent of students' understanding, so that it will improve student learning outcomes in the end. Providing a direct experience on learning gives a profound sense [3], as learners are asked to run an experiment and discuss related issues that occurs during the experiment.

Creating SETS teaching books, regards the principles of setting teaching books, such as validity, effectiveness and practicality [11]. The book cover was made as attractive as possible with brightly colored pictures, it aimed to provide motivation to read, after the cover was drafted a concept map before studying the material. This aimed to provide a basic concept of the material to be studied. And the material presented is equipped with various images and photos of environmental issues related to SETS.



Figure 3. The front page of the SETS-based book



Figure 4. Content in the book based on sets



Figure 5. Summary after the contents of the book

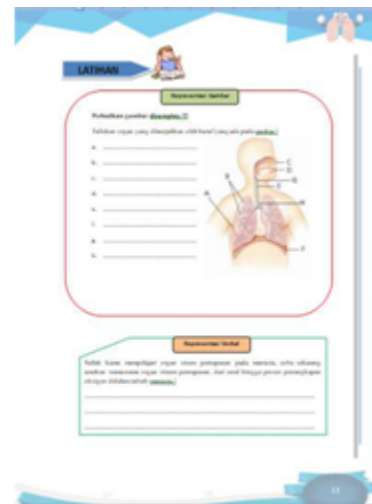


Figure 6. Test questions in the form of multi-representation

4. Conclusion

The study of research results shows that a SETS-based breathing system teaching book contains issues related to SETS in the context of the image, and has a specific writing pattern, i.e. having a chapter title sequence, sub-chapter headings, description Questions and skills, and bibliography. For further research, a field test must be conducted, to obtain empirical results

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References

- [1] Mintowati 2003 *Guidelines for Writing Textbooks* (Jakarta: Depdikbud)
- [2] Mahardika I K 2012 *Representation of Mechanics in Discussion: A Theory and Research Results of the Development of Mechanics Teaching Materials* (Jember: University Press)
- [3] Prasetyowati 2014 *Junior High School Science Learning According to the 2013 Curriculum* (Yogyakarta: Universitas Negeri Yogyakarta press)
- [4] Zunicha, Sunarno W and Suparmi 2017 Physics learning using the science, environment, technology, and society (SETS) approach with project and experiment methods viewed from the critical thinking ability and student creativity *Journal of INKUIRI* **6** 101-112
- [5] Khasanah N 2015 *SETS (Science, Environmental, Technology and Society) as a Modern Science Learning Approach in the 2013 Curriculum* (Semarang: UIN Walisongo)
- [6] Binadja A, S Wardani and S Nugroho 2008 Interpretation of chemistry learning material bonded chemistry materials sets on student learning outcomes *Journal of Chemical Education Innovation* **2** 256-262
- [7] Mahardika I K 2011 *Development of Mechanics Teaching Materials to Improve the Capability of Multirepresentation of Prospective Physics Teacher Students* (UPI Bandung: Unpublished doctoral thesis)
- [8] Van Heuvelen A and Zou X 2001 Multiple representation of work-energy process *American Journal of Physics* **69** 184-194
- [7] Hilton A dan Nichols K 2011 Representational classroom practices that contribute to students' conceptual and representational understanding of chemical bonding *International Journals of Education* **33** 2215-2246

- [9] Hairida 2017 Using learning science, environment, technology and society (SETS) local wisdom and based colloids teaching material *Journal of Education, Teaching and Learning* **2** 84-89
- [10] Nieveen N 1999 Prototyping to reach product quality *Design approaches and tools in education and training* ed van den Akker J, Branch R M, Gustafson K and Plomp T (Dordrecht: Springer) chapter 10 pp 125-135