



ISSN 0852-601X  
e-ISSN 2549-838X

Available online at  
<http://www.pancaranpendidikan.or.id>

*Pancaran Pendidikan FKIP  
Universitas Jember  
Vol. 8, No. 3, Page 63-74, August, 2019*

***Pancaran Pendidikan***

DOI:  
[10.25037/pancaran.v8i3.244](https://doi.org/10.25037/pancaran.v8i3.244)

## **The Development of Biotechnology Textbook with Jember Local Wisdom for Students at Fourth Grade of Elementary School**

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### **ARTICLE INFO**

#### **Article History:**

*Received Date: 1<sup>th</sup> July 2019  
Received in Revised Form Date:  
10<sup>th</sup> July 2019  
Accepted Date: 15<sup>th</sup> July 2019  
Published online Date 01<sup>st</sup> August  
2019*

#### **Key Words:**

**textbook, biotechnology, local  
wisdom in Jember**

### **ABSTRACT**

*This research aims to develop a teaching material in the form of Biotechnology Textbooks with Jember Local Wisdom for Grade IV at Elementary Schools. This type of research is development research using the Borg and Gall model which consists of 10 stages. The quality aspects of the Biotechnology Textbooks with Jember Local Wisdom were validity and effectiveness. The subjects of this research trial were grade IVA students of Public Elementary School 3 of Kepatihan, grade IVA students and IVB Public Elementary School 4 of Kebonsari. Data collection methods in this study used a questionnaire, tests, and validation. Based on the results of data analysis, it was found that biotechnology-based textbooks for local wisdom in Jember were declared very valid with a percentage of validity of 90.6%. The effectiveness of textbooks is known from the percentage of student learning outcomes of, 80.9%, 81.5%, and 84.6%. Textbooks are also categorized as having a positive response with a percentage of 91.5%, 94.6%, and 97%. Based on the results of the analysis of the data it can be concluded that the textbook has been declared to be very valid and very effective and received positive responses from students so that the Biotechnology Textbooks with Jember Local Wisdom can become a learning medium in schools.*

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### **INTRODUCTION**

Science is one of the main subjects at the elementary school level in the curriculum used in Indonesia. According to Rusnadi (in Laksana, 2016) Science is an important subject taught to students because through science learning, students will get

used to being scientific to solve the problems they face. Wahyana (in Trianto, 2015) explains science as a collection of knowledge that is arranged systematically and in its application is generally limited to learning about natural phenomena. The purpose of science learning in general is to lead to active student involvement through providing direct experience (Wicaksono, et al., 2016). Science learning is arranged systematically to foster students' abilities and skills in working, thinking and acting scientifically (Widiantono & Harjono, 2017). Based on the opinion of some experts, it can be concluded that science studies everything or events that occur in nature and is systematically arranged.

According to Utomo (2014) in supporting the process of teaching and learning specifically for science learning, teachers can use a variety of teaching materials. There are various kinds of teaching materials developed in elementary schools, one of which is teaching material in the format of print media. According to Ahmadi et al (in Lestari, 2019) teaching materials with print media formats that are widely developed in schools include textbooks, learning modules, handouts, worksheets, and school magazines.

Textbooks are books that can be used as a guide for students in teaching and learning. Textbooks contain learning material, investigation activities based on theories or concepts, scientific activities, information and application of material in real life. Through textbooks students can find concepts related to the material they will learn (Agustiningsih et al., 2019). The advantage of textbooks is that they can be an easy medium for students to learn anytime and anywhere without using and need special tools to learn them, make it easier for teachers to convey learning, and can accustom students to independent, active, and creative learning (Norlidah et al., 2016). Based on the explanation, it can be concluded that bringing textbooks is a learning source in printed form that contains learning material in accordance with the curriculum as a guide in the learning process carried out by teachers and students and is arranged systematically.

In class IV students' books theme 3 (Animals and Plants in My Environment) subtheme 1 (Animals and Plants in My Home Environment) teaches students about the diversity of plants, the shape and function of parts of plants and how to preserve natural resources in the surrounding environment. However, the material taught is still general. Students must also be taught about material that is related and close to their lives to add insight into the local wisdom of natural resources by utilizing science and technology. One way to preserve nature through the use of science and technology is biotechnology-based. According to Wardani et al., (2017) biotechnology is the utilization of living systems that use organisms to develop new products by utilizing living things or their yields. Biotechnology is an interesting topic because its application is related to everyday life. Although the discussion about biotechnology at the elementary school level is not specifically explained, it is important to introduce biotechnology material from an early age (Nursanti et al., 2016). Objects in biotechnology are living organisms or parts used to meet the needs of human life.

Based on the above problems, it is necessary to develop teaching materials in the form of textbooks as a supplement to support student books to improve student knowledge related to local wisdom of natural resources by utilizing science and technology. Therefore, a development study was conducted under the title "Development of Biotechnology Textbooks with Jember Local Wisdom for Grade IV Elementary Schools". The purpose of this research is (1) to know the validity of

Biotechnology Textbooks with Jember Local Wisdom for grade IV elementary school; and (2) to know the effectiveness of the development of knowing the validity of Biotechnology Textbooks with Jember Local Wisdom for grade IV elementary schools.

## **METHODOLOGY**

This research is research and development (Research and Development). This research procedure uses the Borg & Gall model which consists of 10 stages, including: (1) analyzing potential and problem stage; (2) data collection stage; (3) product design stage; (4) design validation stage; (5) the design revision stage; (6) product trial phase; (7) product revision stage; (8) stage of trial use; (9) product revision stage; and (10) mass production stage (Sugiyono, 2017).

The test subjects in this study were students of IVA grade Public Elementary School 3 of Kepatihan, students of IVA grade Public Elementary School 4 of Kebonsari Jember, and students of IVB grade Public Elementary School 4 of Kebonsari Jember. Data collection methods used were validation methods, tests, and questionnaires. Data analyzed were validation result data, test results, and student response questionnaire results.

Before the trial, a biotechnology-based textbook for local wisdom in Jember went through the validation stage. At that stage the level of validity of biotechnology-based textbooks for local wisdom in Jember was assessed by 4 validators, namely 2 expert validators from the Jember University *PGSD* (Department of Elementary School Education), and 2 validators from grade IV elementary school teachers. The scores given by each validator are then averaged to find the percentage of validity using the formula. Biotechnology Textbooks with Jember Local Wisdom can be said to be effective if  $\geq 80\%$  of the student competency test scores meet the minimum completeness criteria (*KKM*). The category of positive learning responses is marked as  $\geq 50\%$  of all students give positive responses.

## **RESULT AND DISCUSSION**

### **Development Outcomes**

A. The Biotechnology Textbooks with Jember Local Wisdom that was developed in this study consists of several parts. The descriptions of the parts in question are as follows.

- a) The cover included identity such as title, author's name, class, theme, sub-theme, and supporting images, namely images of rice, sugar cane, coffee, *Keta* trees and cocoa. The pictures were chosen as icons of the material in the textbook.
- b) The introduction contained an introduction that explained the benefits and objectives of developing a local wisdom biotechnology-based textbook in Jember.
- c) Table of contents contained the title of the page section and page number. The section headings contained in the contents page are biotechnology understanding, biotechnology characteristics, biotechnology types, biotechnology examples, examples of local wisdom biotechnology in Jember, material summary, exercises, and bibliography.
- d) Instructions accounted for using the book contain how to use textbooks.
- e) Basic competence and learning objectives contained reference to the development of material.

- f) The content of this textbook was on the material discussion page which was the development of basic competencies and learning objectives.
- g) Summary of material was the essence of the material discussed in a chapter. This section presented the entire material from the beginning to the end.
- h) Exercise questions were contained in this textbook in the form of mind maps that assigned students to write mind maps of all the material in the textbook.
- i) Bibliography contained a list of reading references that are used as reading material for compiling textbooks.
- j) The back cover page was designed simply by displaying the name of the study program, faculty, university and year of manufacture.

## B. VALIDATION RESULTS

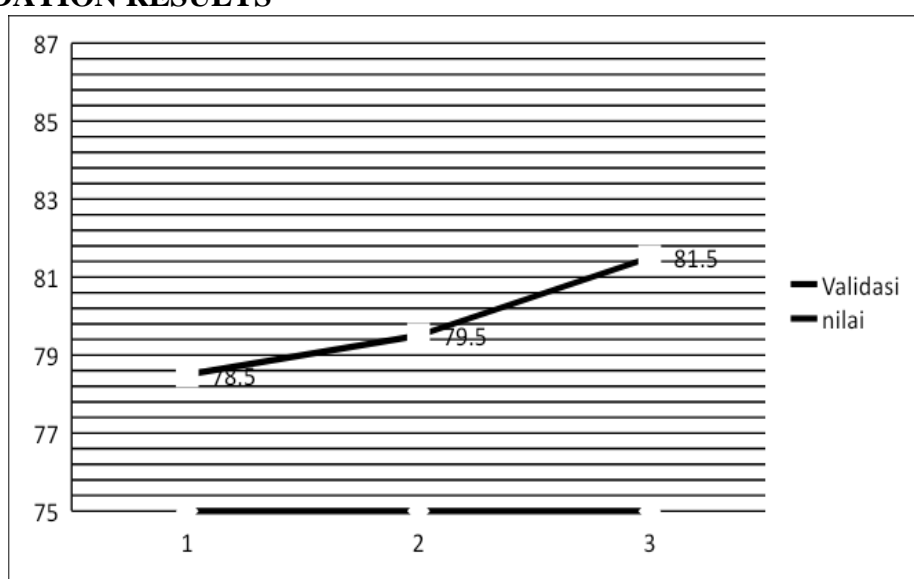


Figure 1. Validation Results on Biotechnology Textbook with Jember Local Wisdom

The scoring results given by the four validators were processed by the expert validation formula and presented into the validation results table. The percentage of validation values obtained were then referred to at intervals to determine the validity level of Biotechnology Textbooks with Jember Local Wisdom. The quantitative data of the validation results can be seen in the following table 1.

$$\begin{aligned}
 V_{-ah} &= \frac{T_{se}}{T_{sh}} \times 100\% & V_{-ah} &= \frac{T_{se}}{T_{sh}} \times 100\% \\
 &= \frac{81,5}{90} \times 100\% & &= \frac{81,5}{90} \times 100\% \\
 &= 90,6\% & &= 90,6\%
 \end{aligned}$$

$$V_{-ah} = \frac{T_{se}}{T_{sh}} \times 100\%$$

The total score of  $V_{-ah}$  refers to the interval representing the validity of textbook, as shown in the following table.

Table 1. Validity Criteria

No.	Achievement Criteria (Effectiveness)	Quality of Product
1.	$80 \leq V \leq 100$	Highly Valid
2.	$60 \leq V < 40$	Fairly Valid
3.	$40 \leq V < 20$	Insufficiently Valid
4.	$20 \leq V < 40$	Hardly Valid
5.	$0 \leq V < 20$	Not Valid

Based on the interval of determining the validity level of textbooks, it can be concluded that textbooks based on local wisdom biotechnology in Jember are classified as very valid with a final validation level of 90.6%.

### C. DATA FROM TRYOUT

The respondents of this tryout were 21 grade-IV students of Public Elementary School 3 of Kepatihan, 26 grade-IVA students of Public Elementary School 4 of Kebonsari Jember, and students of 27 grade-IVB of Public Elementary School 3 of Kepatihan. The effectiveness of Biotechnology Textbooks with Jember Local Wisdom can be seen through the results of student learning in doing post tests and analyzing the results of student response questionnaires. The following data are student learning outcomes.

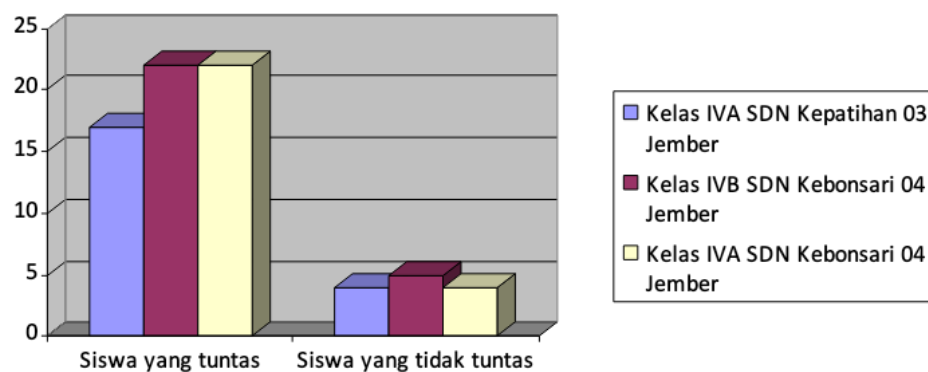


Figure 2. Learning Achievement

Student learning outcomes in IVA at Public Elementary School 3 of Kepatihan get a score above the *KKM* of 80.9% of the total number of students who are subjects of the study. The learning outcomes of IVB Public Elementary School 4 of Kebonsari students scored above the *KKM* of 81.5% of the total number of students who were subjects of the study. Furthermore, the learning outcomes of IVA Public Elementary School 4 of Kebonsari students scored above *KKM* at 84.6% of the total number of

students who were subject of the study. Based on the analysis of the data obtained, it can be seen that the effectiveness of textbooks based on local wisdom biotechnology in Jember reached 80.9%, 81.5% and 84.6% with very effective effectiveness levels.

The students' questionnaire responses were filled out after students worked on the post test questions. The student response questionnaire was then calculated for the percentage to determine the effectiveness of biotechnological textbooks based on local wisdom in Jember. The data obtained are presented as follows.

Table 2. Students' Responses at Grade IVA of Public Elementary School 3 of Kapatihan

Number	Statements	Yes	No
1.	Appearance of attractive textbooks	100%	0%
2.	Textbooks make me more eager to learn	95,2%	4,8%
3.	With the illustration images can provide motivation to study the material	95,2%	4,8%
4.	The material in the textbook is easy for me to understand	85,7%	14,3%
5.	The textbook material made me recognize Jember's local wisdom biotechnology	90,5%	9,5%
6.	The textbook material is in accordance with my daily life	71,4%	28,6%
7.	The sentences and paragraphs used in this textbook are clear and easy to understand.	90,5%	9,5%
8.	The language used is simple and easy to understand	100%	0%
9.	The letters used are simple and easy to read	95,2%	4,8%
<b>Average</b>		<b>91,5%</b>	<b>8,5%</b>

Table 3. Students' Responses at Grade IV B of Public Elementary School 4 of Kebonsari Jember

Number	Statements	Yes	No
1.	Appearance of attractive textbooks	100%	0%
2.	Textbooks make me more eager to learn	100%	0%
3.	With the illustration images can provide motivation to study the material	92,6%	7,4%
4.	The material in the textbook is easy for me to understand	96,3%	3,7%
5.	The textbook material made me recognize Jember's local wisdom biotechnology	100%	0%
6.	The textbook material is in accordance with my daily life	62,9%	37,1%
7.	The sentences and paragraphs used in this textbook are clear and easy to understand.	100%	0%

Number	Statements	Yes	No
8.	The language used is simple and easy to understand	100%	0%
9.	The letters used are simple and easy to read	100%	0%
<b>Average</b>		<b>94,6%</b>	<b>5,4%</b>

Table 4. Students' Responses at Grade IV B of Public Elementary School 4 of Kebonsari Jember

Number	Statements	Yes	No
1.	Appearance of attractive textbooks	100%	0%
2.	Textbooks make me more eager to learn	100%	0%
3.	With the illustration images can provide motivation to study the material	96,2%	3,8%
4.	The material in the textbook is easy for me to understand	88,5%	11,5%
5.	The textbook material made me recognize Jember's local wisdom biotechnology	96,2%	3,8%
6.	The textbook material is in accordance with my daily life	96,2%	3,8%
7.	The sentences and paragraphs used in this textbook are clear and easy to understand.	96,2%	3,8%
8.	The language used is simple and easy to understand	100%	0%
9.	The letters used are simple and easy to read	100%	0%
<b>Average</b>		<b>97%</b>	<b>3%</b>

Based on the questionnaire responses of students in grade IVA at Public Elementary School 3 of Kepatihan, the average total of students who answered "Yes" to the questionnaire option or who gave a positive response to Biotechnology Textbooks with Jember Local Wisdom reached 91.1%. For IVB grade students at Public Elementary School 4 of Kebonsari, the average number of students who answered "Yes" to the questionnaire option or who gave a positive response to the biotechnology-based textbook of local wisdom in Jember reached 94.6%. For IVA grade students at Public Elementary School 4 of Kebonsari Jember, the average number of students who answered "Yes" to the questionnaire option or who gave a positive response to biotechnology-based textbooks on local wisdom in Jember reached 97%. Based on the analysis of student response questionnaire values, the average positive response of students is more than 50% and more than the negative response of students. In the pilot phase, it was shown that biotechnology-based textbooks for local wisdom in Jember were categorized as having a positive response with the percentage of student responses 91.5%, 94.6%, and 97%.

At the potential and problem stage students are analyzed, field studies, material analysis, and analysis of research objectives. In the field study, problems were found in the learning process that had been taking place so far. Then in the analysis of students found how the characteristics of students. In the analysis of the material identified the

concept of material to be presented. Finally, analysis of learning objectives to formulate learning objectives that will be used in the teaching and learning process.

During the data collection phase, media selection activities will be developed, namely textbooks based on local wisdom Biotechnology in Jember. Furthermore, the formulation will be carried out in the textbook. After formatting, the researcher designed the appearance of the textbook to make it look attractive. Once printed, biotechnology-based textbooks for local wisdom in Jember are validated by a validator. The purpose of validation is to assess the feasibility of the textbook being developed. In addition, validation is needed to get input in the form of comments, criticisms, and suggestions from the validator. Enter in the form of comments, criticisms, and suggestions given by the validator used as a reference to make revisions or improvements to the textbook. The aspects assessed in the validation process include three aspects, namely the appropriateness of the content, linguistics, and appearance. Validation was carried out in this study three times. The first validation of biotechnology-based textbooks on local wisdom in Jember was conducted by 2 expert validators from FKSD lecturers at the University of Jember. The results of the first validation of biotechnology-based textbooks for local wisdom in Jember were 87.2%. According to Akbar (2016) the validation results which are in the range of  $80 \leq V \leq 100$  are declared very valid. Based on this, the textbook based on local wisdom biotechnology in Jember has the category "very valid". At this stage of validation input is obtained from the validator to improve the textbook. The input obtained includes writing the identity of the textbook maker on the cover page, adding pictures that are in accordance with local wisdom in Jember, and correcting the use of punctuation and writing errors.

Furthermore, after passing the validation stage, the textbook undergoes a revision according to the input provided by the validator. After the revision, the textbook is tested on students. The trial aims to determine the effectiveness and response of students to textbooks based on local wisdom biotechnology in Jember. The effectiveness of biotechnology-based textbooks on local wisdom in Jember is carried out by providing a post test and student questionnaire responses at the end of learning. The first trial was conducted on grade IVA students of Kepatihan 03 elementary school. Data from the results of the trial phase on grade IVA students at Public Elementary School 3 of Kepatihan showed that 80.9% of the total students scored above the KKM. According to Akbar (2016) the effectiveness results which are in the range of  $80 \leq V \leq 100$  have a very effective effectiveness level. The effectiveness of biotechnology-based textbooks for local wisdom in Jember is in the range of  $80 \leq V \leq 100$ , so biotechnology-based textbooks for local wisdom in Jember can be categorized as "very effective". For IVA grade students at Kepatihan 03 Elementary School, the average number of students who answered "Yes" to the questionnaire options or who responded positively to biotechnology-based textbooks for local wisdom in Jember reached 91.5%. Positive responses of students more than 50% and more than negative responses of students. This shows that the textbook based on local wisdom biotechnology in Jember is categorized as having a "positive" response.

The next stage is the revision of the textbook after experiencing the first trial. Revisions to the textbook are based on the results of the second validation conducted by the validator. The validation of the two biotechnology-based textbooks for local wisdom in Jember was conducted by 2 expert validators from grade IV teacher at Public



Elementary School 3 of Kepatihan and grade IV teacher Public Elementary School 4 of Kebonsari. The results of the validation of the two textbooks based on local wisdom biotechnology in Jember were 88.3%. This shows that the textbook based on local wisdom biotechnology in Jember has the category "very valid". At this stage of validation input is obtained from the validator to improve the textbook. The input obtained includes replacing the words accompanying student books into supporting student books on the cover page, adding pictures of the types of coffee beans according to the initial page of the discussion of the coffee plant, and adding images of the types of coffee beans according to the initial page of the discussion of the coffee plant.

After the textbook was revised according to the results and input in validation, the textbook was then retried. This trial was conducted on grade IVA and IV B students at Public Elementary School 4 of Kebonsari. The results of the trial phase on IVA grade students at Public Elementary School 3 of Kepatihan showed that 84.6% of the total number of students scored above the KKM. Furthermore, the learning outcomes of IVB Public Elementary School 4 of Kebonsari students scored above the KKM of 81.5% of the total number of students who were subjects of the study. Based on the analysis of the data obtained it can be seen that the effectiveness of textbooks based on local wisdom biotechnology in Jember reached 84.6% and 81.5% with an effectiveness level of "very effective". For IVA grade students at Public Elementary School 4 of Kebonsari Jember, the average number of students who answered "Yes" to the questionnaire option or who gave a positive response to biotechnology-based textbooks on local wisdom in Jember reached 97%. For IVB grade students at Public Elementary School 4 of Kebonsari, the average number of students who answered "Yes" to the questionnaire option or who gave a positive response to the biotechnology-based textbook of local wisdom in Jember reached 94.6%. Based on the analysis of the student response questionnaire value from the trial phase shows that biotechnology-based textbooks for local wisdom in Jember are categorized as having a "positive" response with the percentage of student responses 97% and 94.6%.

The next step is revision after the textbooks are tested on a broader scale. The revision in the textbook is based on the results of the third validation conducted by the validator. The validation of the three local wisdom biotechnology-based textbooks in Jember was carried out by 2 expert validators from PGSD FKIP lecturers at Jember University and fourth grade teachers at SDN Kebonsari. Based on the analysis of the assessment of the two validators in the third validation, it can be seen that the validity value of the textbook based on local wisdom biotechnology in Jember is 90.6%. This shows that the textbook based on local wisdom biotechnology in Jember has the category "very valid". At this stage of validation input is obtained from the validator to improve the textbook. The input obtained included adding the latest information and pictures related to biotechnology results in the Jember local wisdom rice plant and adding a column summary about the plant morphology structure contained in the textbook discussion.

## **CONCLUSION**

Based on the analysis of the data, it can be concluded the results of the validity of Biotechnology Textbooks with Jember Local Wisdom for grade IV elementary school are found in the category of very valid with a percentage of validity of 90.6%. The effectiveness of bi Biotechnology Textbooks with Jember Local Wisdom is known from the results of students' post tests on the trials. The results of the post test for IVA

grade students of Public Elementary School 3 of Kapatihan were 80.9%, ranked at *very effective* category. Post test results for IVB grade students at Public Elementary School 4 of Kebonsari Jember 81.5% and post test results for IVA grade students at SDN Kebonsari 84.6% indicate *very effective* category. The effectiveness of Biotechnology Textbooks with Jember Local Wisdom is also seen from student responses. The textbook received a positive response in the trial of IVB grade students of Public Elementary School 3 of Kapatihan with the percentage of positive responses obtained reaching 91.5%. In IVB grade students at Public Elementary School 4 of Kebonsari, the percentage of positive responses obtained was 94.6%. For IVA grade students at Public Elementary School 4 of Kebonsari, the percentage of positive responses obtained was 97%. The local wisdom biotechnology based textbook in Jember is categorized as receiving a positive response.

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