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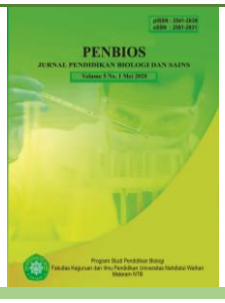

Research Article

Development Of A Booklet On Cell Bioprocess Materials As A Supplement To Biology Teaching Materials For Class XI SMA/MA

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ABSTRACT

Education has a broad meaning and an important role. One of the efforts teachers can make to improve education is to use a good and proper medium of study so that learners can readily understand biological material. The study aims to develop a learning medium of antibiotics that can serve as a supplement to the bioprocess of cells. The study uses a 4-D model of development limited to three stages define, design, and development. Research data is qualitative and quantitative. Validation results obtained a valiance value of 85.33% with very valid criteria. The result of the learner's response test is 82.19% with very positive criteria and the teacher's response test is an average of 90.34% with very positive criteria. It may thus be concluded that the compounds developed are so valid and so practical as to merit their use as a visual supplement.

INTRODUCTION

Education is a vital thing and has an important role. According to Mudyahardjo (2014), education is all learning experiences that take place in all environments throughout life. Education is a living situation that affects individual growth. While the role of education according to Primasari et al. (2015), education creates superior human resources to improve quality to compete nationally and internationally in the face of global competition.

One of the efforts that teachers can make in improving the quality of education is the use of good and appropriate learning media. Ummi (2018) states that with the media, it is hoped that the learning process will be easier for students and teachers because learning media can overcome the limitations of space and time in learning.

Biology learning leads to facts, concepts, and theories. According to Maryanti & Kurniawan (2018), Biology is a discipline that includes many concepts and processes of abstract events. The difficulty of learning Biology leads to the nature of biology which is abstract for students.

Biology learning media is expected to be able to improve the quality of education. The components of the learning media must be considered to qualify to be said to be suitable for use during the learning process. This is explained by Nur et al. (2017), learning media is a very important element in learning. One of the main functions of learning media is as a teaching aid that also motivates, and influences the climate, conditions, and learning environment that is arranged and created by the teacher. Meanwhile, according to Primasari et al. (2014), media makes it easier for students to learn, provides concrete experiences, attracts attention, activates students' senses, and awakens the world of theory with reality.

Based on information from the questionnaire that the researchers distributed to 45 students at SMAN 1 Tilatang Kamang for Biology subjects in class XI IPA, it was revealed that cell bioprocess material is one of the materials that are difficult for students to understand out of 7 (seven) materials studied in class XI. in odd semesters. In the observation questionnaire, students said that it was difficult to understand the cell bioprocess material because there were many confusing terms, the material was rote, the material could not be observed directly and the material was too much. This is in line with the results of an interview with a Biology subject teacher for class XI IPA at SMAN 1 Tilatang Kamang stating that the difficulties faced by students in studying cell bioprocess material are because the material cannot be observed directly and is complicated. Therefore, it is necessary to strive for learning media that can help overcome these difficulties.

Of the 14 materials in Biology class XI, one of the most difficult to understand is Cell Bioprocess material, because this Cell Bioprocess material has many sub-materials, a difficult language to understand, too many processes and in the books, students have there are no such materials (Eroika et al., 2019). So students expect there are learning media that can alleviate these difficulties. It is known that the criteria for teaching materials that are preferred by students based on the questionnaire given are that students want teaching materials that explain the material briefly, densely, and clearly, using language that is easy to understand. Other criteria are readings equipped with pictures, accompanied by explanations for difficult terms, colored on each page, additional external information related to the material, small in size, and practical.

Based on the criteria for interesting teaching materials for students, one of the teaching materials that can be developed is booklets. According to Imtihana et al. (2014), Booklet as a learning resource can be used to attract students' interest and attention because of its simple shape and the many colors and illustrations that are displayed.

According to Rukmana et al. (2018), a booklet is a small (A5) thin small book consisting of 48 back-and-forth pages, a booklet containing writing and pictures. The structure of a booklet resembles a book (introduction, content, and closing) only that the presentation of its contents is much shorter than that of a book. It is known that the booklet criteria are according to student questionnaires, students are interested in teaching materials that are separated by each chapter and are small in size compared to teaching materials that

are combined in one semester and are thick in size. Because during the learning process, students stated that they brought more than three books/teaching materials in one day to school, so students felt that the books they carried were heavy enough. So besides being interesting for students, booklets can also make it easier for students to go to school.

Based on the results of the questionnaire distributed to students, it is known that during the learning process, the material is difficult to convey using modules, textbooks, and student worksheets. However, in cell bioprocess material, students still find it difficult to understand the material. Therefore, it is necessary to have a variety of teaching materials that can support the learning process. So those students are helped by the addition of these other teaching materials. Before being used in the learning process, the developed booklet must be tested for validity or feasibility first by the validator. This study aims to develop and test the feasibility of booklets, as well as see the responses of students and teachers to booklets as a supplement to Biology teaching materials on cell bioprocess materials.

METHOD

This type of research is research and development (R&D) 3 stages the 4 stages of the 4-D development model, namely define, design, and develop. This study produced a booklet as a supplement for teaching materials on cell bioprocess material for class XI SMA/MA. This research was conducted at the Department of Biology, Faculty of Mathematics and Natural Sciences, Padang State University and SMAN 1 Tilatang Kamang. The data used in this study are primary data sourced from observation questionnaires and validity test questionnaires. At the definition stage, it aims to determine and define the requirements needed in learning, which are based on KD and learning materials based on the 2013 curriculum. The steps at the definition stage include front-end analysis, student analysis, task analysis, concept analysis, and analysis. learning objectives. The second stage is the stage for making the initial design of the cell bioprocess booklet. There are three stages in the design stage, namely media selection, format selection, and initial design. The last stage is media development. At this stage, the validity of the media was tested by 3 validators consisting of 2 Biology lecturers and 1 Biology teacher. Data was measured using a Likert Scale with assessment criteria SS = Strongly Agree (score 4), S = Agree (score 3), TS = Disagree (score 2), and STS = Strongly Disagree (score 1). The value of the booklet validity test results was measured using the criteria from Puspita et al. (2017) in Table 1.

Table 1. Validity test assessment criteria

Score Scale (100%)	Assessment Criteria	Follow-up
80-100	Very valid	Not revised
66-79	Valid	Not revised
56-65	Sufficiently valid	Revised
40-55	invalid	Revised
0-39	Strongly invalid	Revised

To see the responses from teachers and students, the data was measured using a Likert Scale with assessment criteria SS = Strongly Agree (score 4), S = Agree (score

3), TS = Disagree (score 2), and STS = Strongly Disagree (score 1). The value of the booklet response test results was measured using the criteria of Nunung et al. (2019) in Table 2.

Table 2 Criteria of value of the booklet response test results

Score Scale (100%)	Assessment Criteria	Follow-up
81,26-100	Very positive	Unrevised
62,6-81,25	Positive	Unrevised
43,76-62,5	Less positive	Revised
0-43,75	Not positive	Revised

RESULT AND DISCUSSION

In this study, a booklet was produced on cell bioprocess material as a supplement to Biology teaching materials for class XI SMA/MA. The booklet is developed through stages, namely the stages of developing a 4D (four D) model. The 4D development model consists of four stages, namely the definition stage, the design stage, the development stage, and the dissemination stage. The study was limited to the third stage due to time and cost constraints.

The first stage in this research is the definition stage. The definition stage is carried out to determine the problems experienced by students in learning Biology at school. This stage is carried out by giving questionnaires to teachers and students at SMAN 1 Tilatang Kamang. Several stages were carried out in the definition, including front-end analysis, student analysis, task analysis, concept analysis, and formulation of learning objectives.

It is known that the results of the front-end analysis show that students have difficulty in studying cell bioprocess material. This is evidenced by the daily test results of students who are still low and below the Minimum Completeness Criteria (KKM). From the questionnaire distributed to teachers and students, it is known that teachers have made efforts to help students understand Biology material more easily. One of them is by using module teaching materials, textbooks, and student worksheets. However, students still have difficulty studying cell bioprocess material and require a variety of other teaching materials as support in students understanding to study cell bioprocess material.

Furthermore, at this stage, an analysis of students is carried out. The causes of students' difficulties in understanding cell bioprocess material are many confusing terms, many as difficulties because the material is rote, too much material, material that cannot be observed directly, as many difficulties because the material is complicated, and difficulties because of the teaching materials used. available difficult to understand. In improving students' understanding, from the results of the questionnaire, it is known that students want the material delivered to be complete, concise, solid, and clear, using language that is easy to understand, and reading accompanied by pictures. From these results, it is also known that students tend to learn by seeing and observing, and reading. So students are helped with varied teaching materials, one of which is by providing booklets as a supplement to teaching materials that can increase students' interest in learning. Booklet development has many benefits for students. Prastowo in Ningrum et al. (2018) state that, firstly, the learning

activities will be interesting, the two students will get many opportunities to study independently with the guidance of the teacher, and the three students will have the convenience of learning every competency that must be mastered.

The next stage of defining is task analysis. Task analysis is carried out to determine the tasks or competencies that must be understood by students in the cell bioprocess material. This stage is used as a reference for the development of the booklet by describing the Core Competencies (KI), Basic Competencies (KD), and Competency Achievement Indicators (GPA). The results obtained from the task analysis, namely Competency Achievement Indicators (GPA) were used to analyze the concepts contained in the cell bioprocess material. The results of the task analysis and concept analysis are then used to determine the formulation of learning objectives.

The second stage of 4D development is the design stage. At this stage, several steps are carried out, namely media selection, format selection, and initial design. The selection of media and the selection of the format of teaching materials will be developed based on the results of the analysis of students at the definition stage. The media chosen to be developed is a booklet that is dominated by blue. The booklet is made with Times New Roman, Garamond, and Calibri fonts.

At the design stage, the initial design is carried out, meaning that the booklet is ready to be validated by the validator to get an assessment, suggestions, and criticism to make the booklet better. The booklet design is made with several components that make up the contents of the booklet, namely the booklet cover, introduction, table of contents, list of pictures, learning competencies, concept maps, materials, bio info, glossary, bibliography, and the back cover of the booklet. The contents of the booklet are designed using Microsoft Publisher 2007 application, and Microsoft PowerPoint 2007 to design the cover of the booklet.

The third stage of booklet development is the development stage. This stage is carried out by carrying out a validity test and a response test to the booklet. The booklet validity test was carried out by three validators, namely two UNP Biology lecturers and one Biology teacher at SMAN 1 Tilatang Kamang. When carrying out the booklet validity test, improvements were made to the booklet in accordance with the suggestions submitted by the validator. Then the validator gives an assessment of the booklet that has been developed. The results of the analysis of the validity of the booklet test that has been carried out by the validator are known that the booklet is declared very valid with an average result of 85.33% (Table 3, Table 4). Validation is carried out by covering four aspects, namely the feasibility of content, language, presentation of material, and graphics.

Table 3. The results of the booklet validity test by the validator.

No.	Components of Assessments	Value Validity (%)	Criteria
1.	Feasibility of contents	87.9	Very Valid
2.	Language	85	Very Valid
3.	Presentation	85	Very Valid
4.	Graphics	83.3	Very Valid
	Average	**85.33**	**Very Valid**

Table 4. Validator suggestions for booklets

No.	Suggestions	Follow-up
1.	Change the text color from white to black	Already repaired
2.	Fix hyphenation	Already repaired
3.	Fix writing errors	Already repaired
4.	Correct the explanation of the sentence in the picture	Already repaired
5.	Fix the title layout on the table of contents and list of Figures	Already repaired
6.	Add year and page on an image obtained from book sources	Already repaired
7.	Fix image layout	Already repaired
8.	In the pinocytosis material, add examples	Already repaired
9.	Fix image source	Already repaired
10.	Consistency of capitalization on image source	Already repaired
11.	Fix arrow on reproduction type scheme cell	Already repaired
12.	The explanation of the translation material must be corrected	Already repaired

The response test was conducted on one biology teacher and 32 students of class XI science at SMAN 1 Tilatang Kamang. The response test aims to determine the ease of use, the effectiveness of learning time, and the benefits of learning Biology in class XI SMA/MA. The results of the analysis of the response test to the teacher can be seen in the following Table 5.

Table 5. Analysis Of The Teacher Response Test

No.	Components of Assessments	Response Values (%)	Criteria
1.	Ease of use	82.14	Very Positive
2.	Effective learning time	100	Very Positive
3.	Benefits	88.89	Very Positive
	Average	90.34	Very Positive

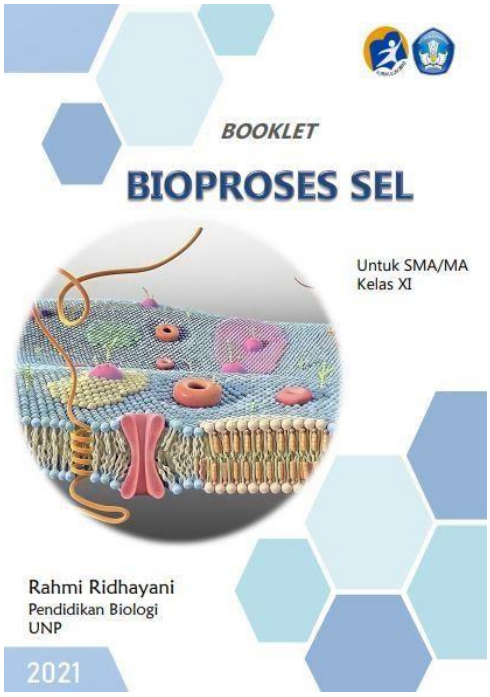

Figure 1. Cover *booklet*

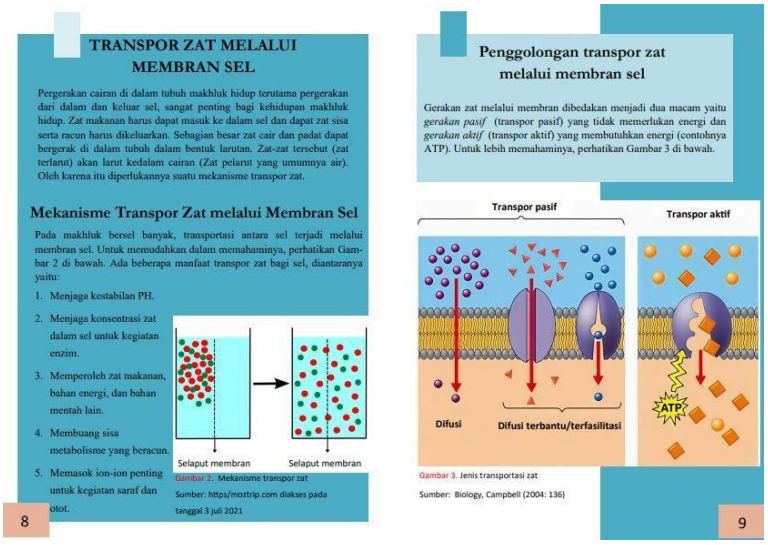

Figure 2. Booklet material description display

Analysis of the student response test can be seen in the following Table 6.

Table 6. Analysis Of The Student Response Test

No.	Components of Assessments	Response Values (%)	Criteria
1.	Ease of use	83.81	Very Positive
2.	Effective learning time	81.25	Very Positive
3.	Benefits	81.51	Very Positive
	Average	**82.19**	**Very Positive**

Based on the results of the study, at the stage of validity testing and response testing, the booklet was declared very valid and received a positive response from teachers and students. So it can be concluded that the cell bioprocess booklet is suitable for use in biology learning, especially in the cell bioprocess material for class XI SMA/MA.

CONCLUSION

This study concludes that, based on the results of the validity and response tests, the developed cell bioprocess material booklet can be stated to be very valid and very practical, so it is worthy of being used as a teaching material supplement.

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