

FEASIBILITY OF BIOLOGY TEXTBOOK CLASS X SENIOR HIGH SCHOOL BASED ON INQUIRY ON THE TOPIC OF THE SCOPE OF BIOLOGY TO TRAIN SCIENCE PROCESS SKILLS

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Abstract

Textbooks have to fulfill the demands of curriculum 2013 objectives of developing higher order thinking skills and accordance with the demands of 21st century skills, so the research on the development of textbooks in accordance with the demands of the curriculum 2013 objectives and 21st century skills is needed. The purpose of this research was to describe feasibility of biology textbook based inquiry developed on the topic of the scope of biology for class X senior high school. The type of this research was development research. The method used in this research was 4D development model. The 4D development stages include define i.e. analyze curriculum, concepts, tasks, students and learning objectives. On the design stage i.e. compile textbook. On the develop stage i.e. validation and the trials of textbook, and the disseminate stage in this research was not implemented. The collected data covered validity and practicality of textbook. The validity of textbook based on advisability in contents, linguistic, and presentation. The practicality of textbook based on readability of textbook and activity of feature process skills. The trials of textbook based inquiry were held to 16 students class X MA Negeri Mojokerto, Mojokerto. The data were qualitative descriptively analyzed. The interpretation of the average criteria score of validation was 82,06 that included valid category. The readability of textbook on level 10, hence inquiry textbook was appropriate for used by students class X senior high school. The inquiry-based textbook was able to train science process skills. The result showed that the textbook was valid and practical.

Keywords: textbook, inquiry, the scope of biology.

INTRODUCTION

The goal of the 2013 curriculum is to develop high - level thinking skills. One of the efforts to improve the ability of high-level thinking by facilitating students to solve problems in life. This is in accordance with the demands of the 21st century that relate the subject matter with real life (Kustanti et al., 2017). Regulation of the Minister of Education and Culture Number 22 of 2016 on the standard of process of basic and secondary education states that the learning process in the educational unit should be able to motivate students to participate actively.

Therefore, in the learning process required a way that can train students to understand the problem, improve the ability to think creatively in preparing the completion plan and involve students actively in finding their own problem solving (Germann, 1989; Sanjaya,

2006). Inquiry-based learning centers on students (Barron and Darling-Hammond, 2008). Through inquiry-based learning, students think independently and solve problems cooperatively (Chang and Mao, 1999). Research-based learning should be the standard and the main one should be based on inquiry (Boyer Commission, 1999).

The inquiry-based textbook is a textbook that provides versatile activities in the form of problem solving. Inquiry activities include exploration, formulating problems, formulating hypotheses, planning experiments, conducting experiments, analyzing data, formulating conclusions (Barron and Darling-Hammond, 2008; Chang and Mao, 1999; Exline, 2004; Khan et al., 2011).

Inquiry activities are similar to the science process skills. Systematic inquiry skills and the capacity to apply these skills need to be developed (Brew, 2003). The

inquiry approach is an independent approach to learn the science process skills (Germann, 1989), the teacher provides little guidance so that students improve

The previous research conducted by Ali et al. (2014) showed that worksheet with inquiry syntax will could bring up learning activities corresponding with the requested by curriculum 2013. Other research by Ijtimaiyah et al. (2016) showed that development of guided inquiry based worksheet on growth and development material could trained process skills with completeness students' process skills after using the developed worksheet by 95%. According to Habsari et al. (2016) that students' science process skills increase after given learning with guided inquiry based module accompanied by interrelationship diagram and enhancement included in high category. Based on the explanation, this research developed inquiry-based textbook on the topic of the scope of biology to train the science process skills. The purpose of this research was to describe feasibility of inquiry-based textbook developed on the topic of the scope of biology for class X senior high school.

METHOD

This research was a development research that developing an inquiry-based textbook. The development model used in this research was 4D included define i.e. analyze curriculum, concepts, tasks, students and learning objectives. On the design stage i.e. compile textbook. On the develop stage i.e. validation and the trials of textbook, and the disseminate stage in this research was not implemented. The development of inquiry-based textbook conducted in the Department of Biology, Faculty of Mathematics and Natural Sciences, State University of Surabaya in July 2017 - October 2017. The implementation stage was limited to 16 students conducted at MA Negeri Mojosari in Class X in November - December 2017. The assessment instruments used in this research were the textbook validation sheet and the readability sheet. Data collection methods of the development research of inquiry-based textbook was a validation method and readability test method. The validation method was performed by three validators, consisting of two experts (biology lecturer), and one biology teacher included content, presentation and linguistic component. The criteria of inquiry-based textbook was valid if validation interpretation ≥ 71 . Readability test method by using Fry graph. It used three samples. Every sample composed 100 words. Each sample calculated of number of sentences and number of syllables. The inquiry-based textbook suitable used for students class X senior high school if the level of

knowledge freely, teacher as well as students' facilitator to learn (Germann, 1989; Sanjaya, 2006).

readability was 10. The students' science process skills is known from activity of feature process skills. Students do activity of MiniLab of inquiry-based textbook included formulate problem, formulate hypothesis, design experiment, analyze data and formulate conclusion.

RESULT

The research produced inquiry-based textbook developed on the topic of the scope of biology. There was a preliminary section include preface, description of the book content, description of the scope presented in the book and how to study it, content section include the topic of the scope of biology presented in features of the inquiry-based textbook, and the closing section include summary, glossary, and references. The inquiry-based textbook developed for students of class X senior high school on the topic of the scope of biology. The content of the textbook include biology as a science, organizational level of life and scientific methods. While the features to facilitate the inquiry-based textbook include the features of BioLab, MiniLab, BioStory, BioFokus, and BioDigest. This inquiry-based textbook was developed to facilitate students in science process skills. The features of the textbook to train science process skills presented in BioLab and MiniLab (see Figure 1). The features designed according to steps in science process skills. The other features also presented in the textbook such as BioStory and BioFokus to describe the content of the topic, and a feature to check understanding of the topic such as BioDigest.

The feasibility of the inquiry-based textbook describe based on the validity and practicality of textbook.

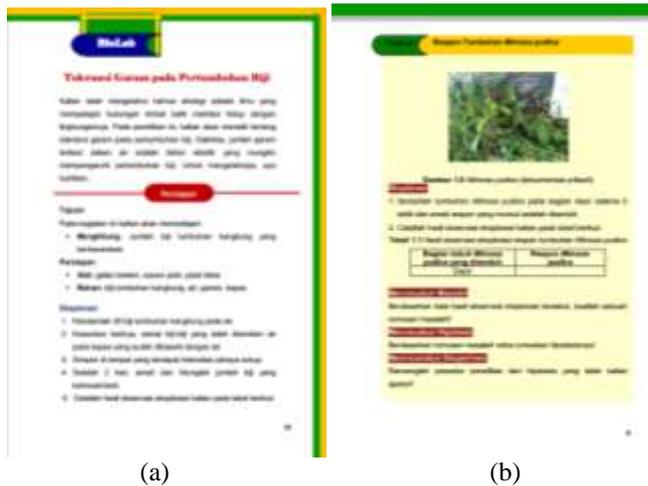


Figure 1. The features of the textbook to train science process skills; (a) BioLab, (b) MiniLab.

The results of validation of inquiry-based textbook by experts (two biology lecturers and one biology teacher) in the form score of validation results. Score of validation results covered content, presentation and linguistic. The results of the validity of inquiry-based textbook showed in Table 1.

Table 1. The results of validation of inquiry-based textbook on the topic of the scope of biology class X senior high school

No	Validated criteria	Score of validation results			Total score
		1 st validator	2 nd validator	3 rd validator	
A. CONTENT					
1	Material coverage	3	3	3	9
2	Material Accuracy	3	4	3	10
3	up to date and contextual	4	3	3	10
4	Health and safety (K3)	3	4	4	11
5	Characteristics of activities	4	4	3	11
B. PRESENTATION					
1	Presentation techniques	3	4	3	10
2	Supporting material presentation	3	3	3	9
3	Presentation of learning	4	3	3	10
4	Completeness of presentation	3	4	3	10
C. LINGUISTIC					
1	Readability	3	4	3	10
2	Ability to motivate	3	3	3	9
3	Simplicity	3	4	3	10
4	Conformity with Indonesian rules	3	3	3	9
The number of scores per criterion of all validators					128
Average criteria score					42.67
Criteria for validation interpretation					82.06

(valid)
Description:
score 4: fulfill all specified criteria
score 3: only fulfill 2 specified criteria
score 2: only fulfill 1 specified criteria
score 1: does not fulfill the specified criteria

Based on Table 1, showed that result of validation inquiry-based textbook based on biology lecturer and biology teacher was valid.

Results of practicality of inquiry-based textbook included readability test and activity of feature process skills presented on Table 2 and Table 3.

Table 2. The result of the readability test of inquiry-based textbook on the topic of the scope of biology class X senior high school

Sample	Number of sentences	Number of syllables	Level of readability
1	7.1	161.4	10
2	6.7	161.4	10
3	6.7	161.4	10

Based on Table 2 showed that the results of readability in level 10 so inquiry-based textbook suitable for used by students class X senior high school.

For learning process, students do activity of MiniLab Snail's behavior of inquiry-based textbook which included steps of process skills i.e. formulate problem, formulate hypothesis, design experiment, analyze data and formulate conclusion. The work results of process skills by students showed on Table 3.

Table 3. Activity of feature process skills

Student	Process skills					
	Formulate problem	Formulate hypothesis	Design experiment	Analyze data	Formulate conclusion	Correct answer
Group 1						
1	20	20	12	20	20	92
2	20	20	12	20	20	92
3	20	20	12	20	20	92
4	20	20	12	20	20	92
Group 2						
5	20	20	11	20	20	91
6	20	20	11	20	20	91
7	20	20	11	20	20	91
8	20	20	11	20	20	91
Group 3						
9	18	20	12	20	20	90
10	18	20	12	20	20	90
11	18	20	12	20	20	90
12	18	20	12	20	20	90
Group 4						
13	20	20	12	20	20	92
14	20	20	12	20	20	92
15	20	20	12	20	20	92
16	20	20	12	20	20	92

Description:
Formulate Problem: if answer of students correct earn 20
Formulate Hypothesis: if answer of students correct earn 20
Design Experiment: if answer of students correct earn 20

Analyze Data: if answer of students correct earn 20
Formulate Conclusion: if answer of students correct earn 20

Based on Table 3 showed that results of activity in process skills. It is known from correct answer obtained by students ranged of 90-92.

DISCUSSION

The purpose of this research was to describe feasibility of biology textbook based inquiry developed on the topic of the scope of biology for class X senior high school. The validity of the developed inquiry-based textbook was obtained based on validation results by experts, i.e. two biology lecturers and one biology teacher. The practicality of the developed inquiry-based textbook was obtained based on the textbook readability and activity of the feature process skills.

The validity of inquiry-based textbook obtained from the score of validation results of experts covered 3 components, namely the content feasibility component, presentation component, and linguistic component. Instruments to determine the validity of inquiry-based textbook developed by adapting the instrument of the National Education Standards Board (BSNP, 2014).

Component of content feasibility on the validity instrument of inquiry-based textbook composed of 5 subcomponents with 19 validated criteria. Based on the validation results of the three validators on the content feasibility component, the score of each criterion ranged from 9-11 (Table 1).

In the first subcomponent in the content feasibility component of the material coverage obtained the score of validation results that most often appear was 3 (good category). Compiling of textbook appropriate to the lesson plan and needs of students. Compiling of textbook is to achieve certain competencies and learning objectives (Arifin and Kusrianto, 2009).

In the second subcomponent in the content feasibility component of the material accuracy obtained the score of validation results that most often appear was 3 (good category). Based on the assessment instrument of the textbook according to BSNP (2014) that the feasibility of textbook based on the content feasibility component can be assessed through material accuracy.

In the third subcomponent in the content feasibility component that was up to date and contextual obtained the score of validation results that most often appear was 3 (good category). The textbook has several criteria as a good textbook that in the textbook is also included opinions or quotations from the research by experts (Arifin and Kusrianto, 2009).

In the fourth subcomponent in the content feasibility component of health and safety (K3) obtained the score of validation results that most often appear was 4 (very good category). Based on the assessment instrument of the textbook according to BSNP (2014) that the feasibility of textbook based on the content feasibility component can be assessed through health and safety (K3).

In the fifth subcomponent in the content feasibility component of the activity characteristics obtained the score of validation results that most often appear was 4 (very good category). The main purpose of science education is to help students to learn the reasons scientifically. The main way to facilitate the learning is by engaging students into inquiry activities such as experimenting (Chinn and Malhotra, 2002). The inquiry learning model has the steps of orientation, formulating problems, formulating hypotheses, collecting data, testing hypotheses, formulating conclusions (Sanjaya, 2006). Another advantage of the inquiry learning is students think independently and solve problems cooperatively (Chang and Mao, 1999).

Presentation component on the instrument of validation sheet of inquiry-based textbook composed of four subcomponents of the 13 criteria were validated. Based on the validation results of the three validators on the presentation component, the score of each criterion ranged from 9-10 (Table 1).

In the first subcomponent in the presentation component of the presentation technique obtained the score of validation results that most often appear was 3 (good category). In textbooks, there should also be a major component of learning guides, then competencies to be mastered, supporting information, exercises, and work instructions (activity sheets), and evaluation. The existing components interact with each other (Depdiknas, 2004). In addition, each paragraph of textbook should contain a single point of idea (Arifin and Kusrianto, 2009).

In the second subcomponent in the presentation component of supporting material presentation obtained the score of validation results that most often appear was 3 (good category). A good textbook is when in writing the textbook is equipped with pictures and descriptions (Majid, 2011). In addition, each page in a textbook should contain text, images, tables, graphs/diagrams (either photographs or illustrations), inset reminders, and inset history (Arifin and Kusrianto, 2009). The textbook is composed of the opening, the contents and the closing section. In the textbook also need to have the main components of training and evaluation (Depdiknas, 2004).

In the third subcomponent in the presentation component of learning presentation obtained the score of validation results that most often appear was 3 (good category). The main purpose of science education is to help students to learn the reasons scientifically. The main way to facilitate the learning is by engaging students into inquiry activities such as experimenting (Chinn and Malhotra, 2002). Inquiry-based learning centers on learners (Barron and Darling-Hammond, 2008).

In the fourth subcomponent in the presentation component of the completeness of the presentation obtained the score of validation results that most often appear was 3 (good category). The textbook is composed of three parts, covering the opening, content and closing sections. In textbooks, there should also be a major component of learning guides, then competencies to be mastered, supporting information, exercises, and work instructions (activity sheets), and evaluation. The existing components interact with each other (Depdiknas, 2004). The textbook has several criteria as a good textbook i.e. footnotes/endnotes/bibliography used and perhaps index included (Arifin and Kusrianto, 2009).

Linguistic component in the validation sheet of inquiry-based textbook composed of four subcomponents of the 12 criteria were validated. Based on the validation results of the three validators on the linguistic component, the score of each criterion ranged from 9-10 (Table 1).

In the first subcomponent in the linguistic component of the readability obtained the score of validation results that most often appear was 3 (good category). Each page of textbooks should be composed interesting and should be easy to remember both visually and verbally (Arifin and Kusrianto, 2009). A good textbook is when in writing the language that used good, easy to understand, interesting (Majid, 2011). The function of textbooks should be able to attract the motivation and interests of students and readers in the presence of language flowing, simple and easy to understand (Arifin and Kusrianto, 2009).

In the second subcomponent in the linguistic component of the ability to motivate obtained the score of validation results that most often appear was 3 (good category). The function of textbooks should be able to attract the motivation and interests of students and readers. The existence of flowing language, simple and easy to understand in the textbook will be able to generate motivation of students and readers. Sentences that are written are motivating and inspiring. In addition to new ideas or ideas contained in textbooks and the relevance of information presented to the learning needs

can also generate motivation for students and readers (Arifin and Kusrianto, 2009).

In the third subcomponent in the linguistic component of the simplicity obtained the score of validation results that most often appear was 3 (good category). A good textbook is when the contents of textbook show that matches idea of writing. Content of textbooks is knowledge can be used students to learn (Majid, 2011).

In the fourth subcomponent in the linguistic component was in conformity with the rules of Indonesian obtained the score of validation results that most often appear was 3 (good category). The text uses standard Indonesian instead of slang or something else. The style of language used semi-formal. The use of minimal sentence structure is SPOK (Arifin and Kusrianto, 2009).

Based on the scores obtained from each validator on each criteria obtained the amount of 128 (Table 1). The score is averaged and obtained the average score of criteria of 42.67. Then the interpretation result of the average score was 82.06 with the validation interpretation criterion of biology textbook class X senior high school based on inquiry on the topic of the scope of biology to train the science process skills was valid. Textbooks included valid category when obtained an average score interpretation of 71-85 (adaptation of Riduwan and Sunarto, 2013).

Based on the calculation of the level of readability by using Fry graph formula can be seen that the number of sentences obtained in the discourse as sample 1 was 7.1 and the number of syllables obtained 161.4, so obtained the meeting point at level 10. Then the number of sentences obtained in the discourse as sample 2 was 6.7 and the number of syllables obtained 161.4, so obtained the meeting point at level 10. The number of sentences obtained in the discourse as sample 3 was 6.7 and the number of syllables obtained 161.4, so the meeting point obtained at level 10. The textbook has several criteria as a good textbook. One of the criteria is every textbook pages should be use short sentences, so easy to remember (10-14 words per sentence) (Arifin and Kusrianto, 2009).

The three sample discourse biology textbook class X senior high school based inquiry to train science process skills have a level of conformity with the ability to read students on level 10 so that the inquiry textbook suitable for used in class X senior high school.

Results of process skills activity by students obtained from work results of MiniLab feature done by students during learning. Work results of students covered activity of MiniLab snail's behavior. The

activity of Minilab was able to train process skills. It proved from steps in activity of MiniLab covered steps of process skills i.e. formulate problem, formulate hypothesis, design experiments, analyze data, and formulate conclusion. Based on students' work results of every step of process skills obtained correct answer of students. Based on activity of MiniLab snail's behavior, the correct answers obtained ranged of 90-92. Hence, the inquiry-based textbook was able to train science process skills.

CONCLUSION

The validity of biology textbook class X senior high school based on inquiry on the topic of the scope of biology to train science process skills based on validation by the experts included in the valid category in terms of content feasibility component, presentation component, and linguistic component. The practicality of biology textbook class X senior high school based on inquiry on the topic of the scope of biology to train science process skills was practical based on the textbook readability to get level 10 which indicates that the textbook suitable for used in class X senior high school and the inquiry-based textbook was able to train science process skills.

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