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THE EVALUATION OF BIOLOGY TEACHING USING INVERTEBRATE TAXONOMY TEXTBOOK

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ABSTRAK

Tujuan dari penelitian ini adalah menghasilkan buku teks Taksonomi Invertebrata pada perkuliahan Biologi menggunakan metode pengembangan berbasis Borg & Gall yang dipadukan dengan pembelajaran Dick & Carey pada tahapan pengembangan yang meliputi: studi pendahuluan, perencanaan, pengembangan draf produk, uji validasi produk oleh pakar, dosen dan peer reviewer, revisi produk, uji coba produk, serta revisi produk. Pengumpulan data menggunakan kuesioner dengan teknik analisis data deskriptif. Berdasarkan hasil validasi, buku tersebut dinilai sangat baik dan layak untuk dijadikan buku ajar dengan nilai rata-rata 101 (80,7%) oleh tim validasi ahli materi dan desain pembelajaran, serta dosen dan peer reviewer dengannilai rata-rata 70 (81,80 %), Hasil uji coba terhadap siswa baik secara individu, kelompok kecil dan lapangan terbatas menunjukkan bahwa buku teks Taksonomi Invertebrata sangat baik dan layak untuk dikembangkan dengan nilai rata-rata 730,6 (85%).

Kata Kunci: Buku Ajar, Taksonomi Invertebrata, Kuliah Biologi

ABSTRACT

The purpose of this research is to produce a book on invertebrate taxonomy in Biology Lectures using Borg & Gall based development methods combined with Dick & Carey's learning in the stages of development, namely: preliminary studies, planning, product draft development, product validation tests by experts, lecturers and peer reviewer, product revision, product trial, and product revision. Data collection uses a questionnaire with descriptive data analysis techniques. Based on the validation results, the book is considered very good and feasible to be used as a textbook with an average score of 101 (80,7%) by the validation team of material and learning designs experts, as well as lecturers and peer reviewers with an average score of 70 (81,80 %), The results of trials by students individually, small groups and limited field shows that the textbook Invertebrate Taxonomy is very good and feasible to be developed with an average score of 730.6 (85%).

Keywords: Textbooks, Invertebrate Taxonomy, Biology Lectures

INTRODUCTION

Education in Indonesia is part of human resources development efforts to achieve the government's goals towards a prosperous society. The educational process is carried out through a learning process to achieve the planned goals in transferring knowledge, skills, and good moral values to students effectively and efficiently.

The use of learning resources and media that are in accordance with students' interests will have an impact on the success of teaching. One of the learning resources that are most often used by students and teachers are textbooks. Most of these books still use only a few pictures and colors so these books have unattractive appearance. The writing in the textbook is also considered relatively long and hardly understood by students, causing low interest in reading for students. Students are more likely to like readings with lots of pictures or colors. This will help students with their high level of imagination to help them improving their memory [1].

Interesting learning resources can increase students'interest in improving their knowledge. In this case, we can integrate the book with field practice, so it is not only provides theory but also examples so it is easier to understand and make students more interested [2].

One of the learning subjects is biology. Biology learning is not only the mastery of knowledge but also a process of discovery [3]. Therefore, it is important for teacher to provide appropriate guidance and learning resources for their students.

During this process, usually an educator will use textbooks as the medium and source of learning. These textbooks alone usually does not meet students' knowledge of the subject, so it is necessary to add the textbooks with field practice to the learning process can run well [4]. Based on the results of previous research, "Development of Animal Development Textbooks Based on Silkworm Metamorphosis Research" is appropriate to be used as a learning resource [5]. Another study also showed that student responses to a research-based textbook in Evolution reached a score of 81% and was valid enough to be used as teaching materials in biology learning [6]. This proves that research-based textbooks can attract students' interest because the information in those books is presented with interesting pictures that can add insight to students, especially infinding facts that clarify the material content so students can understand the theory and practice properly. This research is also in accordance withanother study about environmental-based learning media in Invertebrate Taxonomy in West Kalimantan that is expected to be able to make students understand the material better [7].

In Biology Study Program, Faculty of Science and Technology, UIN Sumatera Utara, especially in the

Invertebrate Taxonomy course, the learning resources available to students, such as textbooks on Invertebrate Taxonomy,are rarely used as references. Moreover, textbooks, as well as secondary books also rarely have images that make students feel bored and less interested in reading it because the material is difficult to understand. In addition, not all students recognize the animals from each phylum of the invertebrate in laboratory, because some animals are difficult to find. Outdoorlearningis conducted to help introduce students directly to the diversity of invertebrates in nature. However, students tend to find it difficult because of the unavailability of adequate references to identify invertebrate animals that they find. This causes students to search for information about invertebrate animals through the internet without a reliable learning source.

The learning outcomes that have been obtained by third semester biology students at the Biology Study Program, Faculty of Science and Technology, UIN-SU, especially on the taxonomy of invertebrates subject in 2017 show that 60% of students only achieved an average score of 60 to 68 (criterionC). This has not met the criteria for mastery learning of KKM expected by the UIN - SU, which is 70 - 79 (criterion B). One of the possible solutions is by renewal in learning resources that can be used by students in and outside the classroom, in the form of research-based Invertebrate Taxonomy textbooks.

RESEARCH METHODS

This research was conducted from May to November 2019 at the Biology Study Program, Faculty of Science and Technology, North Sumatra State Islamic University, Medan. The subjects of this research are third semester students of the 2018/2019 Academic Year, totaling 37 people who are divided into 3 trial groups, namely individual trials, small group trials and limited field trials group.

This is a research and development study because it produces a product in the form of a research-based textbook of Invertebrate Taxonomy. The development model used is Borg & Gall (1983). Research and development is a process for developing and validating developed products [8]. Therefore, besides developing the product, this research also will test the validity, attractiveness, practicality, and effectiveness of the product.

The stages in research that will be carried out are: (1) research and information collecting, (2) planning, (3) develop preliminary form of product, (4) preliminary field testing (validation tests by experts), (5) main product revision, (6) main field testing (small-scale testing), (7) operational product revision, (8) operational field testing (field/class test), (9) final product revision, and (10) implementation.

The technique of collecting data is by conducted product testing to know

the validation and attractiveness of the textbook. The validation is conducted by experts to assess the content and design of the textbook, while the attractiveness and readabilityof the book, was carried out by peer reviewer and Biology lecturers. To find out the responses from students regarding the quality of the book, the testing is carried out through individual group of 3 people, small group of 9 people, and limited field group of 25 students.

The research instrument for the validator is made in a Likert scale with scores. The data then were analyzed by calculating the percentage of the research aspect indicators for each category. The score is then converted into a percentage, then stated in qualitative sentences to stated whether the textbook is valid or not [9]. The Likert scale is shown in the following table [10].

Table 1. Criteria for Validation Instrument

Score in Percent	Scale	Interpretation
85 – 100 %	4	Very Eligible
75 – 84 %	3	Eligible
56 – 74 %	2	Not feasible
< 55 %	1	Not eligible

To determine the responses from students regarding the quality of the Invertebrate Taxonomy textbook was conductedby using questionnaires. The percentage of each question item on the questionnaires is calculated with the equation:

$$K = \frac{F}{NxIxR} X100\%$$

Note:

K: Eligibility Percentage
F: Number of Respondents' Answers
N: Highest Score in the Questionnaire
I: Number of Questions in the Questionnaire
R: Number of Respondents

The interpretation of the results is in accordance with the criteria contained in the following table [11].

Table 2.Criteria for the Percentage of Textbook Quality

Value	Percentage Interval	Criteria
A	80% ≤X≤ 100%	Very Good
B	60% ≤X < 80%	Good
C	40% ≤X < 60%	Medium
D	20% ≤X < 40%	Poor
E	0% ≤X < 20%	Not Good

RESULTS AND DISCUSSION

Biology students in Biology Study Program UIN-SU, Medan face several difficulties in Invertebrate Taxonomy course, such as recognizing animals from each phylum, difficulties in finding them in their habitat, and also understanding the systematics of their scientific names. While learning resources available to these students such as textbooks on Invertebrate Taxonomy are not adequate, those books contain only few images so students feel bored andless interested in reading them because they are difficult to understand. The observation is using observation form, while questionnaire is using to find out the students' responses [12].

The first step is to formulate instructional learning objectives so the material in the book would not differ from the objectives. The learning objective is expected to increase student knowledge, attractiveness, skills, motivation, learning activities and understanding in the learning process so the expected learning objectives could be achieved.

The learning objectives show that the textbook should allow students to know, understand and able to analyze the concepts and working principles in Invertebrate Taxonomy. The textbook should also allow students to understand the role of invertebrate taxonomy in life, analyze the research product in Invertebrate Taxonomy and demonstrate the classification and the role of these invertebrate animals properly. Students should even recognize the existence and shape of the animal so they can improve their knowledge, skills, motivation, learning activities and understanding effectively and efficiently.

After defining the learning objectives, the next stageis the design stage. The text book is designed attractively with images of each animal from different phylum. The size of the book, the writing, the color, and the presentation are arranged accurately and professionally [13]. Images in the book are based on their natural habitats so students can easily identify the animals. The book contains 9 phyla of invertebrate animal i.e: Protozoa, Porifera, Coelenterates, Echinoderms, Platyhelminthes, Nemathelmintes, Annelida, Mollusca, and Arthropods.

The last stage is the development stage where the draft is validated and tested. Based on product validation

through a series of trials and revisions that have been carried out, the Invertebrate Taxonomy textbook that has been developed is declared valid and suitable to be used in the Biology Study Program.

Based on the overall validation results by the material expert team on the three main components in the content assessment indicators which include: content feasibility, presentation feasibility and invertebrate taxonomy components developed, it can be concluded that the textbook is in the "Eligible" category to use with an overall total score of the three components are at a score of "98" with an average percentage of 79.57%.

The data from the analysis of these three main components can be seen in the table below, with the percentage diagram shown in Figure 1 as follows:

Table 3. Analysis of the Validation of the Material Expert Team on Textbooks

No	Items	Total Score	Total Percentage	Criteria
	Content ligibility	27	84,38%	Eligible
	Performance Eligibility	37	77,08%	Eligible
	ComponentsofEligibility	34	77,27%	Eligible
	Total	98		Eligible
	Average	32,6	79,57%	

Figure 1. Diagram of the Textbook Percentage Analysis of the Material Expert Team

Learning design experts validate textbook products that include several indicators, i.e: book size, book cover design, and book content design. The results show that the design of the Invertebrate Taxonomy textbook developed is in the "Eligible" category with an overall score of 107 with an average percentage of 83.59% (can be seen in Figure 2).

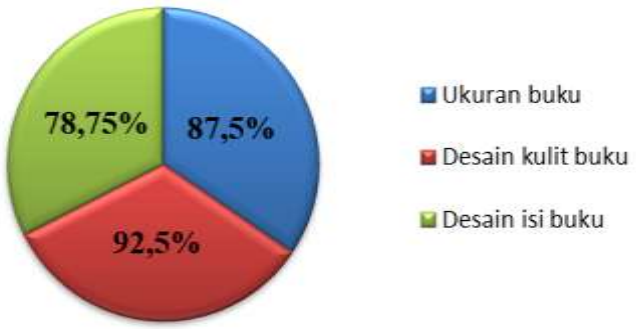

Figure 2. Diagram of the Percentage Analysis of the Learning Design Expert Team

Based on validation and assessment by the experts, lecturers and peer reviewers, the book is then revised according to their suggestions. The result is then tested on students to get a response or feedback whether the book is interesting or not. The testing phase is carried out in 3 groups, i.e: individual trials, small trials, and limited field trials group.

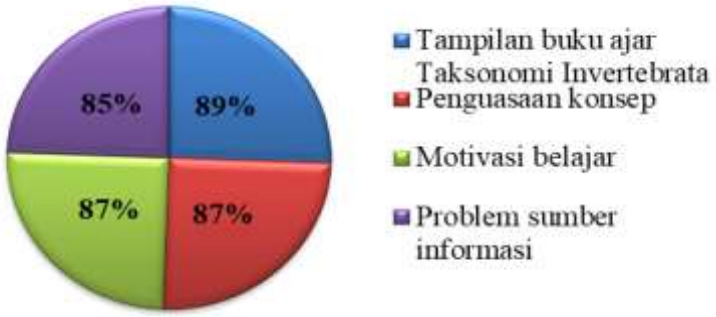

Figure 3. Diagram of the Percentage of Limited Field Trials on Textbooks

The testing phase in the individual trial group consists of 3 students. The results obtained with total score of 160 and average percentage is 89%, so the quality of the textbooks developed is in a "very good" category to be used as student learning materials.

The testing phase in the small group trials consisting of 9 students obtained a total score of 45" with average percentage of 83%, so that the quality of the textbooks is in a "very good" category to be used as student learning materials.

The testing phase in thelimited field group trial which consisted of 30 students obtain a total score of 1560 with an average percentage of 86%, so that the quality of the textbooks developed is in a "very good" category to be used as student learning materials.

Based on the results of students' responses to the textbooks, the overall

total score was 2178, with the percentage the average is 85% so that the textbook is "very good" to be used as learning materials in biology lectures, especially in the Invertebrate Taxonomy course.

Each component of learning that is in a single unit that is collected from several items that are interconnected with each other is an important thing in the teaching and learning process [14]. Product testing is a very important part of development research, which is carried out after the product design is complete [15]. The purpose is to find out whether the product is suitable for use or not and also to see how far the product can achieve its objectives. The development process, validation, and limited field trials need to be carried out so that the resulting product is useful for improving the quality of learning [16]. The process of development, validation, and field trials should be clearly described, so that they can be accounted for academically.

Good teaching materials must meet the following requirements: 1) arranged according to the applicable curriculum, 2) prepared by experts in their fields, 3) should be equipped with activities that support thinking skills, process skills, attitudes, and values, 4) should reflect aspects of presentation, materials and readability in accordance with the level of students' development.

Teaching materials also function as a tool for evaluating the achievement of learning outcomes [17]. Good teaching materials at least include learning instructions, competencies to be achieved, lesson content, supporting information, exercises, work instructions, evaluations and responses to evaluation results [18]. Textbooks are a collection of writings that are written systematically containing a particular subject matter, which is prepared by the author using the applicable curriculum references [19]. The substance in the textbook is derived from the competencies that must be mastered by students.

CONCLUSION

The results of the validation assessment from a team of material experts, teaching design experts, lecturers and peer reviewers obtained a total score of 290 with average percentage of 81.80% so that this textbook product is eligible to be used as a textbook for Invertebrate Taxonomy.

According to the overall student responses based on the results of individual, small group and limited field trials, it was stated that the Invertebrate Taxonomy textbooks, obtained total score of 2178, with average percentage of 85% so the textbooks of Invertebrate Taxonomy is very good to be used as learning material in biology lectures, especially in the Invertebrate Taxonomy course.

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