Development of Research-Based Gastropod Diversity Textbooks in Simalungun Regency, North Sumatra

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Abstract. This study aims to develop textbooks on Gastropod diversity topics, determine the feasibility of the books validated by many experts of materials, learning designs, layouts, teachers and students, and assess the effectiveness of using the books to grade X SMA Swasta Teladan Tanah Jawa, Simalungun Regency, North Sumatra. The study implements a four-D (4D) model, namely definition, design, development, and dissemination. A Likert scale was used in the validation test. Data obtained used a questionnaire and analysed by descriptive analysis techniques. The results present a high validation value of 81.34%, showing the textbooks are feasible with a high response from students and teachers (90.50%). The effectiveness test using t-test shows a significant difference between experimental and control class. The N-Gain post-test effectiveness test in the experimental class is 0.63 (medium), describing the Gastropod diversity textbooks applicable for grade X SMA Swasta Teladan Tanah Jawa.

Keywords: Textbooks, Gastropoda, Feasibility of Textbooks, Effectiveness.

1 Introduction

Teachers, as professional educators, are expected to have the ability to develop textbooks based on students characteristics and their social environment taking into account their local potential so that students can more easily understand and achieve the expected competencies. A textbook is one of the keys in achieving learning objectives. Therefore, a teacher must be able to develop learning books as a learning resource.

Biodiversity refers to every living thing, including plants, animals, microorganisms and genes possessed by living things, where they live in a complex ecosystem interacting with each other to form a living environment. In general, three levels of biodiversity are genetic, species and ecosystem diversity. This study focuses on species diversity from the class Gastropod with the learning outcomes include students to explore diversity, abundance, similarity and dominance of the class by direct observations or field studies which help students to make observations, collect data, analyse data, compile reports and present the reports.

The animal kingdom has an important role in terms of ecology, economy and education to be a source of learning. The topic of Gastropod is included in the Invertebrate sub-topic for Senior High School (SMA) grade X. The learning outcome for this topic is students able to distinguish invertebrate animals according to their body layers, cavities, symmetry, and

reproduction. The class Gastropod, the largest group living in terrestrial, marine and freshwater environments, is a group of animals with soft bodies and they use stomachs to walk. In biology textbooks of grade X, the explanation of the differences between each class tends to be general and short in length. This might cause little information and leads to not comprehensive knowledge. Thus, the development of textbooks on the Gastropod topic is expected to be a complete solution and provider of additional information for students.

Learning using the environment as the learning resource (media) provides a positive response to students [1]. Learning media can help students understand what is being studied because they can observe, feel and interact directly with the material. Utilisation of environmental media with field studies is not optimally carried out by the teachers in SMA Swasta Teladan Tanah Jawa. Meanwhile, Simalungun Regency has local culture which can be used as the learning media. One of the examples is a large area of rice fields and plantations. In the plantation area, there are many large and small gastropods with various shapes as well as water areas such as rice fields and watersheds. In land habitats, many snails (*Achatina fulica*) are found, while in rice fields water snails (*Helix pomatia*) and gold snails (*Pomacea canaliculata*) are widely found in the Simalungun area. There are 280 types of land snails in Sumatra, consisting of 27 families and 77 genus with 33 types of which are categorized as endemic [2]. The number of land snails in Sumatra is 90% of the total families recorded in Indonesia. The Cyclophoridae family has the most members of its type, which is 45 categories, followed by Camaenidae 37 categories and Diplommatinidae 25 categories.

Based on the preliminary study in the form of a questionnaire obtained from students in grade XI who had studied Gastropod topic from the available textbooks, as many as 82.61% of students have never conducted field studies related to the Gastropod topic. The result of interviews with the students is they still need a book in which it describes the class Gastopod. Meanwhile, the interview results with Biology subject teachers at SMA Swasta Teladan Tanah Jawa, learning activities on Gastropod topics in the class are still limited, focusing only on the material in the textbook. This is because the school does not yet have supporting media, only using the textbook to describe the structure of Gastropods in general and does not explain in detail each group of animals belonging to the class Gastropod. It is also observed that students' responses in learning Gastropod topics are less active in the class due to inadequate learning resources. This leads the achievement of classical competence at SMA Swasta Teladan Tanah Jawa in the Gastropod topic to not reach the predetermined minimum completeness criteria (KKM), which is 70, only around 30%. Thus, the research-based Gastropod diversity textbook is expected to be a solution to complete students' knowledge of Gastropod classification at SMA Swasta Teladan Tanah Jawa. This study assesses the effectiveness of textbooks research-based gastropod diversity which was developed in improving students' understanding.

2 Method

The study was conducted between January and March 2022 in SMA Swasta Teladan Tanah Jawa, on Jalan Sisingamangaraja Nagori Balimbingan, Tanah Jawa, Simalungun Regency, Postal Code 21181. The study design implements a four-D (4D) model, namely *definition,* design, *development, and dissemination*. Before launching the textbooks research-based gastropod diversity, a research for identifying the class Gastropod was conducted.

2.1 Gastropod diversity calculation

The location of the research was conducted in three districts in Simalungun Regency, namely Sidamanik, Tanah Jawa, and Dolok Batu Nanggar. Each district has three stations - Sidamanik with three stations (1.1, 1.2, 1.3), Tanah Jawa with three stations (2.1, 2.2, 2.3), and Dolok Batu Nanggar (3.1, 3.2, 3.3). Two techniques in data collection in this research were abiotic and biotic data collection.

Abiotic data collection was carried out directly in the field and simultaneously when collecting biotic data. The abiotic data collection techniques were as follows: (a) substrate observation was conducted by looking directly at the gastropods in it. The substrate type was observed then recorded, and photographed using a cellphone camera; (b) the water temperature was measured using a rod thermometer with units of °C by placing the tip of the thermometer into the water; then recorded the results of the scale reading on it. The temperature measurement was repeated three times at each station, then the average was taken, and (c) the degree of acidity (pH) of the water using a pH-meter by placing the electrode part of the pH meter into a beaker filled with water. Then recorded the results of the scale reading on the pH-meter and repeated three times at each station.

Biotic data collection implemented purposive sampling technique by tracing the habitat of Gastropods using a transect plot. The collection included observations on the animals studied by recording, counting, and measuring the length of the shells of animal species found. The stages of collecting biotic data were as follows: (a) laying of transects and plots. Biotic data collection used a plot transect method with an area of 10m x 10m diagonally, determining five points, which at each point were sampled using a 1m x 1m square plot with 2 repetitions; (b) Gastropod sampling. The number of each species taken was two in each plot and placed in a plastic bottle and labeled the sample. The next stage was to identify the samples found; (c) the identification process was also conducted by photographing each Gastropod specimen using a mobile phone camera. Next, note the characteristics found through observation of shell morphology including shell shape, size, color, surface, apex, aperture, and inner and outer lip. Identification was done by matching the characteristics of the sample using a Gastropod identification book to find the species name, and (d) Gastropod specimens are stored in the form of preservation, which are put into bottles containing 70% alcohol, and shell collections, which were cleaned the inside of the shells and smeared using mineral oil were placed in the places provided. All specimens collected were analysed and calculated using Gastropod density, Frequency of presence and Shannon Wiener Diversity Index formula.

Gastropod density

Gastropod density was calculated using the following formula:

$$\text{Di} = \frac{ni}{A} \ (\text{indiv/m}^2) \tag{1}$$

where:

Di = Density of individuals of type i (indiv/m^2)

ni = the number of individuals of the first type

A = Area of the square of sampling (m^2)

Frequency of presence

Frequency of presence (FK) was calculated with the following formula:

$$FK= \frac{snumber\ of\ plots\ found\ of\ a\ species}{total\ plot} \ x\ 100\% \tag{2}$$

Shannon Wiener species diversity index

Shannon Wiener species diversity index is a way to measure the diversity of species in a community. The formula is:

$$H' = \sum_{i=1}^{S} Pi\ \text{In}\ Pi \tag{3}$$

where:

H'= the species diversity index

s = the number of species (species richness)

pi= proportion of total sample represented by species

i= divide number of individuals of species i by total number of samples.

The index (H') is categorised into three groups.

$H > 3.0$: high diversity

$1.0 \leq H \leq 3.0$: moderate diversity

$H < 1$: low diversity

Textbooks research-based Gastropod diversity

The 4D models used in the study are *definition, design, development, and dissemination.* The definition stage consists of front analysis, task analysis, concept analysis, and object specification. The design stage consists of test construction, media selection, format selection and initial design. The development stage consists of expert appraisal and developmental testing. The dissemination stage consists of validation testing, packaging, and diffusion.

Definition stage

The purpose of the definition stage is to determine and define learning needs by analysing the objectives and limitations of the material. The stage of defining or analysing needs can be done through an analysis of previous research and literature studies. The activities in this stage are early-late analysis, student analysis, concept analysis, task analysis and specification of learning objectives.

Early-late analysis

The analysis was conducted to determine the problems to be overcome; thus, the development of learning materials was needed. Several things to consider in the initial analysis are learning theories, challenges, and future demands. Learning should place students as subjects in learning. Students should actively carry out activities to gain learning experiences. Future challenges and demands in learning are skills. The needs analysis conducted on students and teachers at SMA Swasta Teladan Tanah Jawa shows that there are misconceptions about the lungs in the class Gastropod. Task and concept analysis is a collection of procedures to determine the content in a lesson. The analysis is also carried out to detail the content of the subject matter in the form of an outline. It includes (1) content structure analysis, (2)

procedure analysis, (3) information process analysis, (4) Concept analysis, and (5) goal formulation.

Student analysis

Student analysis assesses students' characteristics in regards to the design of research-based gastropod diversity textbooks developed. Student analysis is an activity to identify the characteristics of students who are the target for the development of research-based gastropod diversity textbooks. This analysis includes scientific process skills (observation, measuring, predicting, hypothesising, and communicating) and scientific attitudes (curiosity, respect for facts, critical thinking, open-mindedness, and cooperation).

Task analysis

Task analysis aims to identify the skills studied by the researcher for later analysis into additional skill sets that may be needed and determine the content or learning materials. It was conducted by interviewing biology teachers to identify activities occurred during the learning process including assigned tasks and evaluation processes in the class' activities related to Gastropod topic

Concept analysis

Concept Analysis is conducted to identify the main concepts that will be taught based on material through the development of research-based Gastropod diversity textbooks. In addition to identifying, these concepts are also linked through a learning concept map. This analysis includes basic competency aiming to determine the amount and type of teaching materials and analysis of learning resources, namely the identification of sources supporting the preparation of textbooks.

Formulation of learning objectives

This formulation was done to limit research to be on the track according to needs. Thus, the specification of this objective can be used as a basis for compiling a research-based Gastropod diversity textbook that will be developed, including in the preparation of tests. This stage refers to the formulation to the basic competencies which must be mastered by grade X students. The expected goals through research-based gastropod diversity textbooks include students being able to recognise and describe the morphological structure of the class Gastropod, classify and identify the class Gastropod, recognise species belonging to the class Gastropod class and carry out research/mini research independently.

Design stage

The purpose of this stage is to design a research-based book. There are four 4 steps in this stage, namely the preparation of a standard test (constructing criterion-referenced test), media selection, format selection and initial design.

Constructing criterion-referenced test

In this step, the preparation of test standards is based on the results of learning objectives and student analysis. It is adapted to the students' cognitive abilities and the creation of a scoring guide including scoring and answer keys to questions.

Media selection

The next step is the selection of media based on the results of concept analysis, task analysis, and the characteristics of students as users.

Format selection

The choice of format in the development of textbooks aims to formulate textbook designs based on the research conducted.

Initial design

The elements contained in the developed research-based book are: front and back cover of the textbook, title of the textbook, preface, table of contents, list of pictures, list of tables, introduction, Opisthobranchia, Prosobranchia, Pulmonata, Gastropod research in Simalungun Regency, Gastropod diversity, student worksheets, glossary, index and bibliography. The description of the relationship and work chain of activities is illustrated by the initial design of the research-based book. The author also pays attention to layoutting on the layout of the images and letters used as well as the size of the writing font so the book is more interesting, readable and easy to understand. The cover of the book is designed to represent the content of the article and is expected to attract readers' interest from an attractive cover design using Microsoft Word 2016 application.

Development stage

The stage is the process of producing textbooks from the initial design that has been designed by the researcher. Validation was done after the textbook was produced. The purpose of this stage is to produce a revised textbook based on input from experts. It includes: (a)validation of the device by experts by a team of material experts, learning design experts, and layout design experts followed by revision of the validation results, and product trials, (b)simulation includes research activities related to the material content of the book, and (c) product trials with real students through three stages, namely individual product trials, small groups, and limited fields. The results of stages (b) and (c) are used as the basis for revising the product results. The development trial was conducted after the textbook was revised based on suggestions and input from expert lecturers and biology teachers. In this study, trials were conducted on students of grade XI SMA Swasta Teladan Tanah Jawa.

Dissemination

After the development trial, the parts which are not appropriate or not yet valid require to be revised to make the final product of the textbook. Once the feasibility test of the books and instruments has been revised, the next stage is the dissemination stage. It aims to test the effectiveness of the use of research-based gastropod diversity textbooks with the normalised gain test (N-Gain) by comparing the results of the pretest with the results of the post test.

All the stages are concluded in the flowchart below (**Fig.1.**).
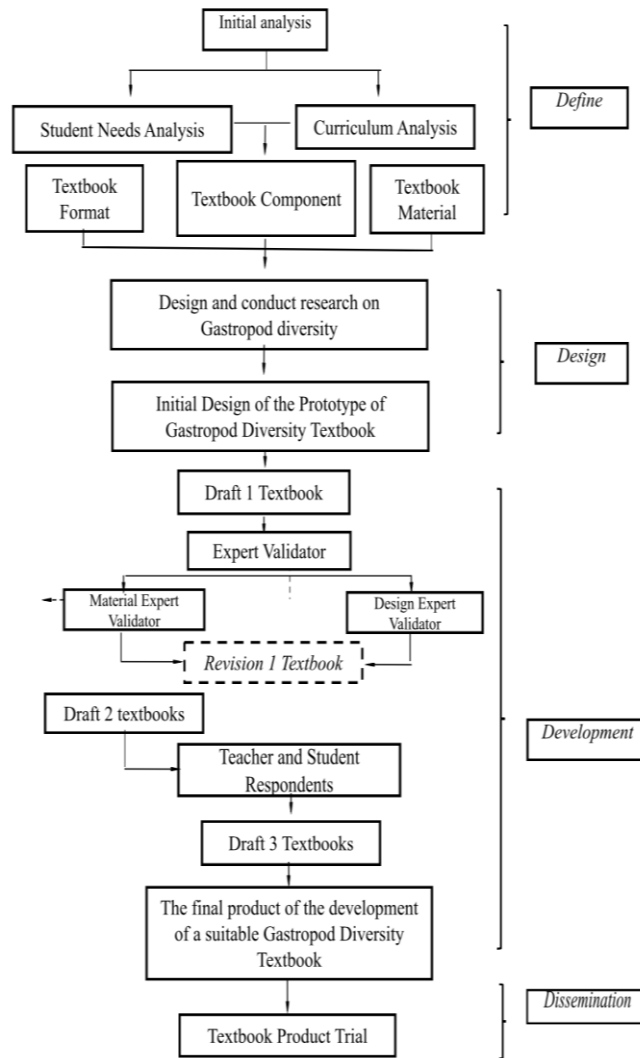
Fig. 1. Flowchart of research process

3 Result and Discussion

3.1 Result

The result of Gastropod diversity calculation

Based on the calculation, the Gastropod density obtained at the three stations has an average of 17.27 Ind/m^2. The highest value of Gastropod density 2.0 Ind/m^2 at station 2.2 with a value of 5 with the highest species density found at *Tarebia granifera* at 48 ind/m^2 and the lowest total density from all stations was at station 2.3 with a value of 4.4 Ind/m^2 (see **Table 1 & 2**).

Table 1. Frequency of presence in the observation

No	Spesies	Stasiun pengambilan sampel									Jumlah individu	istribusi lokasi	Frekwensi kehadiran
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3			
1	Achatina fulica	2	0	0	24	0	0	5	0	0	31	3	0.20
2	Bradybaena similaris	26	0	0	43	0	0	14	0	0	83	3	0.29
3	Subulina octona	13	0	0	23	0	0	4	0	0	40	3	0.20
4	Parmarion martensi	2	0	0	12	0	0	2	0	0	16	3	0.13
5	Laevicaulis alte	0	0	0	2	0	0	1	0	0	3	2	0.07
6	Pomacea paludosa	0	117	23	0	22	15	0	8	33	218	6	0.53
7	Filopaludina javanica	0	0	0	0	3	5	0	10	5	23	4	0.20
8	Lymnaea rubiginosa	0	25	9	0	4	2	0	3	57	100	6	0.33
9	Tarebia granifera	0	0	0	0	240	0	0	0	0	240	1	0.11
10	Gyraulus convexiusculus	0	0	0	0	0	0	0	0	32	32	1	0.09
		43	142	32	104	269	22	26	21	127			

Table 2. Diversity index based on the calculation

Parameter	Sampling station								
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
Species number	4	2	2	5	4	3	5	3	4
Individual number	43	142	32	104	260	22	26	78	70
Density/m^2	8.6	28.4	6.4	20.8	52	4.4	5.2	15.6	14
Diversity Index	0.95	0.47	0.59	1.36	0.33	0.82	1.26	1.12	0.60

The highest frequency (see **Table 1**) is *Pomacea paludosa* with a frequency of presence of 53.33% and 24 times appearing at the time of sampling in each observation plot. A high frequency is also found in *Lymnaea rubiginosa* with a presence frequency of 33% and 15 times appearing at the time of sampling. Meanwhile, the lowest frequency is *Laevicaulis alte* with a frequency of presence of 6.67%, and appearing only three times in each sampling and *Gyraulus convexiusculus* with a presence frequency of 8.89% and four times appearing.

The result of book development

This study emphasises development of research-based Gastropod diversity textbooks, with the aim of increasing student learning resources, adding insight and deepening subject matter about the Mollusca phylum, in particular the class Gastropod. The textbooks are validated by one Gastropod expert, one layout design expert and assessed by two biology teachers and students at SMA Swasta Teladan Tanah Jawa before the treatment was conducted.

After interviewing the biology teacher at SMA Swasta Teladan Tanah Jawa, students commonly have difficulties to identify living things, taxonomic systematics, habitation and benefits for the environment, while the availability of textbooks and secondary books is still limited to be used as a reference for the learning process. Students also find it hard to understand Gastropod learning because of the complexity of Gastropods and lack of pictures to support the learning. Therefore, alternative teaching materials are required to explain the characteristics and differences of each order in the class Gastropod.

In practicum activities often use organisms surrounding where they are not found in the available books which makes it difficult for students to find information about Gastropods. Based on the results of observations from students, it shows that students' reading interest is low. That can be seen from the fact that there were still many students who were still confused when the teacher asked the students related to the learning materials which actually are contained in textbooks they used as learning resources. Moreover, the students' results are still below the KKM on Gastropod material. The development of research-based gastropod diversity textbooks will provide practical learning resource innovations so that students are expected to be able to learn independently. The books not only provide material from each order in the class Gastropod, but also combine the results of research on Gastropods in the Simalungun Regency area.

The preparation of the book draft was carried out by considering the learning objectives to be achieved after the students experience the learning process. In general, textbooks must consist of three parts including the initial part, the content, and the final part [6]. Book development begins with conducting literacy studies from various sources and research. The structure of the draft consists of three parts, namely the initial part consisting of the book cover design, the editor of the textbook, the introduction, and the table of contents. The content section consists of the classification of gastropod animals and the results of research on gastropod animals in Simalungun Regency, student worksheets and competency tests, which consists of 7 chapters and the final section contains a bibliography, glossary, index, and book synopsis.

Initial Part Structure

The design of the book's cover is made attractive and proportional by displaying the Gastropod animals in their respective habitats. The cover is an overview of the book as a whole. It consists of two parts, namely the front and the back. Its size uses A5 paper so that it is easy to carry into the field when students carry out learning activities outside the classroom. The textbook editor contains the identity of the author's name, supervisor, and the title of the textbook. The foreword is the author's thanks to those who have helped in the manufacture of textbooks, either directly or indirectly, as well as a brief description of the contents of the book. The table of contents contains a list of titles and subtitles of the material contained in the textbook. List of Figures and List of Tables contain the titles of Figures and Tables to help the readers easily find out what material is contained in the textbook before opening the whole section of the book.

Content Structure

The content structure of the material contains Gastropod material equipped with an illustrated Gastropod animal classification in each subclass in class Gastropod. In addition, there is a picture of the body structure of class Gastropod and the organ system along with a description of each picture, and examples of the animal. In this textbook, the content of the material displayed is an introduction examining the position of class Gastropod and the shell morphology and anatomy of the Gastropod animal body. Next, examine the three subclasses in class Gastropod including *Opisthobranchia* subclass, *Prosobranchia* subclass, and *Pulmonata* subclass. Each sub-class examines the characteristics, morphology and anatomy, habitat, and its role in everyday life, both beneficial and detrimental to other living things. Research on the diversity of Gastropods examines the steps of the work procedures carried out and processing of Gastropod animal data in the Simalungun Regency area. Gastropod diversity discusses population density, frequency of presence and diversity index. Gastropod diversity also discusses the morphological description of each type of gastropod found by including the classification of the animal. The book also includes a student worksheet on how to make a dendrogram on gastropod animals and includes exercises in the form of questions as an evaluation of the content.

Final Part Structure

The final part consists of a bibliography, an index glossary and a synopsis of the contents of the book. Bibliography in the form of reference sources used to compile material in research-based gastropod diversity textbooks. The glossary is a list of difficult and unfamiliar words with the meaning of each word so that readers can find out the meaning of difficult words contained in the textbook. The index contains important words found on a particular page, thus helping the reader to find them.

At the stage of developing the draft textbook for the Gastropod diversity, it will be validated and tested to obtain textbook results that are expected to be worthy of being used as learning resources for students. There are also stages of validation testing carried out by material experts, learning design experts, biology subject teachers and class X students aiming to identify the feasibility level of the textbook products used and tested this product to students through three stages, namely testing individual trials, small group trials, and limited field trials. The next stage was to carry out a conceptual analysis of information and then revise the Gastropod Diversity textbook. Information from the data is in the form of an evaluation questionnaire which is analysed and then translated using qualitative sentences.

Overall, the validation carried out in the development of Gastropod diversity textbooks, starting from expert validation consisting of material experts, learning design experts, and design experts. After everything is done by reviewing it, the key is that the Gastropod diversity textbook is declared "appropriate" with an average assessment result of the validators of 81.34%. The average percentage of validators can be seen in **Table 3**.

Table 3. Validator percentage average

Validator value	Percentage	Category
Material Expert	85,92%	Appropriate
Learning Design Expert	83,44%	Appropriate
Layout Expert	74,67%	Appropriate
Average percentage	81,34%	Appropriate

The average percentage of responses from biology teachers and students by combining the three stages of product testing resulted in a score of 90.50%, stating that the quality of the textbooks is "very good". The table of the average percentage of biology subject teachers and students at the individual trial stage, small-scale trial, and limited field trial can be seen in **Table 4**.

Table 4. Average percentage of teacher and student responses

Validator value	Percentage	Category
Biology	91,89%	Very good
Individual trial	88,96%	Very good
Small scale trial	90,64%	Very good
Limited field trial	90,50%	Very good
Average percentage	90,50%	Very good

Product effectiveness test data

After testing the feasibility of the book and having revised and declared its feasibility, the next stage is dissemination stage aiming to test the effectiveness of the use of Gastropod diversity textbooks with the normalized Gain test (N-Gain) by comparing the results of the pretest assessment with the results of the post-test assessment. N-Gain can be done if the data is normally distributed and homogeneous then a parametric test is carried out, namely the independent sample t-test to determine whether there is a significant difference between the average post test value of the experimental class group and the class group control.

Descriptive statistics

Descriptive statistics are to describe data clearer and easier to understand including in the variables seen from the mean, minimum value, maximum value and standard deviation [7]. The results of the descriptive statistics can be seen in **Table 5** below.

Table 5. Descriptive Statistical Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest design	26	10	75	38.27	14.761
Post test design	26	45	95	76.35	11.879
Pretest Control	31	10	65	34.03	13.442
Post test Control	31	20	75	44.19	13.235
Valid N (listwise)	26				

Pretest and post test results of experimental group

Based on **Table 5** above, the highest learning score before using the Gastropod diversity textbook in the experimental group (pretest) was 75, while the lowest was 10, the mean was 38.27, and the standard deviation was 14.76. Meanwhile, after using the Gastropod Diversity textbook, namely in the experimental group, the highest post test learning outcome score was 95, the lowest was 55, the mean was 76.35, and the standard deviation was 11.88.

Pretest and post test results of control group

The highest pretest learning score without using the Gastropod diversity textbook in the control group was 65, the lowest was 10, the mean was 34.03, and the standard deviation was 13.44 (see **Table 5**). While the highest post test that was carried out without using the Gastropod diversity textbook in the control group was 75, the lowest was 20, the mean was 44.19 and the standard deviation was 13.24.

Normality test data

To find out whether the data is normally distributed or not, the data requires to meet the criteria for probability value (sig.) > 0.05. For more details, the results of the normality test for the experimental group and the control group can be seen in **Table 6**.

Table 6. Normality test results of the experimental group and control group

| | | Tests of Normality | | | | | |
| | | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Student	Exp Pretest	.124	26	.200[*]	.961	26	.413
Learning	Exp Post test	.143	26	.185	.952	26	.254
Outcomes	Control Pretest	.143	31	.106	.957	31	.238
	Control Post test	.121	31	.200[*]	.969	31	.498

*. This is a lower bound of the true significance.

Based on the table above, all data for the experimental and control groups as well as pretest and post test show that the probability value (sig.) Kolmogorov is > 0.05, which means the data is normally distributed.

Homogeneity test data

Before the independent sample t-test was carried out in the two research groups, a homogeneity test had to be conducted. In this study, the homogeneity value was obtained by using the homogeneity of variance test. The results of the homogeneity test of the two sample groups can be seen from **Table 7** below.

Table 7. Homogeneity test table

| | Test of Homogeneity of Variance | | | | |
		Levene Statistic	df1	df2	Sig.
Student	Based on Mean	.131	1	55	.719
Learning	Based on Median	.134	1	55	.716
Outcomes	Based on Median and with adjusted df	.134	1	54.077	.716
	Based on trimmed mean	.126	1	55	.724

Based on Table 7 above, the probability value (sig.) based on mean is 0.719 > 0.05, representing the data variants of the experimental post test and control post test classes are the same or homogeneous.

Hypothesis test data

Hypothesis testing was carried out using an independent t-test to see whether there was a difference in the post test results between experimental group and control group. The results of hypothesis testing with independent sample t tests can be seen in Table 8 below.

Table 8. Independent test results of t-test sample

Group	mean	t calculation (N=55)	t Tabel (N=55)	Sig. (2-tailed)
Exp Post test	76.35	9,568	2.004	0.000
Control Post test	44.19			

Based on the calculation of the independent sample t-test, it is found that the value of t count > t-table (9.568 > 2.004) and the probability value (2 tailed) < 0.05 (0.000 < 0.05). It concludes that there is a significant difference between the experimental class using books Gastropod diversity teaching compared to the control class.

Normalized gain test data (N-Gain)

An increase in the value of student learning outcomes can be seen from comparing the pretest and post test scores using the normalized gain test (N-Gain). Based on the results of the N-Gain value using the SPSS 22 application in the form of percentages and descriptive output tables, it can be made **Table 9** of the calculation of the Normalized Gain (N-Gain) test as follows:

Table 9. Calculation of normalized gain Test (N-Gain)

No.	Data Centering and Dissemination	Experiment	Control
1.	Mean	63.33	15.11
2.	Median	63.96	13.33
3.	Minimum value	85.71	0.00
4.	Maximum value	80.00	50.00
5.	Range	46.83	50.00
6.	Deviation standard	13.28	13.09

It can be seen that the average value for the experimental class using the Gastropod diversity textbook is $0.3 \leq 0.63 \leq 0.7$ or $56\% \leq 63\% \leq 75\%$ is in the moderate or sufficient category. Meanwhile, for the calculation of the N-Gain test, it can be seen that the average value for the control class using the Gastropod diversity textbook is $0.15 < 0.3$ or $15\% < 30\%$ which is included in the low or ineffective category. So it can be concluded that the use of textbooks on gastropod diversity in the experimental class is quite effective in improving student learning outcomes on gastropod material in class X SMA Swasta Teladan Tanah Jawa. Meanwhile, the control class is not effective in improving student learning outcomes on Gastropod material in class X SMA Swasta Teladan Tanah Jawa.

3.2 Discussion

Gastropod diversity research results

This study managed to collect as many as 777 individuals. Its composition consists of 10 families and 10 species of Gastropods. The types of gastropods found in Simalungun Regency are *Achatina fulica, Bradybaena similaris, Subulina octona, Parmarion martensi, Laevicaulis alte, Pomacea paludosa, Filopaludina javanica, Lymnaea rubiginosa, Tarebia granifera,*

Gyraulus Convexiusculus. The number of species varies from 2 to 5 species per station. The number of species varied, from *Laevicaulis alte* with only one individual to *Tarebia granifera* with 240 individuals and *Pomacea paludosa* with 117 individuals. Likewise with the distribution, starting from *Gyraulus convexiusculus* and *Tarebia granifera* were only found at one point to *Pomacea paludosa* and *Lymnaea rubiginosa* which were found at 6 points. Several species of snails have a narrow distribution so that they are only found in one station, namely *Tarebia granifera* (in Tanah Jawa District), and *Gyraulus convexiusculus* (in Dolok Batunanggar District).

Population density of an organism can be influenced by the area of the habitat and how many records are made in the study. *Tarebia granifera* had the highest density value only at station 2.2 and was not found at other stations, a high density was also found in *Pomacea paludosa* species with a value of 23.4 Ind/m^2 and was found in almost all stations. Gastropods at station 2.3 have the highest density value because of the optimum habitat conditions for gastropod life, so they can breed.

Diversity index differs at each station due to the differences in topography and habitat at each station. The diversity of gastropods classified as moderate is found at station 2.1 with an H' value of 1.36 in the medium category. This is because at station 2.1. high food source consisting of an old oil palm plantation environment so that it provides sufficient food sources.

The lowest gastropod diversity is obtained at station 3.3 with a value of H' = 0.68. This occurred because of the lack of food sources in the irrigation flow where it does not provide food supplies.

Development of textbook results

Preliminary research results

Research on the research-based textbooks' development on Gastropod topic used qualitative data analysis obtained from interviews with biology teachers at SMA Swasta Teladan Tanah Jawa and quantitative data obtained from the results of the questionnaire scores of material experts, learning design experts, layout design experts, teacher response questionnaires, biology and students of class XI SMA Swasta Teladan Tanah Jawa. The development of textbooks used the Four D (4D) development model starting from definition, design, development, and until dissemination stages.

Definition stage

In this stage, the researcher identified the root of the problem by conducting interviews and questionnaires to collect data. The interview was conducted with the biology teacher teaching class X at SMA Swasta Teladan Tanah Jawa. The results of the interviews showed that the classification of living things, in particular, in understanding concepts in classifying living things was difficult material in class X. Students are not well acquainted with animals encountered when doing practical work in the field or gastropod animals brought to the laboratory because the learning resources used do not display the classification and animal shape which are classified as gastropods. There were still few textbooks available in the field, thus, the researchers developed the textbook on gastropod diversity emphasising gastropod classification founded around the students' environment and combined it with the results of studies on the existence of gastropods and their role.

In the learning process in Gastropod material, students are required to be able to directly recognise various living things. That requires students to interact directly with objects, in particular, those in the surrounding environment so that the learning process is more meaningful. Learning by utilising the environment as a learning resource obtains a positive response from students [1]. Learning media is able to help students understand what is being learned, because students will observe, feel and interact directly with the object being studied. Teachers have also used various models, media, and learning resources in learning Gastropods material that is able to activate students. The teacher has conducted learning with a variety of methods such as practicum, projects and discussions so that the lecture method is not monotonous.

Design stage

At this stage the researcher formulated the learning objectives to be achieved as well as the limitations of the material to be discussed in the developed book to make easier for students to understand the Gastropod material. The learning objective is expected to be able to make a dendrogram based on the principle of living thing classification in animals using gastropods available in the environment. The material limitation taken is the subject of each material content including morphological and anatomical characteristics of the class Gastropod. Some examples of subclasses in the Gastropod class include: *Opisthobranchia*, *Prosobranchia* and *Pulmonata* subclasses. Each subclass discusses its description, characteristics, morphology, anatomy, classification, and role in the environment and is combined in several studies contained in the contents of the developed book material. The developed textbook also contains questions in the assessment used to determine the level of understanding of students on Gastropod material.

Development stage

Initial draft of the book was prepared based on existing literacy sources as an initial basis. Designing an interesting and clear book can explain the comparison of the characteristics of each group in the class Gastropod. The arrangement of the developed textbooks is designed to contain the following components: (1) Front and back cover of the textbook, (2) Textbook title, (3) Preface, (4) Table of contents, (5) List of pictures, (6) List of tables, (7) Introduction, (8) *Opisthobranchia* subclass, (9) *Prosobranchia* subclass, (10) *Pulmonata* subclass, (11) Gastropod research in Simalungun Regency, (12) Gastropod diversity, (13) Student worksheets, (14) Book index, (15) Glossary, and (16) Bibliography.

Research on gastropod diversity was conducted in Simalungun Regency, at 3 stations, namely in Sidamanik, Tanah Jawa and Dolokbatunanggar Districts. The initial draft of the book is prepared based on the level of quality of the content and learning design. It includes the making of detailed data for the questionnaire indicators for validation of material experts, learning design experts, layout experts, questionnaires for teacher and student responses to product trials used in the development stage. After the initial draft of the book was formed, a validation stage was conducted to test feasibility and quality so that appropriate and quality textbooks are produced. Experts' opinions (experts' judgements) can be used to test validity [8].

Validation of material experts

Three main aspects, namely content feasibility (aspects of the suitability of the material with core competencies and basic competencies), presentation feasibility and linguistic feasibility,

were validated by material experts. Of the three aspects of validation by material experts on textbooks, an average percentage of 81.26% in the "appropriate" category is used as textbooks in high schools. Material expert validators provide input for researchers to add material about students' concern for the environment and personal and environmental safety. Furthermore, the researcher added the material according to the advice of the material expert validator.

Validation of learning design experts

From the results of the validation carried out by learning design experts on six main aspects, namely content feasibility (aspects of suitability of the material with core and basic competencies), presentation feasibility, linguistic feasibility, effects for learning, evaluation and product assessment. Of the six aspects of validation by learning design experts on textbooks, an average percentage of 83.44%) in the "eligible" category is used as a textbook in SMA Swasta Teladan Tanah Jawa.

The learning design expert validator gave input to the researcher in order to improve the book cover so that it was not too crowded and images were colored with a high quality. Also, it is suggested to improve the content by adding material on the role of each gastropod in life, avoid monotony in writing to respond and motivate students to think critically, and add questions or case studies related to the material.

Validation of layout design experts

The validation results were carried out by layout design experts on five aspects, namely book format, cover design, layout, typography, and illustrations/pictures of the contents of the book. An average percentage of the five aspects are 74.67%, representing the "feasible" category to be used as textbooks in high school schools. The experts provide input to improve images that are still lacking in contrast and proportion in their layout, make illustrations which are easy to understand, use standard language, and avoid conjunctions as objects (main sentences). These suggestions have been added in the textbook.

Teacher assessment results

Based on **Table 4**, the average teacher responses to textbooks on the three aspects of interest, material presentation and language obtained an average score percentage of 91.89% in the "very good" category. Language has the highest proportion. The quality of textbooks can be seen from the aspect of language [9]. To boost students learn independently and master the learning process is to use simple language because they only use textbooks when studying independently. Furthermore, the language aspect in textbooks must match the students' language, which is effective, simple, polite and interesting. An effective sentence is able to convey information, ideas, feelings, in accordance with the author's intent [10].

Students' assessment results

The aspects of assessing student responses both in small group tests, small-scale trials and limited field group trials consisting of aspects of interest, material presentation, and language have the "very good" category (see Table 4), showing the quality of the textbooks developed has a "very good" category to be used as learning material for students. There are eight aspects that determine the quality of textbooks, namely a) having a basic principle and point of view based on linguistic theory, developmental psychology, and learning material theory; b) have a clear concept; c) relevant to the applicable curriculum; d) according to the interests of students; e) growing motivation to learn; f) stimulate, challenge, and excite the activities of

students; g) Have appropriate and attractive illustrations; h) easy for students to understand, effective sentences, avoid double meaning, simple, polite, and interesting; i) can support other subjects; j) respecting individual differences, abilities, talents, interests, economy, social, and culture, and k) strengthening the moral values that apply in society. Furthermore, conceptually the feasibility of a textbook is its criteria for the feasibility in accordance with the objectives of the curriculum [11].

Effectiveness test results

The next stage was the dissemination stage. At this stage, measurement of the goal achievement was conducted to determine the effectiveness of the textbooks being developed. Data analysis from a quantitative test of the textbook effectiveness was used to analyse the results of student learning achievement on the Gastropod material. The effectiveness test was conducted using one experimental class using the Gastropod diversity textbook and a control class using the K13 biology textbook. In the early stage, a pretest assessment was carried out in both experimental and control classes done at the beginning of the learning process. At the end of the learning process, posttest assessment was conducted both in experimental and control classes.

Based on **Table 6**, it is obtained that normality data with a significance value (Sig.) for the Kolmogorov Smirnov test data more than 0.05, representing the pretest and posttest values were normally distributed. The probability value based on mean is more than 0.05, concluding the data variants of experimental and control post test classes are the same or homogeneous. The pretest-post test value data were normally distributed and homogeneous.

An independent sample t-test was conducted to find out a significant difference between the increase in the average pretest-posttest score in experimental and control classes. Based on **Table 5**, there is a significant difference between experimental class compared to control class. In **Table 6**, there is an increase in the average of students' learning outcomes in experimental class using Gastropod diversity textbooks, which is higher than control class, including in the moderate or quite effective category. This can be concluded that the use of textbooks on Gastropod diversity is relatively efficient in improving learning outcomes in Gastropod material for students grade X of SMA Swasta Teladan Tanah Jawa.

The textbook developed can have a significant impact on student learning outcomes. The textbooks have the same or even greater influence than even qualified teachers in the teaching and learning process. In this textbook, students are asked to observe and record the characteristics of animals in the gastropod group that they observe, the type of their food and their habitat. Learning by utilising the environment brings students to do activities outside the classroom through direct observation [13]. Through direct observation, students can identify questions, conduct experiments and conclude experiments based on what they observe. Furthermore, through discussion on student worksheets and good communication can train in decision making for problem solving so that improves students' critical thinking skills [14].

4 Conclusion

After some assessments conducted, this study concludes that research-based gastropod diversity textbook which has been developed has good quality. The use of textbooks on Gastropod diversity is relatively efficient in improving learning outcomes in Gastropod

material for the students. Therefore, it is recommended to use the textbook for learning gastropod topics in grade X SMA Swasta Teladan Tanah Jawa

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