Biology E-Magazine Development in Human Respiratory System Topic for Grade VIII of Junior High School

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Abstract: This research aims to: (1) produce multimedia learning (E-Biomagz) material for the human respiratory system for eighth grade students of Dompu 6 Middle School, Indonesia, (2) reveal product feasibility, (3) reveal the effectiveness of products developed. This development research refers to the steps of the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model. Product testing consists of alpha tests and beta tests to determine the level of product feasibility and product effectiveness. Alpha test results was categorized very well given an average score of 3.74 by media experts and 3.53 by material experts. Beta testing results was categorized as very feasible with an average score of 3.37. Thus, the effectiveness test yielded a mean score of 37.07 for (pre-test) and 83.65 for the final analysis (post-test) so that the N-gain score obtained was 0.740 with the "High" criteria. This multimedia also proved feasible and effective in the learning process of the eighth-grade students of Dompu 6 Middle School.

Keywords: e-Magazine; Biology; Respiratory system; Multimedia.

1. Introduction

Biology is a study which not sufficiently conveyed with the modification of the learning model, but it is essential that instructional media so that the teaching material can be understood by students correctly and correctly, and by the lessons and students. The number of terms and document in learning that students have made in the learning process. Biology has the competence that demands every student to understand, apply, analyze factual, conceptual and procedural knowledge based on their curiosity. Sensitive and caring about environmental problems, safeguarding and loving the environment as a manifestation of the practice of the teachings of the religion he adheres to. Therefore, to achieve this goal, the learning of Biology applied in schools must be carried out optimally. The supporting components of learning such as strategies, methods, media and learning resources that are used must be maximized to achieve the learning objectives. The selection of these components must be adapted to the characteristics of the learning material and characteristics of students, thus making an effective, efficient and on target learning. However, the fact is that the learning process of Natural Sciences, especially Biology, has not been maximally implemented. Whereas Biology learning contains the urgency and usefulness that are needed by students now. Teachers and students still experience difficulties in achieving an optimal education that has been planned. One who experienced this problem was of the eighth-grade students Dompu 6 Middle School. Based on the results of interviews with science teachers (Natural Sciences), it was found that there were several obstacles encountered during the current learning process.

The lack of learning media used in the teaching and learning process in these subjects is a significant obstacle. Books become one of the learning media used, the use of media such as power point only
In the teaching and learning process, the use of media is necessary to facilitate learning. In fact, according to the science teacher (Natural Sciences), the media themselves are not enough to facilitate learning for some material.

Furthermore, the results of the interviews also stated that the material of the Human Respiratory System has its elusive difficulties, namely related concepts, the order of the human respiratory tract organs and their mechanisms. Books as learning media used during the teaching and learning process have not maximally facilitated this learning. Students will better understand the material and be active in the classroom when utilizing the media in the delivery of equipment and can lead to more curiosity responses to the use of the media. States that providing the right and appropriate learning media will make learning conditions conducive. Also, in implementing pedagogic competencies, teachers are also required to have methodological skills in the design and implementation of learning [1]. Also stated that lack of or incomplete learning media is one of the factors that make learning difficulties for students. This non-conducive learning atmosphere can affect student learning outcomes [2].

The observations in class VIII B, another factor that influences the saturation of students is, occasionally the teacher asks students to read and understand for themselves. This also triggers students' lack of interest in reading books because the teacher lacks qualified pedagogic competencies. The teacher is required to have the capability methodologically in the design and implementation of learning [3]. In addition, which causes students less interest in reading books due to books that are denser on the material, the appearance of books that are less attractive, the illustration of the picture is still black and white and only a few are colored, the contents are less concise, and the discussion is less communicative less motivating students to read.

Interviews were continued with library staff to find out books borrowed by VIII B students. The results are known that students often acquire colored books and are not related to biology subjects, students are more likely to hire and read interesting books, such as short stories, magazines, stories people and so on. This is also caused by the limited editions available at the school. So students tend to borrow books that have been mentioned previously. With all the obstacles above, then one solution that is expected to overcome these obstacles is by developing appropriate and appropriate learning media. States that the right learning media will function as teaching aids that also influence the climate, conditions, and learning environment [4]. Also explained that the use of learning media in Biology learning is useful to be able to foster positive attitudes of students towards the material and learning process, to improve the quality of student learning [5].

Learning media that can be a solution to this obstacle is multimedia-based learning media or also known as multimedia learning. Multimedia learning is a learning media that uses the help of computers or other electronic devices to present learning information in the form of text, sound, images, animation, videos and others that are arranged in an integrated and synergistic manner [6]. Multimedia learning combines several elements of media in one whole medium as a means of delivering knowledge information. Media elements in multimedia are very varied and able to convey authentic material. The combination of various media in multimedia can help teachers and students in learning as well as being a benefit in presenting new technologies in the world of education. Multimedia development as a solution to the above problems is the right thing because it suits your needs [7],[8]. This is appropriate because the use of media technology in learning must be by the learning needs [9].

Furthermore, based on the results of these observations, researchers took the initiative to provide several alternative media choices that will be implemented in multimedia. The alternative media supplied through questionnaires are Modules, Magazines, LKS, E-Books, Posters, and Leaflets. Of the several media choices, students prefer magazines to be implemented into multimedia. Some existing studies explained that the use of multimedia as a learning medium has proven effective. The purpose of multimedia in learning provides a positive experience compared to just using the lecture method [10]. Also, multimedia can overcome learning problems for all levels of education. Multimedia is proven to be able to develop cognitive aspects of early childhood [11], and learning outcomes of primary school children [12]. Multimedia also proved useful in improving the learning outcomes of
junior high school students [13],[6], and the learning outcomes of Upper High School students [14]. The use of multimedia is also able to provide understanding and motivation for students to learn [15]. Therefore, this work develops Biology Magazine products in the form of multimedia which will be used as one of the teaching media, because magazines, in general, can be interpreted as information and communicative media with the primary function of delivering actual news, besides the ability of magazines to reach all audiences and be able to raise the specialized content. In the context of school education, magazines to encourage students to create a conducive environment for independent learning so that students can focus more on learning the knowledge learned. In the current technological development. There is a lot of research on the use of digital media in daily life practices which provide more detailed analysis, such as integrating and adjusting media to their needs [16]. With the electronic biology magazine, it will be easier for students who use it in understanding the material of the respiratory system and also help students learn more focus and add insight. It is expected that by using instructional media in the form of multimedia-based magazines. It can attract students' reading interest with its appearance that is implemented into digital, attractive and colorful designs; there are diverse images without reducing the impression of magazines, diverse texts, selection of language that suits students' character making it easy to understand, giving the impression of relaxed and not dull. Presentations of visual and verbal information are concurrently better than sequential (sharing of attention or contact impact). Also, the appearance of images and words combined simultaneously during learning can improve the ability to construct relationships between verbal information and visual information. The presentation of multiple information elements is carried out simultaneously so as not to burden information processing on working memory; excessive load can thwart the success of obtaining meaningful information. Combined message and narrative message design formats simultaneously contribute positively to information acquisition [17] by Mayer found that students who received auditory explanations simultaneously with animation turned out to outperform other students who received visual texts with the same words and the same time with narrative descriptions. They also found that multimedia learners can integrate words and pictures more easily when words are presented auditory rather than visual text [17] by Mayer. Motivated from above explanation, this paper presents biology e-magazine development in human respiratory system topic. It is applied for grade viii of junior high school. The rest of this paper is organized as follow: Section 2 describes the proposed research method. Section 3 presents the obtained results and following by discussion. Finally Section 4 concludes this work.

2. Research Method

This research and development with ADDIE approach (Analysis, Design, Development and Implementation, Evaluation) development model adapted from Dick and Carry in [18] are used. Furthermore, in testing the feasibility of the product, there are two experts; media experts and material experts were involved in the alpha test stage. Whereas in the implementation phase for beta tests were conducted on a small scale, there are 13 students as respondents while in a massive scale test or field test, there are 26 students as respondents. Data collection techniques in this study used questionnaires, observation, interviews, and tests. The instrument in the survey used a questionnaire sheet for students for needs analysis, and a questionnaire sheet assessing the feasibility of the product in the alpha test and beta test. The Instruments on observation including school facility observation sheets in needs analysis. The tools in the interview used interview protocol for teacher and student interview guidelines in the needs analysis. The data collected in this study consisted of qualitative and quantitative data. Qualitative data is obtained in interviews with the subjects are teachers and students, and also their comments, suggestions, and improvements in the stages of alpha testing, as well as beta tests. Qualitative descriptive analysis techniques analyzed qualitative data. This data analysis technique aims to describe the data obtained so that it is easy to understand. The description of the qualitative data is also used as a guide, direction, and improvement for the research conducted.
Quantitative data was obtained on the assessment score on the multimedia feasibility questionnaire provided by media experts, material experts, other data collected from student respondents. Quantitative data collected from surveys is converted into a Likert scale. Likert scale is used to measure attitudes, opinions, and perceptions of a person or group about social events or symptoms [12]. In this case, the Likert scale is used to see and know the attitudes and opinions from media experts, material experts, and users about the product being developed. The Likert scale Table 1 for the assessment of questionnaire instruments is as follows.

| Value Scale | Interpretation     |
|-------------|--------------------|
| 4           | Very Feasible      |
| 3           | Feasible           |
| 2           | Less Feasible      |
| 1           | Not Feasible       |

Next, calculate the score of the assessment criteria produced by determining the interval based on the highest (ideal) and lowest (ideal) scales. The requirements are attached in the following Table 2.

| Average Score | Classification/Category |
|---------------|-------------------------|
| 3.25 ≤ xi ≤ 4.00 | Very Feasible (VF)     |
| 2.50 ≤ xi ≤ 3.24  | Feasible (F)           |
| 1.75 ≤ xi ≤ 2.49  | Less Feasible (LF)     |
| One ≤ xi ≤ 1.74   | Not Feasible (NF)      |

From the above formula, the product can be used if you succeed in entering the minimum category L (feasible). While the products developed can be tried to try subjects in the small-scale test and field tests. The results of this value are then interpreted into the classification Table 3 of interpretation of the gain value as follows:

| Values Gain | Category |
|------------|----------|
| g ≥ 0.70   | High     |
| 0.70 > g ≥ 0.3 | Medium  |
| g < 0.30    | Low      |

3. Result and Discussion

This study aims to produce multimedia-based E-Magazine products in the subjects of Natural Sciences, especially Biology, material for the Human Respiratory System in class VIII of Dompu 6 Middle School. The development was carried out by following the ADDIE (Analysis, Design, Development and Implementation, Evaluation) development model procedures adapted from Dick and Carry (1996). The full details of obtained results are explained as follows.

3.1. Analysis Stage

In the analysis stage, preliminary research is carried out namely observation and interviews with teachers. This preliminary study includes consideration of activities during the teaching and learning process, interviews with technical drawing subject teachers and student response questionnaires. This initial objective is to obtain data on aspects of needs analysis. At this stage determine the learning
material that will be developed, namely the Human Respiratory System of eighth-grade students Dompu 6 Middle School. The results of interviews with subject teachers explained that the material of the Human Respiratory System was quite difficult and because it was abstract so that students only imagined related to the article received, other than students found it difficult to explain the mechanism of breathing when this material was closely associated with their daily lives. Besides that, the media used are only textbooks that are densely packed with content; they explain that they are saturated due to a solid material, colorless images, and explanations of difficult material. Observations were also made to library staff, obtained from book lending data showing class VIII B students that the classes studied were more often borrowing books that were not related to science subjects such as magazines, short stories, historical storybooks that were illustrated. Based on this, the researchers took the initiative to develop media combined with multimedia. Students are given their opinion questionnaire related to the media that will be connected with multimedia, the media namely, Magazines, Modules, E-Book, LKS, Posters, and Leaflets. From several alternative media, students prefer to choose magazines to be combined with multimedia. From the data obtained, researchers will develop multimedia-based E-Magzbio (Biology E-Magazine) products.

3.2. Design Stage
Based on the results of the pre-survey that has been conducted, the researcher first determines and collects the resources needed in this product development research. What is required to develop this multimedia is a source of media related to media elements used in multimedia, either by producing it yourself or with the help of the internet. To create these media elements, it requires some software. As for some of the software used, namely Flip PDF Professional / Flip Builder and Photoshop CC 2014 for editing images to be used, Ummy Video Downloader to download the required video, Filmora for video editing, Microsoft Word 2016 text storage material. Furthermore, the source material for Human Respiratory from several school textbooks with several authors and publishers. After several things above, flowchart and storyboard are made.

3.3. Development Stage
The development stage is the stage of making multimedia e-magazine biology based on the sources that have been collected, namely preparing text such as font type and font size, creating graphics and editing graphics using Adobe Illustrator CS6 software and Adobe Illustrator CS6. Producing audio and video in multimedia learning uses two software, namely Filmora. While Ummy Video Down-loader is for downloading the necessary videos from youtube. Integrating the media components into the whole program, using the Flip PDF Professional / Flip Builder software. The integration of all these components refers to the flowchart and storyboard that was designed beforehand. The following are some of the elements which are depicted in Figures 1, 2, 3 and 4 below.

![Figure 1. Cover Interface](image-url)
Another thing that was done was the making of research instruments for the validity of multimedia learning in the alpha test phase, a beta test. The research instrument will go through the validity stage by two validators. After passing the validity of the instrument, the product will then be tested for alpha. Alpha test is the first validation stage for multimedia learning that is developed. This stage involved four respondents who became multimedia validators. Four respondents consisted of two media experts and two material experts. After the alpha test phase, there is a revision suggested by the validator as an improvement. This revision is done before entering the next stage. The results of media validation by the first media expert assessed this learning multimedia with a mean score of 3.58 on a scale of 4 with the criteria of "Very Good." The second media expert assessed this learning multimedia with a mean score of 3.89 on a scale of 4 with criteria for "Very Good." Then the overall score for the assessment regarding media is at a score of 3.74 with the criteria of "Very Good." The following are the results of the assessment of multimedia learning by media experts presented in the bar diagram (see Figure 5).
Qualitatively, the above results show that this learning multimedia regarding media is included in the "Very Good" category (x > 3.25). Both experts concluded that this multimedia learning was ready to be tested in the next stage with some suggestions and improvements. Furthermore, the results of the material expert, the first Material Expert assessed this learning multimedia with a mean score of 3.41 on a scale of 4 with criteria for "Very Good." The second material expert assessed this learning multimedia with a mean score of 3.60 on a scale of 4 with criteria for "Very Good." With the results of the assessment of the two material experts, the mean obtained was at a score of 3.53 with the criteria of "Very Good." The following are the results of the multimedia assessment of learning by the expert material presented in the bar diagram (see Figure 6).

Figure 6. The result of Material Expert

Qualitatively, the results show this learning multimedia regarding the material included in the category "Very Good" (where x > 3.25). Both experts concluded that this multimedia learning was ready to be tested in the next stage with some suggestions and improvements.

3.4 Implementation Stage

After getting products from experts, the next process carried out by researchers is the process of applying the product. At this stage, the researcher starts the product that has been made. There are two stages that researchers must do, namely beta testing and testing. This beta test is intended to see the response regarding the multimedia of this product. The beta test involved 13 respondents from the eighth-grade students taken randomly. Based on the data that has been obtained the average highest score of the user is 3.37 on a scale of 4 with the criteria of "Very Good." The following Figure 7 is the result of the respondents rating.
3.5. Evaluation

Evaluation is the last stage of ADDIE development multimedia. This evaluation is carried out by researchers by analyzing the research data obtained. The data is the feasibility data collected from the student questionnaire. As explanation above.

3.6. Effectiveness Test

After the alpha test and beta test, there are suggestions and comments given by the respondent. Then the effectiveness test involved 26 respondents of class VIII B of eighth-grade students of Dompu 6 Middle School. This test uses 20 items each with different cognitive levels. Effectiveness test using one pretest-post-test deviation group. The first meeting was given a pretest to find out the extent of students' understanding of the material "Human Respiratory System." Furthermore, the learning process is carried out using the developed E-Biomagz multimedia. The next meeting was followed by the learning process and supported by the post-test to find out how far the material was understood. The assessment results in the Field Testing stage are presented in the following Table 4:

| Students | Pretest | Post-Test |
|----------|---------|-----------|
| 1        | 30      | 90        |
| 2        | 25      | 80        |
| 3        | 35      | 80        |
| 4        | 40      | 85        |
| 5        | 50      | 90        |
| 6        | 15      | 75        |
| 7        | 35      | 85        |
| 8        | 65      | 95        |
| 9        | 60      | 95        |
| 10       | 50      | 90        |
| 11       | 15      | 75        |
| 12       | 30      | 80        |
| 13       | 30      | 80        |

| Students | Pretest | Post-Test |
|----------|---------|-----------|
| 14       | 50      | 80        |
| 15       | 30      | 75        |
| 16       | 35      | 90        |
| 17       | 25      | 75        |
| 18       | 55      | 95        |
| 19       | 30      | 75        |
| 20       | 50      | 85        |
| 21       | 25      | 90        |
| 22       | 35      | 80        |
| 23       | 40      | 80        |
| 24       | 50      | 85        |
| 25       | 15      | 90        |
| 26       | 35      | 75        |

| AVG  | 37.07  | 83.65    |

Based on the data in Table 4 above, the average results obtained from the pre-test were 37.07 with the lowest value of 15, and the highest was 65. While the post-test captured a mean score of 83.65 with the lowest amount of 75 and the highest score of 95. Following the score of the test effectiveness in pictures.
Figure 8. Pre-Test and Post-Test score

Based on the reference data that has been described previously, the scores increasing calculation using the N-Gain formula is given as:

\[ g = \text{Error! Reference source not found.} \]

\[ g = \text{Error! Reference source not found.} \]

\[ g = \text{Error! Reference source not found.} \]

\[ g = 0.740 \]

Based on the above calculation, the gain value is 0.740 which is included in the "High" classification (0.70 > g > 0.3). The results of these calculations are presented in the following Table 5.

| No. | Variable     | Pre-Test | Post-Test |
|-----|--------------|----------|-----------|
| 1   | Lowest Score | 15       | 75        |
| 2   | Highest Score| 65       | 95        |
| 3   | Average      | 37.07    | 83.65     |

| Gain Score | 0.740 |
| Gain Criteria | High |

This E-Magazine Biology is a learning media that contains the subjects of Biological Natural Sciences with the material in the Human Respiratory System for eighth-grade junior high school students. This multimedia learning was developed based on the analysis of needs obtained through interviews with subject teachers and questionnaires about students' perceptions of the learning media used during learning to the eighth-grade students. Through the needs analysis, the following results are obtained:

a. Students are following bored lessons because the teacher only uses power-point media a few times so that students are not directly involved.

b. Teachers have not been able to make alternative learning media themselves.

c. The books used are more robust in the material, the use of sentences in books is difficult to understand, and the pictures are colourless and less attractive.

d. Lack of resources and learning media. Some students commented that multimedia was able to motivate them to learn because the material was explained through communicative pictures, audio, video, language and speech that they had never received because all this time learning had only used books.

Furthermore, after analyzing the needs, multimedia learning was developed as a solution to the constraints above. The development model used in this learning multimedia follows the ADDIE by
Dick and Carry development model [18] which consists of stages of analysis (analysis), design (design), development (implementation), and evaluation (evaluation). The multimedia development process also uses the Principles of Multimedia Learning Development by Mayer [17] as a reference for development. Use of these principles to produce excellent and useful learning multimedia so that the purpose of information or instructional messages is delivered optimally.

Technically, this multimedia learning was developed using the Professional Flip PDF / Flip Builder application. The results of this multimedia development product are in several formats namely .swf, HTML, and apk stored in the Compact Disc (CD). The content of multimedia learning consists of:

- Developer profile
- Core Competencies and Basic Competencies
- Indicators and Learning Objectives
- The material in the Human Respiratory System which is equipped with supporting articles related to the material
- Quiz
- Glossary and References

As for the visual display, this multimedia uses several elements of multimedia media compilers, such as text, images, video, and audio. The main book in this multimedia uses a sans serif type font, the Gothic Century font. This type of font is used for reasons because the font is characterized by bright, upright and unrelated. This type of font is suitable because it has excellent clarity and readability on a computer screen. Font size has also been tested first, the level of readability, not only on the computer directly but even after being projected on the LCD. Furthermore, in the color composition, this multimedia uses various colors as the background color. The application of color matching in several aspects, such as text and background, first through contrast check so that it is clear, legible and does not hurt the user's eyesight.

For the feasibility stage, this learning multimedia has passed the alpha test and beta test processes. In the alpha test with validation by two media experts and two material experts, it was found that these learning multimedia was included in the criteria of "Very Eligible" with the results of validation regarding media at a score of 3.74 and regarding material at a score of 3.53 in 4.00 scale. Then in the beta test on a small scale with 13 respondents included in the criteria of "Very Decent" with a result of 3.37 on a scale of 4.00. While in the effectiveness test with 26 respondents, E-Biomagz multimedia proved effective with a "high" level of effectiveness with the Gain score of 0.740 (0.70> g. 0.3). Overall, this learning multimedia has been assessed as "very feasible" by media experts, material experts, and users. The existence of this learning media much helps teachers and students. This is of course in line with the central concept of educational technology, which with the development of multimedia learning can facilitate teachers and students to learn and improve their performance.

4. Conclusion

Conclusions on the results of research on the development of E-Magazine Biology material for the Human Respiratory System for VIII Grade Middle School students are as follows: (1) Products developed in the form of biology-based multimedia biology learning magazine containing respiratory system material. This product consists of the home page, competencies, developers, core material, supporting content, videos, quizzes, references, and glossaries. The core material contains the primary element that is in the school learning process while the supporting document comprises a material that is still closely related to the human respiratory system. Learning evaluations have three quizzes with an assessment at the end of the questionnaire. There is also a learning video that facilitates students in knowing the mechanism of the human respiratory system in everyday life; (2) Products developed are suitable for use as one of the class learning aids. This is reviewed from: (a) The results of the alpha test by two media experts obtained a mean score of 3.74 with the category "Very Feasible." (b) Alpha test results by two material experts obtained a mean score of 3.53 with the category "Very Feasible." and (c) The results of the beta test on a small scale obtained a mean score of 3.37 with the category
"Very Feasible."; and (3) The effectiveness test results for learning multimedia proved useful by producing a mean score of 37.07 for the initial test (pre-test) and 83.65 for the final analysis (post-test) so that the N-gain score obtained was 0.740 with the criteria "High."

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