



Biology Learning Innovation Using Booklet Media

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ABSTRACT

Purpose of the study: This study aims to develop booklet-based learning media for the 11th grade Biology subject, as well as to measure the level of validity and effectiveness of the media in improving the learning of Biology for 11th grade students.

Methodology: This study uses a development research method with a 4-D approach (define, design, development, disseminate). The subjects of the study were students of class 11 MIA I at Islamic high school Madani Pao-Pao (24 students) and State Islamic High School 1 Makassar (35 students). Data collection techniques were through observation, interviews, and documents. Data were analyzed qualitatively with descriptive presentation.

Main Findings: The results of the study showed that the developed booklet-based learning media received validation with an average of 3.5, which means it is very valid. Field trials at Islamic high school Madani Pao-Pao and State Islamic High School 1 Makassar showed that this media was effective, with an average implementation value of 3.6 and 3.1, which were included in the good and very good categories. Positive responses from teachers and students stated that booklets helped increase learning motivation and facilitated understanding of the material.

Novelty/Originality of this study: The novelty of this research lies in the development of booklet-based learning media that integrates material summaries with relevant images and quizzes to train students' critical thinking skills. This media is also designed to increase learning motivation through an attractive and practical display, and is adjusted to the curriculum and needs of Islamic high school students.

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1. INTRODUCTION

Education is a deliberate and planned effort to create a learning environment and learning process so that students can actively develop their potential in spiritual, religious, self-control, personality, intelligence, noble character, and skills needed for the benefit of themselves, society, nation, and state. The success of education is influenced by changes and renewal in all components of education, including curriculum, infrastructure, teachers, students, and teaching models [1], [2]. Selecting the right learning media is also a key factor in achieving educational success [3], [4]. All of these components are interrelated to support the achievement of the desired educational goals [5]-[7]. The learning process is a dynamic journey in which teachers and students interact with each other to achieve educational goals [8], [9].

Teachers have a central role in designing learning experiences that are engaging, relevant, and motivating for students. The delivery of materials, the application of teaching strategies, and the use of appropriate learning media are key to stimulating students' interest and understanding [10], [11]. On the other hand, students play an active role in exploring knowledge, participating in discussions, and applying the concepts learned. An effective learning process involves students' emotional and intellectual involvement, building connections between new concepts and prior knowledge, and providing space for reflection and the development of critical skills [12], [13]. With an interactive approach, learning becomes more contextual and relevant, creating an environment where students can grow and develop holistically.

Teachers are required to demonstrate creativity in finding and collecting the resources needed to create teaching materials in the learning process. However, some teachers may still face obstacles in creating teaching materials or learning media that suit students' needs. Because the success of learning is highly dependent on the selection of learning media or learning resources used, teachers need to be careful in choosing them [14], [15]. Effective learning media and learning resources are those that are able to achieve learning objectives by motivating, attracting attention, and stimulating students through learning materials. Careful planning is needed in the use of media in the learning process. When considering technological developments, media can be grouped into two main categories: traditional media and cutting-edge technology media. [16], [17].

In the context of this research, the focus is on the development of printed media in the form of booklets. Booklets, in the form of small books that communicate messages or information, are chosen as an effective medium for presenting Biology materials. Booklets not only function as a summary of the material with interesting pictures, but are also able to arouse interest and joy in learning Biology. The use of booklets is considered very effective in improving student learning outcomes. Biology learning plays a crucial role in developing students' understanding of life and the processes that occur in nature [18], [19].

Biology teachers are responsible for providing materials that involve scientific concepts, life processes, and interactions between organisms. In addition, the use of innovative learning media, such as booklets that combine simple words and interesting illustrations, can have a positive impact on increasing students' absorption of the material. Biology learning also emphasizes observation, experimentation, and application of concepts in real contexts, allowing students to develop analytical and problem-solving skills [20], [21]. With a dynamic and interactive approach, Biology learning is not just a transfer of knowledge, but also a process of forming scientific attitudes, concern for the environment, and appreciation for life around us.

The researcher conducted initial observations at Islamic High School Madani Alauddin Pao-Pao on the learning media used by teachers when teaching Biology material. Teachers use textbooks available in the library and Student Worksheets. This Student Worksheet is a book that has been made a mandatory reference by every grade XI student. In the Student Worksheet, there are various discussions of materials and various assignment questions. The results of the study showed that students tend to open their Student Worksheets after receiving instructions from the teacher to open the book. Based on the results of observations at State Islamic High School 1 Makassar, information was obtained that the textbooks used still have a lot of reading material, forcing students to read all of it in order to understand the material. Therefore, the researcher believes in the need for innovation in learning media that can be easily absorbed by students. This innovation includes the use of simple words without sacrificing essential meaning, as well as the inclusion of interesting illustrations to increase student motivation in understanding Biology subjects in more depth.

Previous research has found that learning media contributes to advancing educational practices through the creation of effective and engaging learning materials [22]. However, previous studies have focused on physics learning topics. To fill the gap, this study was conducted to develop and analyze the effectiveness of booklet learning media in biology subjects. This study presents novelty by focusing on the development of booklet-based learning media specifically designed for Biology subjects at the Madrasah Aliyah level. This media was developed with an approach that combines the presentation of material using simple words, attractive illustrations, and designs that motivate students to learn independently. Different from previous studies that have focused more on learning media in physics topics, this study emphasizes the application of booklets for Biology materials, which have unique characteristics such as complex concepts and reliance on visualization to understand life processes.

The urgency of this research lies in the urgent need to overcome obstacles to Biology learning, such as the lack of interesting and effective media variations, and students' difficulties in understanding text-heavy material. With this innovation, research is expected to make a significant contribution to improving the quality of Biology learning, encouraging student learning outcomes, and enriching the literature on the development of learning media in Indonesia. Based on the explanation above, this study has the objectives of developing booklet-based learning media in Biology subjects, determining the level of effectiveness of booklet-based learning media in Biology subjects and determining the level of validity of booklet-based learning media in Biology subjects.

2. RESEARCH METHOD

The type of research used is development research, namely an approach used to create special products and test the extent of their effectiveness [23], [24]. The research location was conducted at Islamic High School

Madani Pao-Pao and State Islamic High School 1 Makassar. The research subjects in this study were class XI MIA I, where there were 24 students at State Islamic High School Madani Pao-Pao and 35 students at State Islamic High School 1 Makassar, so that the total number of research participants reached 59 students. The data sources used in this study were primary data and secondary data. Primary data is data collected through field research activities, involving interviews, observations, and direct document collection from related parties [25], [26]. Meanwhile, secondary data is data consisting of various documents, including learning tools, books, journals, research documents, and other relevant sources [27], [28].

The device development model as suggested by Thiagarajan and Semmel is the 4-D Model. This model consists of 4 stages of development, namely define, design, development, and disseminate [29], [30]. The purpose of define is to determine and clarify learning requirements starting with analyzing learning objectives from the limitations of the material that is the focus of development. The purpose of the design stage is to prepare a prototype of learning media. The purpose of the development stage is to produce a product that will be developed.

The purpose of the disseminate stage is to test the effectiveness of media in learning activities in other schools on a limited scale. The instruments used in this study were guidelines for observing the implementation of learning media, and teacher and student interview activities. Data collection techniques are techniques or methods used to collect data, namely validity test data and effectiveness test data [31], [32]. The data obtained through this research activity is analyzed qualitatively and then presented descriptively, namely by outlining, explaining and describing according to the problems that are closely related to this development research [33], [34]. The data analyzed in this discussion is qualitative. This type of qualitative data involves information and descriptions expressed in the form of language, then connected with other words to achieve an understanding of the truth or otherwise. Below are the categories of research instrument assessments.

Table 1. Criteria for the Level of Validity and Effectiveness of Learning Media

Value	Criteria	
	Validity	Effectiveness
$3,5 \leq x \leq 4$	Very Valid	Very Good
$2,5 \leq x < 3,5$	Valid	Good
$1,2 \leq x < 2,5$	Quite Valid	Not Good
$0 \leq x < 1,5$	Not Valid	Very Bad

3. RESULTS AND DISCUSSION

The validation results in the form of suggestions and criticisms from the validator are then used as a reference in revising the media that has been developed. After revising prototype 1, prototype 2 will be produced which will be tested in the field with limited distribution at Islamic High School Madani Pao-Pao and State Islamic High School 1 Makassar. The results of the expert validator's assessment of the media can be seen as follows:

Table 2. Results of Validator Assessment of Developed Media

NO	Assessed Aspects	Validator I	Validator II
1.	Content/Material Suitability	3,1	4
2.	Presentation Suitability	3	3,9
3.	Language/Readability Suitability	3	3,7
Total		3,03	3,9
Average		3,5	

Based on the table above, the results of the validation of prototype 2, namely the average value of the validity of the media given by two media validators is 3.5 which is in the very valid category, from the average results of the assessment, it can be concluded that the learning media in the form of booklet-based learning media that has been developed by researchers is suitable for use and tested in the field on a limited scale. The researcher brought 3 people as observers so that they could directly review the teaching and learning process through the learning media implementation sheet provided by the researcher.

Based on tables 3 and 4, each school can be said that the learning carried out looks effective because the students' activeness is seen during the discussion process through question and answer activities between groups. This can be shown by the average value of 3.6 and 3.1 which are included in the good and very good categories. After going through a large-scale trial stage, to strengthen the validity of the quality of the booklet learning media, it is necessary to conduct a validity stage test in the field [35], [36]. Based on this, the researcher used an instrument in the form of an interview sheet for both students and teachers from each school. The results of interviews with teachers showed that the booklet learning media has an attractive design appearance with a lively feel through the addition of aesthetic colors. The contents of the booklet are considered to support the learning process because they present material in the form of a summary equipped with relevant images. The results of the assessment of

the level of implementation of the booklet learning media between teachers and students can be seen in the following table:

Table 3. Implementation of Islamic High School Madani Alauddin Pao-Pao Learning Media

NO	Assessed Aspects	Observer I	Observer II	Observer III
1.	Teacher's Teaching Activities	3.8	3.9	3.7
2.	Student Learning Activities	3.8	3.3	3.1
	Total	3.8	3.6	3.4
	Average		3.6	

Table 4. Implementation of Learning Media at State Islamic Senior High School 1 Makassar

NO	Assessed Aspects	Observer I	Observer II	Observer III
1.	Teacher's Teaching Activities	3.4	2.9	3.3
2.	Student Learning Activities	3.3	2.6	3.1
	Total	3.4	2.8	3.2
	Average		3.1	

In addition, the quizzes in the booklet are able to train students to think critically, because the quiz answers are summarized in the booklet material, thus encouraging students to read. The variety of quizzes provided also increases students' motivation to learn. The use of flexible booklets with various learning models such as Discovery and Inquiry, as long as the teacher is able to master the class during the learning process. This media is considered suitable for use as long as it follows the development of the curriculum, with language and terms that students can generally understand, although there are some Biology terms that require additional references. The language in the booklet is in accordance with the development level of class XI Islamic Senior High School students. The practicality of the booklet's size which is easy to carry and the combination of attractive colors and images are added value. However, important input in the form of additional student skill assessment activities can be considered for further development. Overall, booklet learning media is considered capable of fostering students' learning motivation by creating a feeling of joy and an effective learning atmosphere.

The results of interviews with students showed that Biology learning at home is done by reading books repeatedly to understand the material, especially if there is homework, while at school students pay attention to teachers, read guidebooks, and participate in learning activities such as discussions or presentations. Both learning methods, both individual and group, have advantages; group learning allows students to exchange ideas, while individual learning helps improve focus. Learning media commonly used include textbooks, leaflets, and student handbooks. The use of booklets during learning is considered interesting and easy to understand because the content is short and does not contain too much material. Booklets are also practical to carry because they are small and simple, and have never been used in schools before. Quizzes in booklets are considered effective in training students to think critically and increase insight. In addition, booklets are able to increase students' motivation and interest in learning through the display of material accompanied by interesting pictures, clear summaries, and content that is not confusing. Compared to previous media, booklets are superior because of their practical form, contain material concisely, and provide students with a feeling of joy thanks to their attractive appearance, use of easy-to-understand language, and illustrations that support learning.

Based on the observation results from the validation process, the learning media that has been developed shows an average value of 3.5 which is in the valid category ($x > 3.4$) and has produced prototype 2. All aspects of media assessment are in the valid category, so the learning media that has been developed can be used in the next stage, namely trials I, II and trial III in classroom learning, to then measure its effectiveness. However, the notes given by the validator on each validated component, need to be made minor improvements or as needed according to the notes given.

The trial phase was conducted on a total of 59 students consisting of 2 classes XI MIA I with different school implementations, namely at Madani Islamic High School Alauddin Pao-Pao and State Islamic High School 1 Makassar. Based on the previous trial process, there were 3 stages, namely trial I, trial II, and trial III. At Islamic Senior High School Madani, the material being tested was the blood circulation system, while for State Islamic High School 1 Makassar, the material was the food digestion system. Each trial method and learning scenario was carried out with the same method, namely by dividing students into several groups based on the division of teaching material, then the teacher gave a little apperception to students to enter the material to be discussed. The results of teaching and learning activities can be said to be effective because there was a change in attitude through student actions that were seen actively carrying out the learning process as shown in question and answer activities between groups. The data produced will be calculated the average value of each aspect of the activity points, and after that the results of the average will be added up as a whole and divided by the number of aspects of the activity points, so that this data produces a number that is not much different in 2 schools. At Islamic Senior High School Madani Alauddin Pao-Pao, the average result obtained was 3.6 while at State Islamic High School 1 Makassar school, the average result was 3.1. The interview activity was carried out after the learning was finished, the researcher

interviewed the teaching teacher to obtain response data or comments regarding the product that had been tested in class XI MIA 1 Islamic Senior High School Madani Alauddin Pao-Pao and class XI MIA 1 Islamic Senior High School 1 Makassar. The researcher recorded everything expressed by the teacher related to several aspects of the questions contained in the interview sheet. Then to obtain student activity data, the researcher distributed interview guide sheets to several people from each school to fill out the interview sheet. This was done because of time constraints so that the researcher did not have time to interview several students in turn. The results of the data obtained through interview activities, namely teacher and student interview data, can be concluded to have received an average positive response and response.

The development of the media is based on the aim of producing booklet learning media with good feasibility, especially for the material on the circulatory system and digestive system. Each teaching material has characteristics ranging from its level of difficulty to other characteristics that require special handling in learning so that the learning message can be conveyed to students. The existence of this product includes a summary of the material accompanied by a description of sample images, as well as a more colorful design appearance, especially for the material on the circulatory system and digestive system in the booklet media so that it can help students understand the learning media. This can be packaged more attractively to be displayed on the booklet media including information on the material on the circulatory system and digestive system.

In line with the results of previous studies that in the use of booklet-based learning media as an effective tool to improve student learning outcomes [37], [38]. Both previous and current studies underline the importance of booklet media as an effective learning tool, with a design centered on student needs. The main difference lies in the focus of the research; previous studies used booklets as a complement to conventional biotechnology learning, while current research emphasizes the integration of booklets as the main media specifically designed to enhance students' motivation, critical thinking skills, and learning experiences through a more visual and interactive approach. This shows that booklet media continues to develop as an innovative method in supporting effective learning processes.

By using booklet learning media, students can have senses that play a role like visual activities by getting a more focused learning nuance because of the motivation and interest in reading [39], [40]. The development of learning media is carried out by looking at previous relevant research. Improvements are made in terms of technical aspects by modifying the scope of the material summary. If in previous research, development was carried out with a booklet product drawing directly on the learning media book, in this study, media development was carried out by containing learning about the summary of the material accompanied by examples of images related to the discussion of the teaching material.

This study presents innovation in the development of learning media in the form of booklets specifically designed for the material of the circulatory system and digestive system. This media not only provides a dense and structured summary of the material, but is also equipped with interesting illustrations and quizzes designed to train students' critical thinking skills. The practicality of booklets as learning media allows students to learn flexibly and enjoyably compared to other conventional media. In addition, the integration of learning models such as Discovery and Inquiry through booklets provides a more interactive and in-depth learning experience, an approach that has not been widely applied at the Islamic Senior High School education level.

In the short term, this booklet learning media can increase students' interest and motivation in the Biology subject thanks to its attractive visual appearance and easy-to-understand material. In addition, this booklet contributes to increasing the effectiveness of learning by supporting the application of interactive models such as group discussions and questions and answers. The implementation of the booklet also allows for further trials in other schools with a wider coverage area to validate initial findings and improve the media based on user feedback. In the long term, this booklet has the potential to be integrated into the curriculum as official teaching materials for the Madrasah Aliyah level, especially for Biology subjects. Its success can be an inspiration for the development of similar learning media in other materials or even in different subjects.

The use of booklets is expected to support the development of students' critical and analytical thinking skills and significantly improve learning outcomes. This study has several limitations. First, the research sample only included two Madrasah Aliyah schools, so the results do not fully represent the wider population. Second, the duration of the trial was relatively short, so the long-term effectiveness of this learning media cannot be known in depth. Third, some students had difficulty understanding complex Biology terms, even though the booklet media had been written in simple language and adjusted to the students' development level.

4. CONCLUSION

This study concludes that booklet-based learning media designed for circulatory system and digestive system material for grade XI students of Islamic Senior High School shows validity with an average score of 3.5 (very valid category) based on the validator's assessment. This media is effective in increasing student learning activities with an average implementation value of 3.6 at Madrasah Aliyah Madani Pao-Pao and 3.1 at State Islamic High School 1 Makassar. Positive responses from teachers and students highlight that this booklet is interesting, practical, and motivates students to learn through attractive visual displays, clear material summaries, and quizzes

that train critical thinking skills. For further research, it is recommended that the development of this booklet media include the addition of more detailed and in-depth student skill assessment features. The trial can be expanded to more schools with a wider coverage area to strengthen the validation of the media's effectiveness. Research also needs to focus on a longer duration of use to measure the long-term impact on student learning outcomes. In addition, booklets can be further developed for other materials and subjects to expand their benefits at various levels of education.

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Conceptualization, A.M.A. and I.A.; Methodology, A.M.A. and I.A.; Software, A.M.A.; Validation, A.M.A., I.A. and A.F.O.; Formal Analysis, A.M.A.; Investigation, A.M.A.; Resources, I.A. and A.F.O.; Data Curation, A.M.A.; Writing – Original Draft Preparation, A.M.A.; Writing – Review & Editing, A.M.A., I.A. and A.F.O.; Visualization, A.M.A.; Supervision, I.A. and A.F.O.; Project Administration, I.A.; Funding Acquisition, A.F.O.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

Not applicable.

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