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Development of Guided Inquiry Based Textbooks on Respiratory System Material on Critical Thinking Ability

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Abstract

This study aims to produce a product of teaching materials in the form of textbooks that are used in the biological learning process on the respiratory system material. The textbooks developed are expected to be in accordance with the needs of students, valid, effective and practical to improve students' critical thinking skills. The research method uses Research and Development (R&D) with the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The trial was conducted on 30 students of class XI IPA 4 SMAN 5 Palu. The learning method used in applying the textbook product is guided inquiry. Assessment of effectiveness with pretest and posttest. The data collection methods used were validation, observation, questionnaires and tests, while the data analysis techniques used qualitative and quantitative descriptive analysis. Based on the validator's assessment with valid criteria, it is known that the guided inquiry-based human respiratory system textbook that has been developed has an average score of 88.68%. The textbook category developed was very effective on student learning outcomes, seen from the pretest score of 26.32 and posttest of 63.00 with an N-gain value of 0.76. The students' critical thinking ability in the pre-test was obtained 36 while the posttest was 86. Based on the N-gain criteria, namely high with interpretation with very critical critical thinking skills. Learning responses with guided inquiry-based textbooks make students feel interested, easy, *up-to-date* and easy to understand. The results of the research generally show that the guided inquiry textbooks on respiratory system materials are valid, practical and effective on student learning outcomes and critical thinking skills.

Keywords: Development, Textbooks, Guided Inquiry, Critical Thinking

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INTRODUCTION

Regulation of the Minister of Education of the Republic of Indonesia Number 41 of 2007 concerning Process Standards in primary and secondary education units states the need to develop thinking skills in the learning process, namely at the stage of core activities, especially elaboration activities. The consequence of rule 4 is that teachers are required to be able to develop thinking skills, both logical thinking skills, analysis, and critical thinking skills. Critical thinking skills in Indonesia based on the *Program for International Student Assessment* (PISA) are still low. This is shown from data in 2012 with a score of 396, then in 2015 with a score of 397 Indonesia was ranked 62 out of 72 countries (Hayudiyani et al., 2017) .

Things that must be considered in preparing teaching materials are the materials and research objectives (Magdalena et al., 2020) . Based on the analysis of the need for teaching materials, the respiratory system material is classified as difficult material. This is because

the material is related to everyday life with abstract concepts. Learning is expected to begin with facts that are often experienced by students. So teaching materials are needed that motivate students to understand the material and understand the material as a whole (Zaharah & Susilowati, 2020) .

Teaching materials are a set of teaching materials that are arranged systematically, showing a complete picture of the competencies that will be mastered by students in learning activities. In teaching materials, it is possible for students to learn a basic competency sequentially and systematically so that cumulatively they are able to master all competencies in a complete and integrated manner (Rosida et al., 2017) .

Students' critical thinking skills are currently in the low category (Norhasanah, 2018; Nuryanti et al., 2018; Susilawati et al., 2020) . Critical thinking skills have a very big role in improving student learning processes and outcomes. Biology learning requires critical thinking skills because it includes facts, laws, and scientific knowledge (Komalasari et al., 2019) . Critical thinking skills are not only needed in the learning process but are also used in solving everyday problems. Critical thinking has an important role in student learning activities which include mental processes, strategies and representations used to solve problems, make decisions and learn new concepts (Nuryanti et al., 2018) . In addition, critical thinking skills are considered important because 1) intellectual capital (knowledge) which is very important for everyone 2) a fundamental part of human maturity 3) as another discipline to prepare students for success in life (Wibowo et al., 2021) .

Based on the results of initial observations at SMA Negeri 5 Palu City, by interviewing one of the teachers in the field of biology, he stated that students' critical thinking skills had never been studied before. In addition, the textbooks used by students are currently only limited to Modules/LKS. The condition of the books being distributed is still in black and white with a too concise explanation of the material. With these conditions, students feel less motivated in reading. This is because the design is less attractive and has not focused on critical thinking skills.

Therefore, it is necessary to conduct research on the development of text-based guided inquiry textbooks on the human respiratory system material to improve the critical thinking skills of high school students. Based on the above background, the formulation of the problem in this research is the development of guided inquiry-based textbooks on human respiratory systems and materials to improve students' critical thinking skills. With increased learning motivation so as to be able to achieve critical thinking skills and student learning outcomes (Asmara et al., 2020; Fitri & S, 2020) .

One option that can be used as the basic material for the respiratory system is a textbook. In this textbook, material on the respiratory system is presented with a dissertation with interactive quizzes. The learning model developed in the book can help students learn the learning process in the classroom. The development of textbooks is expected to improve students' critical thinking skills. Based on this research, this study developed an inquiry-based textbook based on the respiratory material system as a teaching material for students in biology subjects in high school. From the textbook products developed, it is valid, practical and effective in improving students' critical thinking skills on the respiratory system material.

METHOD

This research is a Research and Development (R&D) research. The type of research used is Research and Development (R&D). The research and development model used is ADDIE (Analysis, Design, Development, Implementation and Evaluation) (Aldoobe, 2015) .

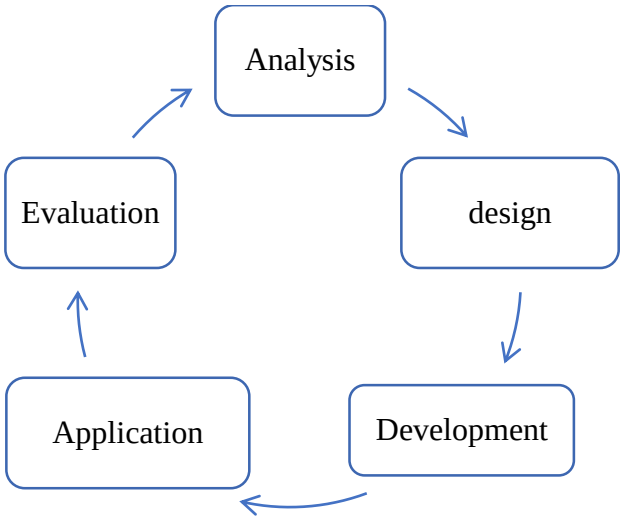

Figure 1. Research using the ADDIE model (Aldoobe, 2015)

In this study, the product of teaching materials was in the form of a book about the Respiratory System. Product development in the form of guided inquiry-based teaching materials which aims to improve critical thinking skills of SMA Negeri 5 Palu students. The sample in this study were all students of class XI IPA 4 which was opened by 34 people. Expert validators are lecturers who have expertise related to learning media materials and the respiratory system. Data collection techniques are questionnaires, observations and interviews. In the product development process, first analyze the material that includes the human respiratory system. The product development instruments were interview sheets, expert validation questionnaires, pre-test, post-test and student response questionnaires. Data collection techniques include observation, questionnaires and documentation. Stages of analysis carried out is to analyze the description of the results of teacher interviews related to the needs of teaching materials and the learning process. In addition, researchers analyzed questionnaires to analyze student needs in the learning process and learning barriers. The results of expert validity, effectiveness and student responses were analyzed with percentage descriptions. the percentage formula is as follows:

$$P = \frac{f}{n} x\ 100$$

P = Percentage
f = Total score
n = Total maximum score

Table 1. Validation Criteria (Widoyoko, 2012)

Percentage Score (%)	Criteria
<21%	Invalid
21-40%	Invalid
41-60%	Quite valid
61-80%	Legitimate
81-100%	Very valid

The test of the effectiveness of the textbooks was carried out using the N-gain test to process the data on the students' pretest and posttest scores. The normalized gain (N-gain) is calculated by the equation:

$$g = \frac{S_{Postest} - S_{Pretest}}{S_{Max} - S_{Pretest}}$$

g = Normalized Gain
$SPretest$ = Pretest Score
$SPostest$ = Postet Score
$Smaks$ = Maksimum Score

Furthermore, the calculation results are categorized according to the following table 2 gain categories,

Table 2. Criteria for N-Gain Score (Bao, 2006)

Interval Score	Criteria
g 0.7	Tall
0.7g 0.3	Currently
g 0.3	Low

RESULTS AND DISCUSSION

Needs Analysis

The analysis stage aims to find out the problems experienced by students in the learning process in the classroom. In addition, this observation looks at the compatibility between basic competencies and learning materials. needs analysis aims to see the weaknesses of the previous textbooks so that they become the basis for developing textbooks. Needs analysis was conducted on 10 students from representatives of 7 science classes in class XI. The use of textbooks in the biology learning process is still not optimal, this is because students are still using the module/LKS. The results of the needs analysis show that the respiratory system in humans is a difficult material to learn. In addition, the module/LKS used is colorless and is not equipped with pictures of the respiratory organ system. The material described is in accordance with basic competencies but not based on critical thinking.

Product Design

At this stage, it begins with the design of teaching materials to be developed, namely guided inquiry textbooks based on the human respiratory system. The textbook section includes covers, instructions for use, materials, mini laboratories, assessments, diseases related to the human respiratory system and a summary. The novelty of this product is the mini laboratory and evaluation section. The previous module was not equipped with this part. The cover and content design are equipped with pictures of the respiratory system and abnormalities of the respiratory system. An attractive layout design is able to attract students' reading interest (Nugraha & Syafi, 2020) . This textbook is designed using Microsoft Word and Corel Draw applications. The end result of this product is a textbook made in pdf format and printed/printed. The product developed is a guided inquiry-based textbook.

Figure 2. Design Textbook Products on Human Respiratory System Material

Product Development

The development stage is the core stage of this research. Textbook products are developed based on suggestions from expert lecturers. The development stage includes the validation of the textbook. The textbook that was developed was based on guided inquiry on the material of the respiratory system. Before being tested on students, the textbook was validated by 2 experts in their field. The validators are 2 lecturers from the Biology Education Study Program, Tadulako University. The following are the results of the validation of the material, language and appearance of a guided inquiry-based textbook on the respiratory system material.

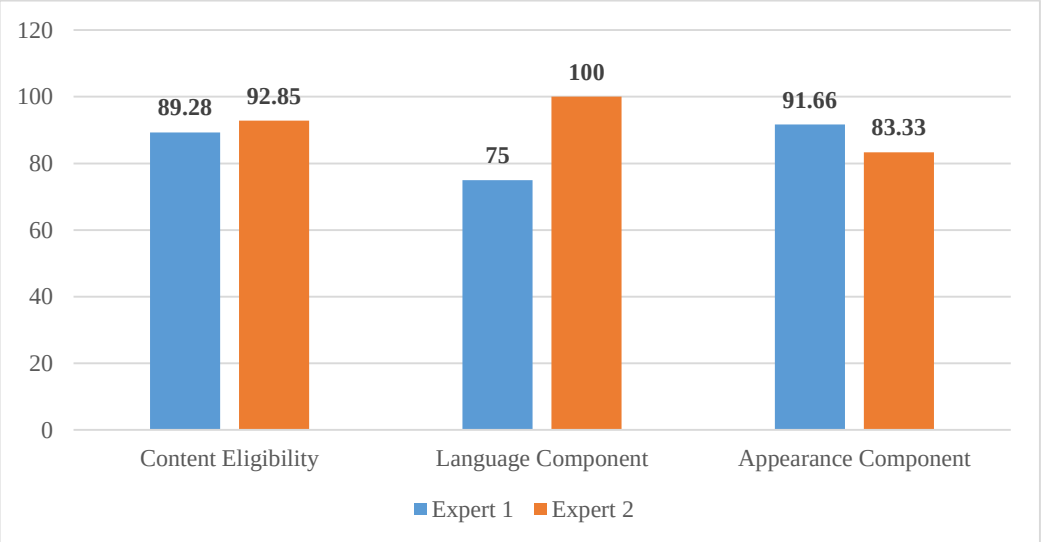

Figure 3. Expert Validation Results

Based on the validation results above, it is known that the guided inquiry-based human respiratory system textbook that has been developed has an average score of 88.68% which is in the "Very Valid" category . So that this textbook product can be used as student teaching materials in the human respiratory system material. There are several suggestions regarding this textbook, namely the use of the Indonesian language must be in accordance with the

general Indonesian language guidelines. In addition, the content aspect needs to be more concrete in presenting it in everyday life. At each stage of this development, researchers make revisions to correct existing deficiencies. These improvements include the depth of the material and the suitability of basic competencies with the contents of the text. Another validator said that researchers need to pay attention to writing or grammar in accordance with the General Guidelines for Indonesian Language (PUEBI). The appearance or layout of the cover, content, and cover is good, you just need to maximize the color with the image display. The existence of these suggestions and criticisms is useful for improving textbooks so that before they are applied students can achieve critical thinking skills. The developed textbooks can equip students with an understanding of the message and the suitability of the description with the substance of the message. This is in line with research (Arsanti, 2018) which reveals that the presentation of material, pictures and explanatory texts can make students understand and interested in learning.

Application

After the development stage is complete, it proceeds to the next stage, namely implementation. Trial of the use of guided inquiry on the material of the human respiratory system to students. The number of students is 34 students of class XI IPA SMAN 5 Palu, Central Sulawesi. The purpose of this stage is to see the learning outcomes and critical thinking skills of students in the learning process. Textbooks were tested using the guided inquiry method, which began with giving pretest questions as a measure of student knowledge before being used. After that, the researcher gave an introduction to teaching materials and guidelines for the use of teaching materials. The implementation of the learning process was carried out for 4 meetings. And at the end of the meeting continued with posttest assessment. Cognitive learning outcomes obtained from the pre-test and post-test scores are shown in the Table 3.

Table 3 . Recapitulation of n-gain test calculation results

Total students	Pretest Average	Post Average	Average N-Gain	Criteria
3 0	26.32	83.0	0.76	Tall

Analysis of student learning outcomes can be seen that there is an increase in student learning outcomes from before learning by using guided inquiry-based textbooks on the human respiratory system material. From the posttest average value, it is more than the Minimum Mastery Standard for High School Learning in Indonesia so that the product developed is in the "Effective" category. After the N-Gain test was carried out, it was continued with the Kruskal Wallis test to see that the overall difference had statistical significance. The purpose of this test is to measure statistically the difference in the average data has a significant difference or not. The following are the results of the t-test analysis using SPSS. Based on the data below, it can be seen that all significant variables are <0.05, so it can be concluded that the two data have significant differences.

Table 4 . Kruskall Wallis t-test on pretest and posttest data

T-test Analysis	
Chisquere	757,347
df	30
asymp. Sig.	.000

Students' critical thinking ability is the score obtained by students after conducting a critical thinking ability test. The level of students' thinking ability can be seen through

interpretation, analysis, evaluation, inference, explanation, and self-regulation which is assessed using a description question instrument. There are 6 questions in the description that are done during the learning process using the guided inquiry method. Critical Thinking Ability was measured by critical thinking ability test which was conducted twice, namely at pre-test and post-test. Based on the results of the analysis of students' critical thinking skills on the pretest, the score "36" is included in the less critical category. In the posttest assessment, students' critical thinking skills increased to "86". The value of n-gain pre-test and post-test is 0.78 which, if interpreted, is in the high category. From these data, it can be seen that there is an increase in students' critical thinking skills using guided inquiry-based textbooks with very critical categories.

Evaluation

After analysis, design, development and implementation, the last stage is evaluation. At this stage, the researcher looked at the advantages and disadvantages of using guided inquiry-based textbooks. Assessment is done by giving a response questionnaire to students at the last meeting. Based on the results of the response analysis showed students feel interested in textbooks with a percentage of 87%. Textbooks developed in the learning process as many as 90% of students stated that the book had novelty. Students' responses to this textbook are easy to understand because the language used is simple. In developing learning media that are easily understood by readers. So that the material presented can be understood by students (Murdika et al., 2021) . The method used is guided inquiry so as to provide opportunities for students to get help from the teacher during the learning process. The percentage of learning process assessment scores obtained an average of 82% including the very good category. Learning methods are needed that can invite students to be active during the learning process. One of them is guided inquiry which can invite students to discuss in groups (Hastuti et al., 2020) . The existence of group discussions can help students in solving problems, scientific literacy and able to improve students' critical thinking skills (Ellwood & Abrams, 2018; Pratiwi et al., 2021) .

CONCLUSION

Based on the discussion and research results, it can be concluded that the guided inquiry textbook material on the respiratory system in humans is valid, practical and effective on students' critical thinking skills. critical is 86%.

RECOMMENDATION

This study was limited to SMA Negeri 5 Palu due to limited funding and time so that the researchers limited it to only one school. For this reason, it is necessary to conduct large-scale trials in SMA in Palu or Central Sulawesi

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