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Development of e-Handout based on Discovery Learning for Respiratory System Material

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ABSTRACT

Motivated by the needs of students for teaching materials on Respiratory System material, the researcher decided to develop teaching material in the form of electronic handout to support the learning of Respiratory System material. This study aims to produce an e-Handout based on Discovery Learning for Respiratory System Material that is valid, practical, and effective. This research uses a 4D development model with four stages, namely define, design, develop, and disseminate. Based on the results of the media and material validity test of e-Handout based on Discovery Learning for Respiratory System Material, the results were very valid. The results of the practicality of media get results with the criteria very practical. The media effectiveness assessment received the very effective criterion with an average classical completion of 86.6%. Based on the results of the research obtained, it can be concluded that the e-Handout based on Discovery Learning for Respiratory System Material is declared valid, practical, and effective for use in learning Biology of Respiratory System material. The developed e-Handout is packaged in a pre-existing form and can be used for independent learning. This research is expected to be a reference for other researchers who will develop similar products on other Biology materials.

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Keywords: e-Handout, Discovery Learning, Respiratory System, Students

Introduction

In the biology learning process, there are components that support the course of learning, one of which is teaching materials. Teaching materials are all materials that are arranged systematically, including information, tools, and data that present all components about the skills that will be mastered and used by students in the learning process (Prastowo, 2012). The use of teaching materials during learning can also create an interesting, active, and communicative learning atmosphere so that learning is more dominant focusing on students (Rozalia et al., 2019).

Based on the results of preliminary observations at SMA Negeri 1 Singkep, in Biology subjects, teachers use Biology package books from publishers and modules that downloaded from the internet. From the results of interviews with class XI students, the module has a display that is less attractive to students because it tends to have too many explanations. Based on the results of the analysis of student needs, 82.1% of respondents stated that they needed other teaching materials to understand certain materials because the teaching materials available today were too many explanations and the language was difficult to understand. This results in students' lack of understanding of biology material so that student learning outcomes are low. One of them is on the material of the Respiratory System class XI. Based on data obtained in the field, the percentage of student learning completion in the Respiratory System material is quite low, namely 26%.

Because of these problems, it is necessary to develop more interesting and modern teaching materials to support Biology learning and increase students' interest in reading, especially in the Respiratory System material. One of the teaching materials that can be used as an alternative to support learning is e-handout teaching materials. e-Handout is a practical teaching material developed with the aim that students can easily gain knowledge (Sarita et al., 2021). Arsyad (2013) stated that handouts are additional written teaching materials that function as an increase in learning motivation for students to fulfill the basic competencies to be achieved. e-Handouts present the overall learning material concisely and concisely. The presentation and appearance on the e-handout is also more attractive as teaching material for students. By using e-handouts, it is hoped that students can more easily understand the learning material.

In realizing the creation of a conducive learning climate, the use of handouts is often adjusted to the learning model so that students will learn directionally through prepared handouts (Laela & Rinaningsih, 2021). The Discovery Learning is a model for developing an active way of learning discovering by yourself, investigating on your own, then the results obtained will be faithful and long lasting in memory (Hosnan, 2014). (Kristin, 2016) said, the Discovery Learning is used to develop an active way of learning by discovering by yourself, investigating by yourself, then the results that will be obtained last a long time in memory so that it is not easily forgotten by students. Therefore, the application of the Discovery Learning model to the development of respiratory system e-handouts is expected to optimize the cognitive and psychomotor abilities of students.

The advantage of e-handout teaching materials is that it stimulates the curiosity of students, students learn according to their respective speeds, can be done repeating the material independently. In addition, e-handouts are more economical and easy to distribute because they are more practical and can be accessed from anywhere and anytime. In research conducted by (Ramadan et al., 2020) showed that the use of e-handouts has been shown to help improve students' critical thinking skills and learning independence.

A similar study conducted by (Pratama & Sakti, 2020) showed that the use of e-handouts can improve student learning outcomes. This is because the use of e-handouts can facilitate students' understanding in learning the materials. Therefore, student learning outcomes have

also improved. Based on this background, researchers are interested in developing Biology teaching material based on the Flipbook application with the research title "Development of e-Handout based on Discovery Learning for Respiratory System Material ".

Methods

The research and development model used in this research is the 4D development model. The 4D development model consists of 4 stages, namely define, design, develop, and disseminate (Thiagarajan, et al., 1974). At the define stage, the researchers do an analysis of student needs and curriculum analysis. In the design stage there are media selection, format selection, and initial product design. The design of the e-handout developed is based on the Depdiknas (2008) which says that the constituent elements of the handout consist of a title component and supporting information. This was later clarified by Majid (2009) who said that handouts consist of competency standards, basic competencies, material summaries, evaluation questions, and reading resources. The constituent elements of e-handouts in general can also be equated with handouts. At the develop stage, an expert validation process is carried out on the product being developed. Validation was carried out by a lecturer in Biology Education at Raja Ali Haji Maritime University and a teacher of Biology at SMA Negeri 1 Singkep to test the validity of the media and material developed. After the product developed has been tested for validity, the product can test in schools to see the level of practicality and effectiveness of the product being developed. The last stage, namely disseminate is carried out by spreading the products that have been developed.

Results and Discussion

E-Handouts developed by researchers have several advantages including presenting material in an interesting way because there are images and videos, making it easier for students to repeat the material independently, and efficiently. This development product in the form of e-handouts is the answer to students' problems about the need for teaching materials that contain concise, easy to understand, and interesting explanations. The e-Handout that the researcher developed is also a solution to the problem of low student learning outcomes in the Respiratory System material. This is because the use of e-handouts developed by researchers in Respiratory System learning can increase students' interest in reading so that it affects student learning outcomes that have increased.

The development of the Respiratory System e-handout began with making product designs in the form of storyboards. Furthermore, the results of the storyboard that has been made are used as a reference to create a respiratory system e-handout design using the Canva application. e-Handouts of the respiratory system are designed in A4 size. The design process includes the creation of the entire e-handout section, ranging from covers, prefaces, table of contents, table of tables, image lists, animation lists, instructions for use, material content sections, bibliography, contributor pages and author profiles.

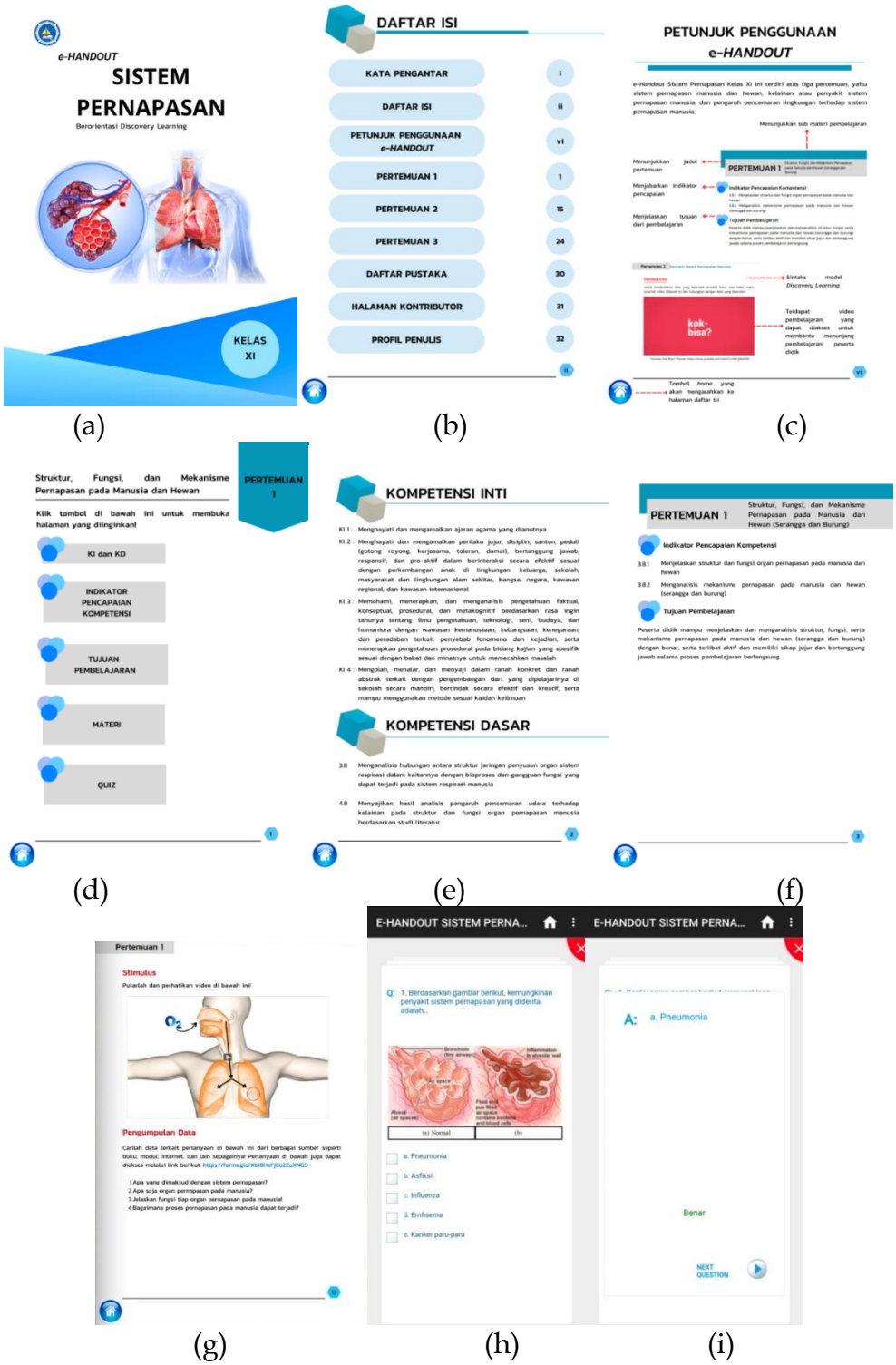

Figure 1. (a) Cover Display; (b) Table of Contents Page View; (c) User's Instructions Page View; (d) Menu List View (e) Page View of Core Competencies and Basic Competencies; (f) Page View of Competency Achievement Indicators and Learning Objectives; (g) Student Activity Page View; (h) Question Display on the Quiz Page; (i) Quiz Question Answer Page View

This e-Handout based on Discovery Learning for Respiratory System Material has been validated by 2 media experts, namely a lecturer in Biology Education at Raja Ali Haji Maritime

University and a teacher of Biology at SMA Negeri 1 Singkep. The media is declared very valid with the media validation result from validator 1 which is 94.3% and the media validation result from validator 2 which is 90%. The results of media validation can be seen in Table 1.

Table 1. e-Handout Media Validation Results

No.	Assessment Aspects	Validator 1	Validator 2	Average	Criterion
1.	Elements	92,8%	100%	96,4%	Very Valid
2.	Characteristic	90%	95%	92,5%	Very Valid
3.	Display	100%	75%	87,5%	Very Valid
	Overall average			92%	Very Valid

The assessment on media validation includes 3 aspects, namely elements, characteristics, and appearance. In terms of elemental aspects, there are 7 questions that contain elements or components that must be present in the handout, including core competencies, basic competencies, indicators of achievement of basic competencies, learning objectives, materials, practice questions, and reading resources (Majid, 2009). The average value of the two validators for the elemental aspect is 96.4% with the criteria being very valid. The results of the assessment showed that the appearance of the media element aspect was clear and attractive so that it received very valid criteria from both validators.

Reviewed the characteristic aspects, there are 5 questions about the characteristics of teaching materials. According to the Direktorat Keguruan Menengah Kejuruan Direktorat Jenderal Pendidikan Dasar dan Menengah Departemen Pendidikan Nasional in 2003, teaching materials have 5 characteristics, namely, self-instructional, self-contained, stand alone, adaptive, and user friendly. Of the five questions, the average obtained from the two validators was 92.5% with very valid criteria. This shows that e-Handout based on Discovery Learning for Respiratory System Material has met these five characteristics so that they get very valid assessments from both validators.

In terms of appearance, there are 5 questions related to the appearance of the media. According to (Dhamayanti & Ishafit, 2021), the presentation of illustrations on e-handouts can help students understand the concept of a material better. In the assessment of display aspects, the things that are assessed are about the color composition, clarity of images and videos, the typeface used, and layout settings. The average value of the two validators for the display aspect is 87.5% with very valid criteria. This shows that color composition selection, layout settings, and validated letter selection have a good and attractive appearance. In addition, the display of images and videos is also validated clearly and informatively.

Based on the assessment of the media from the three aspects above, the e-handout media is declared very valid with an average percentage of 92%. The results of this validity are supported by the opinion of Riduwan (2010), who said that if the product get a percentage with a range of 76%-100% then the product is declared very valid. According to (Kintoko, 2017), learning media is said to be valid if it has met the assessment criteria of validators and states that the resulting learning media is valid with revision or valid without revision.

In addition to the media validity test, a material validity test is also carried out. The material validation results from validator 1 are 82.3% and the validation results from validator 2 are 93.75% so that they get an average of 88% with very valid criteria. The results of material validation can be seen in Table 2.

Table 2. e-Handout Material Validation Results

No.	Assessment Aspects	Validator 1	Validator 2	Average	Criterion
1.	Linguistics	83,3%	100%	91,6%	Very Valid

2. Fill	81,2%	87,5%	88,4%	Very Valid
	Overall average		88%	Very Valid

This material validation assessment includes 2 aspects, namely the linguistic aspect and the content aspect. In terms of linguistic aspects, there are 3 questions. The average score obtained from the two validators is 91.6% with very valid criteria. This shows that the material on the discovery learning-oriented e-handout on the respiratory system material for class XI students has applied the writing rules regulated in the Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 50 Tahun 2015 tentang Pedoman Umum Ejaan Bahasa Indonesia (PUEBI) and the information conveyed is clear, so that the assessment for the linguistic aspect is very valid.

Another aspect that is measured is the content aspect. In the content aspect, there are 8 questions. Assessment of content aspects about the suitability of the content with the handout component, for example, the suitability of the material with competencies, learning objectives, and reading resources. Other assessments are about the suitability of the discovery learning model used and evaluation questions. The content aspect assessment obtained an average score from the two validators of 84.4% with very valid criteria.

Based on the above results, e-handouts are declared very valid because the average obtained is 88%**.** This is reinforced by the opinion of Esmawati (2008) who states that the teaching material is said to be valid and appropriate if the material is in accordance with the curriculum, competencies, indicators, and learning objectives to be achieved. This proves that the material on the e-handout developed is appropriate both in terms of linguistic aspects and content aspects so that it gets a very valid assessment.

To see the level of practicality of e-Handout based on Discovery Learning for Respiratory System Material, a practicality test was carried out. The practicality test of e-Handout based on Discovery Learning for Respiratory System Material was carried out by the teacher of biology subject class XI SMA Negeri 1 Singkep and 30 students of class XI. There are 3 aspects of assessment in the practicality test, namely, ease of use, language, and content. The teacher's response to the practicality of e-Handout based on Discovery Learning for Respiratory System Material got an overall average of 91.6% with very practical criteria by teachers. In terms of ease of use, there are 6 questions about ease of installation, access, use, media flexibility, and ease of media storage. The ease of use aspect gets a percentage of 100%. The teacher's response to the linguistic aspect gets a percentage of 100%. Assessment on the linguistic aspect is about the ease of language used in the media. The last aspect that is assessed is the content aspect. In the content aspect, there are 3 questions, namely about the ease of material, videos, and quizzes. The teacher's response to the content aspect received a percentage of 75%. The results of the assessment of the practicality of e-handouts by teachers can be seen in Table 3.

Table 3. Results of e-Handout Practicality by Teachers

No.	Assessment Aspects	Percentage	Criterion
1.	Ease of Use	100%	Very Practical
2.	Linguistics	100%	Very Practical
3.	Fill	75%	Practical
	Average	91,6%	Very Practical

Students' responses to the ease of use aspect averaged 85.7%. The linguistic aspect gets an average of 85.8%. And the content aspect gets an average student response of 80.3%. Based on the results of an interview with one of the students, he said that the e-Handout based on Discovery Learning for Respiratory System Material is easy to use and has an attractive

appearance. The average result for students' responses to the practicality of e-Handout based on Discovery Learning for Respiratory System Material is 83.9% with very practical criteria. According to (Arifin, 2017) practicality means the convenience of a product, both in preparing, using, processing, and interpreting, as well as administering it. In addition, according to the Big Indonesian Dictionary, the word practical itself means easy and happy to wear it (running and so on). This means that the results of the e-handout practicality assessment show that e-Handout based on Discovery Learning for Respiratory System Material have ease of access and use. The results of the assessment of the practicality of e-handouts by students can be seen in Table 4.

Table 4. Results of e-Handout Practicality by Students

Class : XI MIPA 3
Number of Students : 30 Siswa

No.	Assessment Aspect	Percentage	Criterion
1.	Ease of Use	85,7%	Very Practical
2.	Linguistics	85,8%	Very Practical
3.	Fill	80,3%	Very Practical
	Average	83,9%	Very Practical

To measure the level of media effectiveness, an evaluation of learning is carried out after using the media. The effectiveness of the medium is measured using the classical completeness formula. According to Trianto (2009), a class is said to be complete in learning (classical completion) if in the class there are ≥85% of students who have completed their studies. Based on data on student learning outcomes, a percentage of classical completion of 86.6% was obtained with very effective criteria. This can be seen from the number of students who are complete with standard values of Biology subjects, which is 75. The number of completed students is 26 people and incomplete students are 4 people with the total number of students is 30 people. The highest score obtained by students is 100 with the lowest score of 45.

Researchers also compared student learning outcomes using e-Handout based on Discovery Learning for Respiratory System Material with class that did not use e-handout. The class that did not use an e-handout received a classical completion percentage of 36.6%. From the results of this comparison, it can be concluded that classes that use e-Handout based on Discovery Learning for Respiratory System Material have a higher classical completeness than classes that do not use an e-Handout based on Discovery Learning for Respiratory System Material. This is because the use of an e-Handout based on Discovery Learning for Respiratory System Material can help students have a deeper understanding of the material, because the Discovery Learning model can encourage students to build and discover their own knowledge. Research by (Masitoh et al., 2015) concluded that the use of handout teaching materials by combining Discovery Learning model can improve student learning outcomes and this shows that these teaching materials are effectively used in learning. The results of processing the evaluation value using the classical completeness formula get a value of 86% with very effective criteria. The results of the effectiveness test of students on the respiratory system material can be seen in Table 5.

Table 5. Effectiveness Test Results

Standard Values	Number of Students	Number of Complete Students	Number of Incomplete Students	Classical Completeness	Criterion
75	30 People	26 People	4 People	86,6%	Very Effective

Conclusion

The development of this e-handout aims to provide alternative teaching materials needed by students and improve the cognitive abilities of students. Based on the results of the research and discussion that has been submitted, it can be concluded that the e-Handout based on Discovery Learning for Respiratory System Material that was developed received very valid, very practical, and very effective criteria and can be used for Biology learning in schools. Researchers hope that this research can be a reference for other researchers who will develop similar products in other biological materials with new innovations.

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