
Developing Science Teaching Material to Increase Elementary Students' Science Process Skill

Ai Hayati Rahayu^{1*}, Bunyamin Faisal Syarifudin²

¹Sekolah Tinggi Keguruan dan Ilmu Pendidikan Sebelas April Sumedang, Sumedang, Indonesia

²Sekolah Tinggi Keguruan dan Ilmu Pendidikan Sebelas April Sumedang, Sumenda

*ahayati75@gmail.com

Received: 23 January 2019

Revised: 16 February 2019

Accepted: 18 February 2019

Abstract

Mastering science process skill is very beneficial in problem solving process. This research aimed to develop teaching materials such as science process skill-based textbooks on energy and its changes. The method used in this research was research and development, by using the 4D design, which include define, design, develop, and disseminate. Research and development method were used to produce a product and to test its efficiency. The result showed that the learning material fulfill the assessment criteria. The mean validation result of textbook showed a number of 3.58 indicated as a good category. Based on T test, it was proven that the use of textbooks is indeed influential towards the development of students' science process skill.

Keywords: *Science teaching material, science process skill, energy and its change*

1. INTRODUCTION

Teaching material is a set of material or substance for learning and teaching activity which has been arranged systematically. This material shows a complete picture of the competence which will be mastered by the students and will be used in the learning and teaching activity with the purpose of planning and analyzing the implementation of learning activity. This teaching materials can be in form of textbooks, modules, hand outs, LKS, models or mockups, audio teaching materials, interactive teaching materials, etc (Prastowo, 2012).

Textbooks as one of teaching materials is becoming an important aspect to be developed. One of the main reason in and conclusion. If necessary, the authors can add sub section.

Selecting textbooks as teaching material is the existence literacy program. Textbooks are expected to develop students' comprehension of the concepts, increase students' science process skill, as well as to increase students' literacy skill.

Capability of science process skill is the ability used by scientists and scholars in producing their concepts and theories. By mastering science

process skill, it is not only will be beneficent in science, but also will give a positive impact towards students' life in near future (Sukarno, Anna & Ida, 2013a, 2013b). The learning of science process skill is aslo able to increase students' creativity (Aktamis, 2008).

Reality shows that on site, science process skill is not yet achieved and mastered by students. This has been investigated by Rahayu and Anggraeni in 2017 which concluded that the lack of skill-based teaching materials is one of numerous factors to cause the low ability of students' science process skill. Other factors are the lack of teachers' comprehension towards KPS, the lack of school's medium and infrastructure, as well as the lack of thorough understanding on evaluation process.

Availability of textbooks is still becoming a deciding factor of the success in learning and teaching process. Therefore, there were a number of research has been done regarding teaching material. Some of them are The Analysis of availability of science process skill in textbooks (Aziz & Zain, 2013), the development of *Salingtemas*-based Science teaching material (Arlitasari, 2013), and The development of science module with SETS vision (Esmiyati, 2013).

Other research on teaching material has been done by Kurniawati, Anitah and Suharno in 2017 which developed scientific-based science teaching material to increase the result of students' learning in Elementary School. Before that, Abadi et al in 2017 has developed interactive and scientific-based approach in teaching material which covers about social arithmetic

for elementary school. In this research, the researcher aims to develop teaching material in form of science textbook using scientific approach with the reinforcement of process skill-based in order to increase the students' science process skill.

2. METHOD

The method used in this research is research and development which is designed by Thiagarajan. This research include 4D design developed by Thiagarajan which are define, design, develop, and disseminate.

The instruments used are validation sheet of feasibility test on teaching material which covers feasibility of substance, presentation, graphic, language, and process skill. Science process skill test to find out the efficiency of teaching material in order to increase the elementary school students' ability in science process skill. Observation sheet of students' process skill assessment during learning activity using science process skill-based teaching material. And a fill in the blank test sheet to find out the legibility of teaching material's product.

Technique of collecting data is done when the product design is ready by giving validation of assessment instrument to validator. The collection of data validation is also done after the product is being revised. Validation used id in form of expert judgement from expert lecturer and elementary school teachers. Validation result then being analyzed and set as material to be revised in teaching material.

The second data is product test, which is a legibility of teaching material.

The last data is the implementation test of teaching material. In this stage, the efficiency of teaching material being developed is being tested. Test design used was pre-experimental design with one group pretest posttest design. Research design is shown in figure 1 as follow:

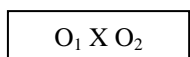


Figure 1. Research Design

Description :

O_1 = pretest value before given any scientific approach treatment based on Textbook

O_2 = posttest value after given scientific approach treatment based on textbook

3. RESULTS AND DISCUSSION

Research data are collected through stages of RnD method with Thiagarajan design as follow:

Define

In this stage, the researcher is doing an analysis on curriculum, students' characteristics, students' process skill aspect and the purpose of learning. The analyzed data conclude that the composing of teaching material is being focused on IV class with the

material of energy and its change. The material include energy and its utilization which covers alternative, heat, and sound energy. Students' process skill aspect include observing, questioning, classifying, trying, predicting, inferring, and communicating aspect. Not only expected to be able to increase the students' comprehension about energy and its change, teaching material is also aims to increase the students' science process skill aspects.

Product Design

In this stage, the researcher design teaching material. Design and prepare validation instrument media as well as other instruments. Product design is made in form of curriculum 2013 textbook for IV graders on energy and its changes. Validation instrument is arrange based on substance, presentation and graphic, language, and process skill feasibility. Validation instruments are adapted and developed from arranged instrument by Puspita in 2017. Chosen validators are 2 expert lecturers and 1 elementary school teacher. The result from validator is shown in the following table:

Table 1: Textbook Assessment

Assessed aspects	Assessment result		
	Validator 1	Validato2	Validator 3
Substance feasibility			
Relevance (max 40)	40	30	39
Accuracy (max 16)	16	12	15
Presentation and graphic feasibility			
Presentation completeness (max 12)	11	10	12
Presentation systematic (max 8)	8	6	7
KPS aspect feasibility			
Compatibility with the KPS (max 20)	20	20	15

Language feasibility			
Language rule compatibility (max 12)	11	12	9
Legibility and communicative (max 16)	13	10	16
Total (max 124)	119	102	113
Average	3,8	3,3	3,6
Percentage	95,97	82,25	91,13
Category	Good	Good	Good

From table 1, can be seen that the average of validator 1 assessment is 3,8 and validator 2 is 3,3 and validator 3 is 3,6. Therefore, the total average of the 3 validator assessment is 3,75

which equals with the percentage of 89,8%. This can be categorized as good. The next assessment is the process skill assessment. The data is shown in the following table 2.

Table 2. Assessment on the emerge of science process skill aspects

Assessed KPS aspects	Assessment result		
	Validator 1	Validator 2	Validator 3
Observing	8	6	6
Classifying	6	6	6
Questioning	8	7	7
Predicting	6	6	5
Experimenting	14	12	12
Inferring	3	3	3
Communicating	12	12	9
Total (max 60)	57	52	48
Average	2,85	2,6	2,4
Percentage (%)	95	86,7	80

From table 2, can be concluded that the average number of teh emerge of KPS from validator 1 is 2,85, validator 2 is 2,6, and validator 3 is 2,4. The average number from the 3 validator is 2,6 . with this criteria, if being assessed between 0-0,9 means that the aspect is not emerged yet, 1-1,9 means that KPS aspect is emerged but rearely, 2-2,9 means that the KPS aspect is emerged and adequate, while in range 3-3,9 means that the KPS aspect is emerged and is bery adequate. From these criterias, the assessment result concluded that ke emergence of KPS 4.

aspect is adequate for the learning process. This means, that the KPS-based textbook is appropriate with the criteria.

Develop

In this stage, the researcher revise the result of validation such as fixing some errors on typing and figures, as well as adding some concept according to the suggestion from validator. In this stage, the researcher also did the legibility and definite test on textbook. The result of legibility test using the fry formula is shown in the following table

Table 3. Result of legibility analysis using Fry formula

Discourse page	Amount of syllable	Amount of sentence
4	174,9	12,1
38	81,75	11,25
56	153,6	10
Jumlah	410,25	33,35
mean	136,5	11,1

From table 4, can be seen that the average amount of syllable is 136,5 and the average amount of sentence is

11,1. This result then applied into Fry graphic as follow:

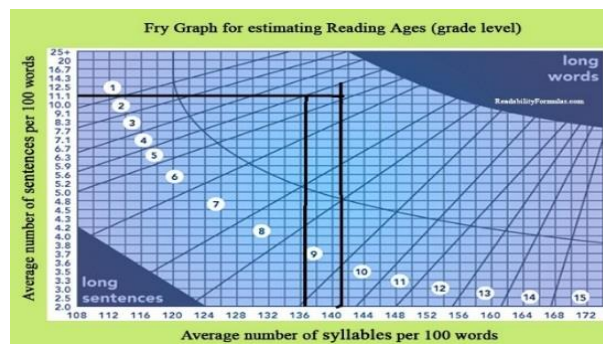


Figure 1 Fry Graphic

Based on the result of Fry graphic above, the line withdrawal is on level 5. This means that the legibility of textbook is appropriate for IV graders level.

Readability test using Fry formula is done to determine the level of readability of the discourse without involving the reader. In addition, this formula can also determine the feasibility of a discourse for certain class levels in terms of readability (Anih & Nurhanasah, 2016)

Disseminate

In this stage, the researcher used teaching material in-class learning activity which already been decided. Test instrument that will be used has been tested its validation and reliability prior to the research. The result of analysis shows that all the questions are valid and reliable with $r = 0,783$. The next instrument is used to test the students' KPS. The result of pretest and posttest are presented in the following table 4.

Table 4. Class IV Pretest and Postes Results with a Scientific Approach Assisted by Textbooks.

Nilai	Skor Terkecil	Skor Tertinggi	Skor Rata-rata	Standar deviasi
-------	---------------	----------------	----------------	-----------------

Pretest	40	90	66	13,9
Posttest	60	100	80	12,0

Test Hypothesis Using the t Test

Formulation of the problem

Is there a difference between the pretest and posttest scores after the use of a scientific approach assisted by textbooks based on science process skills at Cipameungpeuk Elementary School?

The research hypothesis

There is a difference between the pretest and posttest scores after the use of a scientific approach assisted by textbooks based on science process skills at Cipameungpeuk Elementary School.

Formulation of statistical hypotheses and research hypotheses

$H_0: \mu A = \mu B$

$H_1: \mu A \neq \mu B$

T test results with SPSS analysis shown in table 5 below.

Table 5. Independent Sample t test for equality of mean.

T	Df	Sig. (2-tailed)	Mean difference	Std. Error Difference
-3.553	40	.001	-14.286	4.021

Based on the table above it turns out that the sig value = 0.01 and this value is smaller than the value of $\alpha = 0.05$ so that H_0 is rejected and H_1 is accepted. Because H_1 is accepted, it means there is a significant difference between the pretest value and the post test score. Next to see which one is better can be seen from the average pretest and post test scores. The average pretest score is 66 while the average score of the post test score is 84.

Based on the average score, the post-test average is bigger, meaning the post test is better. The conclusion is that there is the influence of the use of a scientific approach assisted by science process based textbooks at Cipameungpeuk Elementary School.

4. CONCLUSION

Based on the validators' assessment result, science textbook on

energy and its change using reinforcement of process skill-based scientific approach has an average of 3,58 out of 4. This result categorized as good. While based on the emergence of science process skill aspects, the average value is 2,6 which means that the emergence of KPS aspects are seen as adequate for the learning process. This also means that the KPS-based textbook is appropriate with the criteria. To test the efficiency of the textbook, it is measured with T test at SDN Cipameungpeuk. The result show that there is any influence in using the textbooks towards the increasing of the students' process skill.

REFERENCES

Abadi, M.K., Cahya E., & Jupri A. (2017). The Development Of Interactive Mathematics Learning Material Based on Local Wisdom.

- Journal of Physics:Conferences Series*, Volume 895.
- Anih, E., & Nurhasanah, N. (2016). Tingkat Keterbacaan Wacana pada Buku Paket Kurikulum 2013 Kelas 4 Sekolah Dasar Menggunakan Formula Grafik Fry. Didaktik: *Jurnal Pendidikan Guru Sekolah Dasar*, 1(2).
- Aktamis, H., & Ergin, O. (2008). The Effect of Scientific Process Skill Education on Student's Scientific Creativity, Science Attitude, and Academic Achievements. *Asia Pasific Forum On Science Learning and Teaching*. 9(1).
- Arlitasari, O. (2013). Pengembangan Bahan Ajar IPA terpadu Berbasis Salingtemas dengan Tema Biomassa Sumber energy Terbarukan. *Jurnal Pendidikan Fisika*, 6(1).
- Aziz, M. S., & Zain, A. N. (2010). The Inclusion of Science Process Skill in Yemeni Secondary School Physics Textbooks. *European J of Physics Education*. 1(1).
- Esmiyati. (2013). Pengembangan Modul IPA Terpadu Berbasis SETS (Science, Environment Technology and Society) pada tema Ekosistem. *Unn Students Learning es Science Education Journal*. (USEJ) 2(1). <https://journal.unnes.ac.id/sju/index.php/use>
- Kurniawati, A., & Suharno. (2017). Developing Learning Science Teaching Material Based On Scientific To In Elementary School. *European Journal of Education Studies*, 3(4) www.oapub.org/edu.
- Rahayu, A. H., & Anggraeni, P (2017). Analisis Keterampilan Proses Sains Siswa Sekolah Dasar di Kabupaten Sumedang. *Jurnal Pesona Dasar*, 5(2).
- Prastowo, A. (2012). *Panduan Kreatif Membuat Bahan Ajar Inovatif Menciptakan Metode Pembelajaran yang Menarik dan Menyenangkan*. Jakarta: Diva Press.
- Puspita, R. A. (2017). The Use of Interactive Compensatory Model Based-Learning Material to Improve Informational Text Reading Comprehension Ability of 5th Grade Elementary School in Bandung Regency Indonesia. *Advanced Science Letters*, 23(3) <https://www.ingentaconnect.com>
- Sukarno., Anna P., & Ida H., (2013a). The The Profile of Science Process Skill (SPS) Student at Secondary High School (Case Study in Jambi). *International Journal of Scientific Engineering and Research (IJSER)*, 1(1) www.ijser.in
- Sukarno., Anna P., & Ida H., (2013b). The Analysis of Science Teacher Barriers In Implementing Of Science Process Skills (SPS) Teaching Approach At Junior High School And It's Solution. *Journal of Education and Practice*, 4(27).