Research Module Development of Animal Tissue Structure and Function

Ervina Dewi[1], Rahmi Agustina[1*], Nasyta Irhamna[2], Yuswardi[3]

[1] Department of Biology Education, Faculty of Teacher Training and Education, Jabal Ghafur University, Aceh, Indonesia.
[2] Student at Department of Biology Education, Faculty of Teacher Training and Education, Jabal Ghafur University, Aceh, Indonesia.
[3] Departement of Informatics Engineering, Faculty of Engineering, Jabal Ghafur University, Aceh, Indonesia.

Abstract: This study aims to produce teaching material products in the form of research-based modules that contain techniques and research results on animal tissue. The development model used as a reference in the development of this research-based module is the Thiagarajan (4D) development model which consists of the define, design, develop and disseminate stages, but the dissemination stage was not carried out in this study. The results of the module validation from material experts and media experts stated the level of validity of the module with a percentage of 81,17% with very good qualifications and the criteria are Valid/Not Revised and small group test 90,64% with very practical criteria to use. It can be concluded that the resulting structure and function research-based module of animal tissue is feasible to use because it has been validated.

Keywords: Histology; Modul Development; Structure and Animal Tissue

Introduction

Education is a form of activity and effort to develop self-potential through learning (Azhar & Sa'idah, 2017). During learning, students not only interact with the teacher who acts as the main learning resource but also interact with other learning resources to obtain good results. Thus, students need new learning resources as support to understand learning (Supriadi, 2015). Utilization of relevant new learning resources in class can optimize the learning process (Cahyadi, 2019).

This research is a continuation of previous research, which is about analyzing the needs of students' learning resources on the concept of structure and function of animal tissue. The results of the preliminary study show that 59.98% of students think that the concept of structure and function of animal tissue is very difficult to learn. 74.31% of students already have a handbook but 54.32% of students think that the handbook has not been able to make them understand the concept. And 71.76%

of students need new learning resources as additional support and can be used independently.

Modules are one of the learning resources that are packaged as a whole and systematically which contain a set of learning experiences that are planned and designed to help students master specific learning objectives. Modules are learning resources that trigger student independence and are easy to use. The module acts as a substitute for a handbook in addition to the package books provided by the school because it is self-contained and stand-alone so it does not depend on teaching materials or other media (Yulia, 2020).

The module developed in this study is research-based innovation to anticipate problems in learning the concept of structure and function of animal tissue. This module contains a combination of theory and research results so that students can understand concretely the application of the concepts learned. This module is specifically designed for self-study tools. This independent learning is necessary for developing independent learning (Prawiyogi et al., 2020).

Various previous research results prove that the implementation of modules can increase learning independence (Mulyasari, 2021), learning becomes effective and efficient (Fitriyati et al., 2015), and improves learning outcomes (Rusilowati, 2018). This research-based module is expected to support and complement the teacher's role as a source of information.

This study aims to analyze the feasibility, practicality, and evectiveness of a module based on the structure and function of animal tissue research that was developed and see its effect in improving student learning outcomes.

Method

This research is a Research and Development with mixed methods. The product developed in this is a research-based module that can be implemented in the Biology subject of the Structure and Function of Animal Tissue Concepts.

Respondents in this study were Lecturers in the Biology Education Study Program at Jabal Ghafur University who acted as material experts and media experts, Biology subject teachers, and students of SMA Negeri 1 Simpang Tiga, Simpang Tiga District, Pidie Regency. Biology subject teachers act as material experts and observers.

The module development method used adapts the 4D development model by Thiagarajan (1974), namely define, design, develop, and disseminate. However, this research only reached the development stage (Figure 1). The define stage aims to determine and define the learning requirements. This stage begins with analyzing the students' initial conditions and concept analysis of the Biology concept of the Structure and Function of Animal Tissues. The design stage aims to design a prototype module based on research results (draft I). The development stage aims to produce drafts II and III modules which have been revised by material experts and media experts and tested individually or in small groups. The data obtained are in the form of descriptive qualitative and quantitative descriptive data. Validation by material and media experts is useful in assessing the validity of the developed modules. The module validation instrument refers to research by (Wahyuni et al., 2018). Giving meaning and decision-making on the quality of this research-based module refers to Table 1 and the quality of the practicality of the module refers to Table 2 (Riduwan, 2010).
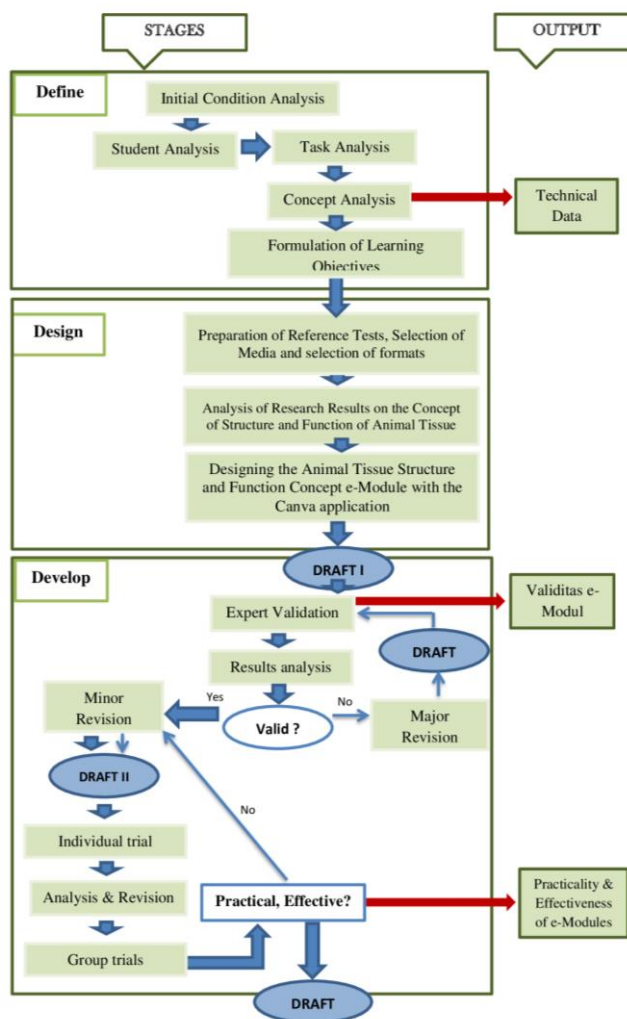

Figure 1. Module Development Stages

Table 1. Module Validity Indicators

Achievement Level (%)	Qualification	Criteria
81 - 100	Very Good	Not Revised/Valid
61 - 80	Good	Not Revised/Valid
41 - 60	Enough	Revision/Invalid
21 - 40	Not enough	Revision/Invalid
60 - 20	Very less	Revision/Invalid

Table 2. Module Practicality Indicators

Achievement Level (%)	Criteria
$80 < P <- 100$	Very practical
$60 < P <- 80$	Practical
$40 < P <- 60$	Pretty Practical
$20 < P <- 40$	Less Practical
$P < 20$	Impractical

The research instruments used to collect data were: research-based module validation questionnaires, observation sheets, and module practicality sheets. The parameters measured are the validity, practicality, and effectiveness of the research-based module. Research

data were analyzed using descriptive qualitative (data input, responses, comments, and suggestions for improvement from experts) and descriptive quantitative (data from expert validation and questionnaires distributed to observers and test subjects) were analyzed using descriptive percentages. Then presented in the form of figures and tables.

Result and Discussion

Modules based on animal tissue structure and function research were developed based on an analysis of the needs of teachers and students. Various research results that lead to microscopic (histological) structures are implemented into the module. Research-based modules are arranged according to the needs of teaching materials, which are presented sequentially in the order in the 2013 Curriculum syllabus. The development of the Animal tissue Structure and Function module is the result of various studies that have been done. This research is a research that produces various microscopic images of various tissue systems in the animal body.

The research-based module was developed through 4 stages, namely define, design, development, and disseminate, which in this study was limited to stage 3. The define stage included five main steps, namely initial condition analysis, student analysis, task analysis, concept analysis, and formulation. learning objectives (Thiagarajan, 1974).

Analysis of concepts related to the structure and function of animal tissues, namely: Epithelial tissue, connective tissue, muscle tissue, nervous tissue, and blood tissue. The task given (media selection) to master this competency is an independent assignment. The learning objectives are for students to be able to analyze the relationship between cell structure in animal tissues and the function of organs in animals and to present data from observations of various forms of cells making up animal tissues to show their relation to location and function in bioprocesses and their applications in various aspects of life.

The next stage is Design. At this stage, preparation of test standards is carried out, selecting images that are by following the characteristics of the material and indicators to be achieved, selecting formats, and making initial designs. Formative tests developed at the end of each sub-material are adjusted to the cognitive abilities of students. The module format chosen was to adapt the format from the 2008 Ministry of National Education. The initial design of the module included the design of all learning tools that had to be worked on.

The Development stage to produce modules goes through two steps, namely expert appraisal followed by revision and developmental testing (Thiagarajan, 1974).

The feasibility of this research-based module was validated by 3 experts, namely 2 material experts and 1 media expert. Material expert validation aims to validate the content (material) of the developed module. Material experts for the animal structure module came from the Biology Education Study Program, Faculty of Teacher Training and Education, Jabal Ghafur University, and Biology Subject Teachers at the Senior High School (SMA) level. Media experts come from the Informatics Engineering Study Program, Faculty of Engineering, Jabal Ghafur University.

Data validation by material experts and media experts on modules based on animal tissue structure and function research is useful for module improvement and feasibility. Suggestions for improvement from material and media experts: 1). The cover display does not show the names of the subjects and the images displayed do not fully explain the microscopic structure of the tissue, the composition of the images is not correct so that it affects students' understanding, 2). The number of images of microscopic tissue structures is still small so it needs to be added to influence students' interest in reading , and 3). Prepare Student Worksheets (LKPD) to analyze student learning abilities (Figure 2). And the results of the analysis of the distribution of the Validity Questionnaire based on Animal Tissue Structure and Function Research are presented in Tabel 3.

Revision of the module is carried out, the graphic composition can be adjusted so that it looks attractive. According to Nurcahyo (2021), module revisions based on expert suggestions for improvement are very useful for correcting errors or deficiencies in the module. Thus it will produce that is truly effective, engaging, appropriate, and to the point. The appearance of an attractive module increases reading interest (Rahmatullah et al., 2020).

Based on the results of data analysis of the four aspects of the assessment (language validity, content validity, presentation component and graphical component) consisting of 26 feasibility assessment criteria based on the Structure and Function of Animal Tissue research module, it was found that the average percentage of validity was 81.17% with very high qualifications, good and Not Revised/Valid category. That showed the module is classified as effective. According to Rosyadi (2018), and Nugroho et al. (2018), the effectiveness of a learning module is seen from the validity of the module, practical, clear instructions, and helps students understand concepts.

The Percentage validity of research-based module of animal tissue structure and function by material and media experts Has not yet reached 100%. This is not caused by errors in the content of the material, but by the ability to display images that can make it easier for students to gain knowledge. The module before revision

had very few microscopic images of animal tissue and there was no Student Worksheet (LKPD) available that could train students. Alias and Siraj (2012) explain that modules are teaching materials that are suitable for use in visual learning, so they must be designed as attractive as possible so that students are motivated to read and understand the modules.

Cover
Before

Suggestions for Improvement: In the cover section, it is better to explain the name of the subject and display a picture of the animal tissue structure.

After

Module Contents
Before
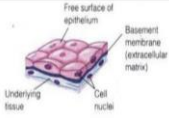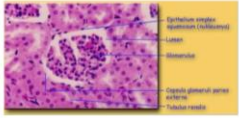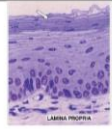
Suggestions for Improvement: The images inserted in the module are only illustrative images. It is better to add microscopic images of animal tissue to the module so that students can better understand direct tissue examples.

After

Experiment Section
Before

Suggestions for Improvement: The Experiment Section should be replaced with Student Worksheets (LKPD) so that students can also increase their knowledge and skills through direct observation under a microscope. This LKPD is made at the end of the module and includes all the material studied.
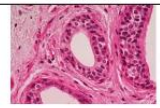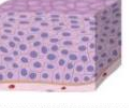
After
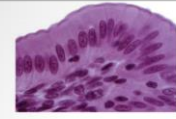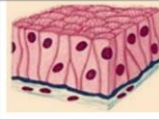
Figure 2. Research-Based Module Revision Results Structure and Function of Animal Tissue Based on Improvement Suggestions from Validators

Table 3. Results of Module-Based Validity Analysis Research on Structure and Function of Animal Tissues

Rated aspect	Achievement Level (%)	Qualification	Criteria
Language Validity	71.67	Good	Not Revised/Valid
Content Validity	90.00	Very Good	Not Revised/Valid
Construction Validity (Serving Components)	85.00	Very Good	Not Revised/Valid
Construction Validity (Graphical Components)	78.00	Good	Not Revised/Valid
Amount	324.67%		
Average	81.17%	Very Good	Not Revised/Valid

Practicaly Research-based Module

The trials were carried out 2 (two) times, namely individual trials of 5 students and group trials of 35 students. Individual test data include typographical errors, incorrect use of punctuation marks, use of lowercase and capital letters, and other matters that need to be corrected. Revisions were Made based on suggestions from participants in this individual trial.

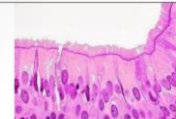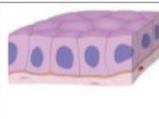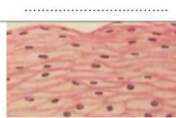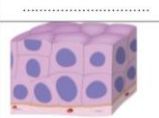Testing the practicality of modules based on the Structure and Function of Animal Tissue research aims to find out to what extent its feasibility as a learning medium that can be used independently by students. Bukit et al. (2022), explained that the use of modules is very effective in increasing independent learning. Rosyadi (2018) explains the practicality of learning modules in terms of the implementation of the learning process, and teacher and student responses. The results of the observations show that the research-based module on the Structure and Function of Animal Tissues is very practical for students to use.

The group test was carried out by distributing practicality questionnaires which aimed to measure the level of use and implementation of the module by students and teachers who had been validated and revised. The results of the distribution analysis of the practicality of the use of modules based on the structure and function of animal tissue research on 35 students in the group test and Biology subject teachers showed that respondents gave an average statement of 90.64% (students) and 90.97% (teachers) with very practical qualifications for each aspect measured in the module Table 4.

Table 4. Practicality of Modules for Students and Teacher

Rated aspect	Respondents			
	Students		Teacher	
	Achievement Level (%)	Qualification	Achievement Level (%)	Qualification
Ease of Use	85.60	Very Practical	100	Very Practical
The attractiveness of the dish	100	Very Practical	93.75	Very Practical
Benefit	86.31	Very Practical	79.17	Practical
Amount	271.91%		272.92%	
Average	90.64%	Very Practical	90.97%	Very Practical

Effectiveness of Research-based Module

The effectiveness of the Animal Tissue Structure and Function research-based module is obtained based on the increase in scores from students' formative tests. The average score on students' formative tests is presented in Table 5.

Table 5. Average Student Formative Test Scores

Subject	Average Value	% Classical Mastery
Epithelial Tissue	83.60	87.00%
Connective Tissue	81.10	84.50 %
Muscle Tissue	85.70	85.00%
Neuron Tissue	78.20	86.20%

Table 5 shows that all the formative tests tested on students have exceeded the Minimum Classical Completeness (KKM) score set by the school, which is 75. The highest average formative test score was obtained on the topic of muscle tissue (85.70), followed by epithelial tissue (83.60), connective tissue (81.10) and the lowest on the topic of nerve tissue (78.20). Anggani et al., (2016) explained that students had learning difficulties in the sub-topic of neural networks and material factors as the main cause, the material was too difficult. But overall, research-based modules trigger independent learning (Prawiyogi et al., 2020) learning outcomes (Rusilowati, 2018) and 4C/ Creativity and Innovation, Collaboration, Communication, Critical Thinking and Problem Solving) (Monica et al., 2021).

This is in line with Fitriyati et al. (2015), that the implementation of research-based modules can improve learning outcomes, and scientific literacy Sutrisna et al. (2020), and make learning effective and efficient (Mulyasari, 2021). Research-based modules have tasks that can stimulate student creativity (Fitriani et al., 2022).

Conclusion

Based on the results of the research data analysis it can be concluded that: A research-based module on the

Structure and Function of Animal Tissue which was developed according to the needs of high school (SMA) level students. The module is feasible to use with a percentage of 81.17% with very good qualifications and non-revision/valid criteria for all aspects tested, very practical and effectiveness for use by both teachers and students.

Acknowledgements

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