

Development of E-Book Animal Ecology for Biology Students Education

Lukky Jet Zarmi Chandra^{1*}, Abdul Razak²

¹Student of Master Degree Program of Biology Education, Faculty of Mathematic and Sciences,
Universitas Negeri Padang, Indonesia

²Biology Department, Faculty of Mathematic and Sciences, Universitas Negeri Padang,
Universitas Negeri Padang, Indonesia



Abstract – This research is based on problems found in the field, namely the impracticality of the available teaching materials. From this problem the researchers distributed a questionnaire to see the obstacles experienced by students in animal ecology lectures. The purpose of this research is to make it easier for students to obtain teaching materials in the form of valid, practical and effective e-books. This research is a development research using the PLUM development model. The plomp development model consists of 3 stages, namely the initial investigation stage, the development stage and the assessment stage. Based on the development and testing of animal ecology textbook e-books, the results of the development of animal ecology textbook e-books are as follows, the validity of the e-book animal ecology textbooks developed has very valid criteria with a value of 85.22%, the practicality of e- Animal ecology textbook developed according to the lecturer is very practical with a value of 86.64%, and according to students it has very practical criteria with a value of 83.78%, the effectiveness of animal ecology textbook e-books developed according to knowledge competence is obtained with very effective criteria, according to the competency of attitudes obtained by the criteria very effective with an average of 84.81%, and according to the competency skills obtained by the criteria very effective with an average of 86.29%. Thus the animal ecology e-book can be used by lecturers and students in the lecture process.

Keywords – *E-book*.

I. INTRODUCTION

We can see in the large development of the human population from the large birth rate. The large birth rates have an impact on increasing the number of inhabitants and trigger competition problems getting a job. Competition in the job market is increasingly competitive and it is difficult to get a job.

Currently, there are one million job seekers who are university graduates and they are still unemployed each year (<https://jurnalsoreang.pikiran-rakyat.com/pendidikan/pr-101886310>; 29 October 2020). The world of work requires university graduates who have competence and plus qualifications. The plus meaning is requires additional skills such as being able to speak English, mastering some computer applications or information technology required by the world of work and soft skills, namely morals and a reliable personality in order to work properly according to the needs of the workplace.

Education develops along with advances in technology that continue to advance. The rapid development of technology has resulted in various types of smart cellular phones (smartphones) and Android tablets. Users of smartphones and tablet android that's large in Indonesia seemed to have entrenched in Indonesian society. Today is very rare, the students found gathered talk task group or reading a book.

Most students prefer to use their smartphone but do not use it for studying. The teaching materials available on smartphones are also minimal. More Student spent their time on social media . Students who belong to the generation and power milineal more individualized learning concentration just for 18 minutes. This is according to the opinion of Prof. Sudjarwadi, Chancellor of Gadjah Mada University (UGM) for the period 2007-2012 who stated that the millennial generation generally gets bored easily in studying and other jobs even though their intellectual abilities are on average higher than previous generations (<https://www.pikiran-rakyat.com/nasional/pr-01289944/daya-konsentral-generasi-milennial-only-18-minutes-414758> ; 29 October 2020). This is also a learning problem for students in many departments or study programs at UNP.

The learning process in higher education is called lecturing. Lectures are active student activities in building competencies and learning experiences. Higher education is responsible for encouraging, providing the competencies needed in the job market and providing opportunities for students to carry out study activities optimally (Mulyasa, 2013). Study activities can optimally create graduates who are competent in their respective fields.

The competencies of college graduates are adjusted to Presidential Regulation No. 8 of 2012 concerning the Indonesian National Qualifications Framework (KKNI). KKNI is to equalize and integrate between the fields of education and the field of job training and work experience in order to provide recognition of work competencies in accordance with the structure of work in various sectors. There are levels 1 to 9 in the KKNI, level 9 being the highest. Higher education graduates with a degree equivalent to level 6. KKNI is used as a guideline for determining the qualifications for learning outcomes obtained through formal, non-formal and informal education or work experience. Formal education in tertiary institutions requires a meaningful lecture process in order to achieve graduate competence according to KKNI.

Lecturing in college is a programmed activity to make students learn actively, which emphasizes learning resources. Lecturing is developing process of thinking creativity that can improve thinking ability of students, and to improve, construct new knowledge as mastery and development efforts to improve the well to the lecture material. One of the compulsory courses in the biology education in UNP department is Animal Ecology. Ecology (ecology , from the Greek words oikos , house, and logos, studied), a field of science that studies the interactions between organisms and their environment (Campbell 2008: 326).

During the learning process that has been carried out by students and the results obtained in animal ecology lectures, it is still a problem in universities. Based on the results of the analysis of student scores in the animal ecology course 2017, it was found that the average score of students was 60. With this average, the results of student learning still low. This is due to the lack of students' ability to understand animal ecology materials based on available teaching resources so that it has an impact on student learning outcomes.

Based on observations that have been made by several students UNP in January - February 2019 found that the willingness of students to get material teaching is very lacking . Students are also constrained to understand animal ecology materials due to the lack of student reading interest in the text books provided, textbooks are less interesting and boring . Students prefer to look for teaching materials using the internet and prefer to have teaching materials available in pdf form.

Based on the results of interviews with lecturers who teach animal ecology, it was found that the available materials are less practical and had a real effect on activity patterns, learning methods and motivation of students who were studying at university. Lack of students' ability to read, reason and ask questions. This shows low motivation to learn. However, during the presentation, students were asked to look for information by utilizing their Android smartphone and tablet products . This reality shows that students prefer to learn using information technology that is currently developing.

One way to make students learn actively, effectively and not boring and to increase students' desire to learn is by utilizing the information technology that is currently developing. One way of utilizing information technology that is currently developing is by creating / making teaching materials that can be integrated with current developments in information technology. Materials teaching it an electronic book (e-book). E-book can provide convenience for students to access, so that students can take advantage of e-books anywhere and anytime can learn to understand the materials.

E-book can be opened electronically via a computer. The digital form of books is also divided into 2, namely electronic books and audio books. E-books in the form of files have various formats such as portable document format (pdf) that can be opened with the Acrobat Reader program or with the format of hypertext markup (htm), which can be opened by browsing or

when internet explorer is offline. E-books are designed to be read on devices called e-readers or e-book devices such as computers, cellphones, iPods and iPads (Andina, 2011: 4).

Based on the results of observations that the researchers encountered in the field, the researchers conducted research on the development of animal ecology e-books for biology education students.

II. REVIEW OF LITERATURE

In a Big Indonesian dictionary, books are defined as sheets of paper that are bound, contain writing or are blank; the book (KBBI 1994: 152); bound with sheets of paper of the same length and width, whether written or not (Badudu 1996: 217). This definition is likely to continue to change along with technological developments. Books are no longer found in binding and paper, but also in digital form, both written and sound recordings. Textbooks are a form of teaching material that can be used by students and educators in learning. Prastowo (2011) said that teaching materials are all materials that are arranged systematically, which displays a complete figure of the competencies that students will master and use in the learning process.

Textbooks are printed teaching materials containing a science analysis result of the curriculum in written form, so that students can use them for learning (Depdiknas, 2008: 12). Textbooks are specifically divided into two, namely main and complementary textbooks. The main textbook contains lesson materials in a field of study that are used as the main book used by students and educators. While complementary textbooks are books that are helpful or are an addition to the main textbooks used by students (Prastowo, 2013: 168). Daryanto (2010: 24) said that textbooks have benefits, as individual learning tools, teacher guidelines in teaching, tools to encourage students to choose appropriate learning techniques and improve teacher skills in organizing learning materials.

The textbook developed by the researcher is in the form of an electronic book (E-book). E-books are the result of extraordinary innovation, because they are able to cut operational costs, the costs of manufacturing and distributing products. Regarding the environment and the preservation of natural resources of wood forest products, the E-book is a tremendous discovery, because it saves the wood for making paper, as well as the savings in ink making materials.

E-books or electronic books are textbooks that are converted into digital format, e-books also have the meaning of a learning environment that has applications that contain a multimedia database of instructional resources that stores multimedia presentations on topics in a book (Restiyowati, 2012)

E-books are a technology that utilizes computers to display multimedia information in a concise and dynamic form (Munadi, 2010). E-books can be integrated through sound, graphics, pictures, animation, and movie shows so that the information presented is more varied than conventional books.

E-books are digital books that make it easy for readers who want to consume wherever they want to read and get information. E-books are ideal because they can be accessed via an Android cellphone and also allow readers to get content that makes it easier for readers to understand the purpose of the book because of the varied content.

E-books have advantages including making it easier to find the desired word compared to paper books, in E-books the reader determines which words are searched and marked, while in paper books the writer determines the words that are considered important, so in the E-book, the words the important thing is seen from the reader's side, not the writer's side. Then eBook dapat combined with applications and other technologies, such as multimedia content audio and video. E-book are efficient in cost and operating costs distribusianya and producing E-book is an excellence process (Tama, mica 2010).

E-Book also have minus thing like risk loss of data if the storage media is damaged or exposed to the virus, more people still feel more comfortable reading the opening pages of the book. They feel tired and trouble if they have to read in front of the monitor, then a different standard from E-books. The large number of data formats requires the readiness of the reader software, which not everyone has. Finally, the language limitation is due to the lack of E-books in Bahasa, especially those containing the latest technology tutorials. Most of them are still in foreign language. Usually, publications with special content are not free or paid.

When this product is developed it requires an assessment of the instruments used. This is known as validity. Validity is a criterion for assessing the measuring instrument (instrument) used in the measurement procedure. Lufri (2014) said that validity refers to the accuracy, meaningfulness and usefulness of a conclusion stated by the expert. Expert review according to Sander (2014) is carried out by experts by reviewing and analyzing the development designs that have been carried out, with or without the

presence of researchers. The person who does the validation is called a validator. There are two types of validity, namely logical validity and empirical validity.

After the product is valid, then the product is tested for practicality, known as the practicality test. Practical according to Plomp et al. (2013) is when a product developed is used by users, the product is useful, easy for them to use and is in accordance with the researchers' goals. Then, after the product is valid and practical, its effectiveness is tested. Products are said to be effective if they achieve the desired results (Plomp et al., 2013). The effectiveness test is carried out like experimental research, so it is necessary to explain the experimental design used, the appropriate samples and analysis techniques (Lufri et al., 2014).

III. METHODOLOGY

Type of this research is development research with a procedural model. Development research is a research method used to produce certain products and test the effectiveness of these products (Sugiyono, 2008). In this case, the research being developed is an e-book animal ecology textbook for Biology Department students. After the product has been developed, an analysis of validity, practicality and effectiveness is carried out.

The e-book development of this textbook uses the Plomp development model, where this model was developed by Prof. Tjeerd Plomp. Plomp Model consists of three stages, first stage is preliminary investigations (preliminary research), stage of development or prototype manufacture (development or prototyping phase), and the stage of assessment (assessment phase) (Plomp et al., 2013).

The initial investigation stage (preliminary research) is carried out by conducting problem and needs analysis, syllabus analysis, concept analysis, student analysis, e-books of textbooks used in universities and developing conceptual and theoretical frameworks for research. In the development or prototyping phase, what is done is the development of an e-book for animal ecology textbooks with formative evaluation which aims to determine what should be improved or revised so that the quality of the product being developed is more effective and efficient. Furthermore, in the assessment phase, a semi-summative evaluation is carried out which aims to determine the effectiveness of the products that have been produced during the development or prototyping phase. The formative evaluation method used in this study is as below.

1. Self evaluation or screening, self assessment by my self based on the first design to be developed.
2. Overview of the expert (expert review), a group of experts to provide an assessment and suggestions for products to be developed.
3. One to one evaluation, a product assessment is carried out by three students with different abilities. The evaluator observes, by interviewing respondents.
4. Evaluation of small groups (small group or microevaluation), evaluation products made by six students who have different abilities. The evaluator provides a questionnaire to the respondent.
5. The trial was a large group (field test), a user group of about thirty-two students use the product in actual conditions to measure the practicalities and effectiveness of the product.

IV. RESULT AND DISCUSSION

A. Research result

Research on the development of e-book for animal ecology textbooks uses the Plomp model which consists of three stages, the preliminary research stage, the prototyping phase, and the assessment phase. After these stages are carried out, results are obtained about the validity, practicality, and effectiveness of the e-book. The results of the activities at each stage are as follows.

The initial investigation stage was carried out by analyzing the problems and needs of biology education students about animal ecology textbooks. Analysis of the problems and needs of students in this study was conducted to determine the problems faced by students during lectures on animal ecology and the needs of students in lectures on animal ecology textbooks. Researchers collected data by interviewing lecturers and giving questionnaires to students of the Department of Biology Education, Padang State University.

The ability of students to master material in animal ecology courses can be influenced by several factors, one of which is teaching materials. The available teaching materials are not practical to obtain. Based on the results of interviews with lecturers who teach animal ecology, it was found that the available materials were less practical and had a real effect on activity patterns, learning methods and motivation of students who were studying at university. Lack of students' ability to read, reason and ask questions. This shows low motivation to learn. However, during the presentation, students were asked to look for information by utilizing their Android smartphone and tablet products. This shows that students tend to or prefer to learn using information technology that is currently developing.

Based on the results of observations made with several UNP students in January - February 2019, it was found that the willingness of students to obtain teaching materials was very lacking. Students are also constrained in understanding animal ecology materials due to the lack of student reading interest in the text books provided, textbooks are less interesting and boring.

One of the ways to make students learn actively and effectively to increase the desire of students to learn is by utilizing material teaching. Material teaching can be like an e-book. E-book can give provides convenience for students to understand the material lesson.

Basen on the accumulation of problems in the animal ecology lecture obtained from the lecturers and students, we need e-book of animal ecology textbooks. So the researchers made an e-book animal ecology textbook for biology education students

1. Tahap Pengembangan atau Prototipe

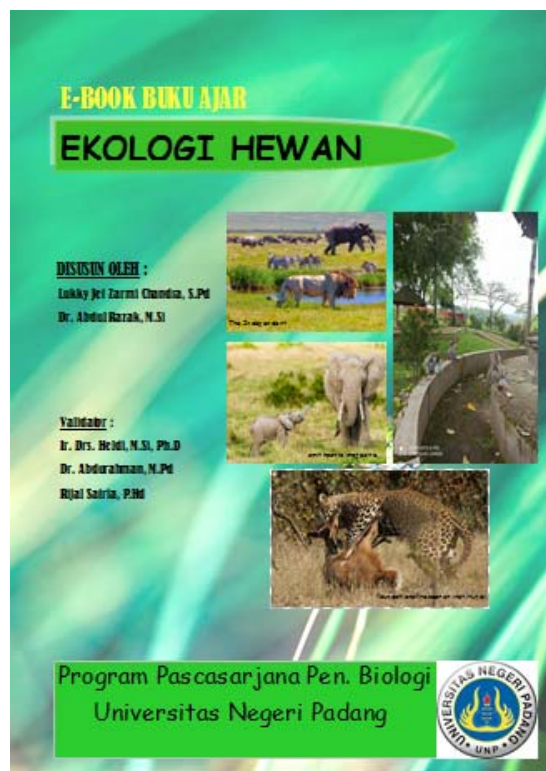
The development or prototype stage begins after the initial investigative stage is complete. The results of the initial investigation stage were used as guidelines in developing products in the form of e-books for animal ecology textbooks for biology education students.

a. The results of developing prototype I

The development of prototype I started with the design and manufacture of animal ecology textbook e-books for biology education students. Animal ecology textbook e-books were created using the Microsoft Office Publisher 2007 application. Components in animal ecology textbook e-books cover e-book textbooks, preface, purpose of writing e-books, table of contents, bibliography, and author profile.

1) Display of Animal Ecology Textbook E-Book Cover

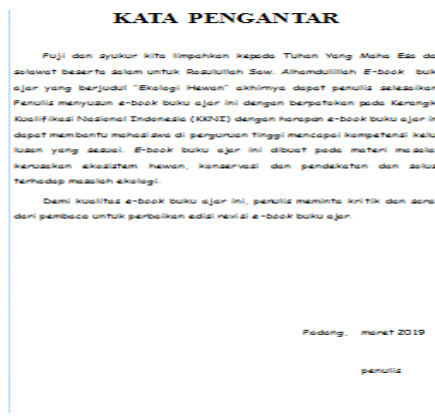
The cover section of the animal ecology textbook e-book contains the identity of the animal ecology textbook e-book, the identity of the e-book compiler of animal ecology textbooks, and images for the e-book cover of animal ecology textbooks consisting of images that reflect animal ecology courses. Font Bernard MT Condensed and Comic Sans MS. The identity of the compiler, supervisor and validator of the e-book animal ecology textbook is listed on the cover, with the type of writing Bernard MT Condensed with a size of 14. The cover is dominated by Tosca and green colors. The cover display on the e-book animal ecology textbook can be seen in the picture



Picture 1. Example of cover design e-book animal ecology

2) Preface Display

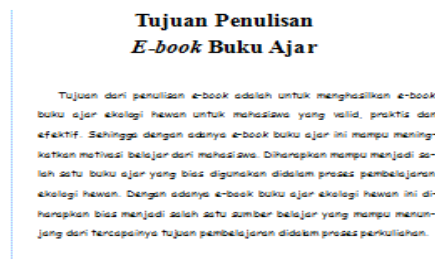
The foreword uses the letters Comic Sans MS with a size of 12. The writing of " **PREFACE** " is in bold type in Times New Roman with a size of 24. The appearance of the foreword in the e-book of Animal Ecology textbooks can be seen in the picture.



Picture 2. example of preface E-book animal ecology

3) Display of the Purpose of Writing Animal Ecology E-Book

For the purpose of writing, it uses the MS Comic Sans font with a size of 12. The writing " **Purpose of Writing Textbook E-Book** " is in bold type in Times New Roman with a size of 24. Display of the preface to the e-book animal ecology textbook can be seen in the picture.



Picture 3. Example of a purpose writing e-book animal ecology

4) Table of Contents Display

The table of contents was compiled to provide information to students and lecturers about the location or page of the e-book component of animal ecology textbooks. The type of writing used is Comic Sans MS with the writing size 12. The words " **LIST OF CONTENTS** " are in bold with the words Comic Sans MS in size 14 and given a background matching the writing in green. The display of the contents of the e-book animal ecology textbook can be seen in Figure .

Daftar Isi	
Kata Pengantar	i
Tujuan Penulisan E-Book	ii
Daftar Isi	iii
Bab I Pengantar Kenapa dan Bagaimana Mempelajari Ekologi Hewan	1
1.1. Konsep dan Definisi ekologi	1
1.2. Keluasan investigasi Ekologi : Dari sel sampai lau global	3
1.3. Ekologi sebagai disiplin ilmu	5
1.4. Fenomena ekologi dalam skala ruang dan waktu	6
Bab II Hewan dan Ekosistem	10
2.1. Konsep Ekosistem	10
2.2. Rantai dan Jaring-jaring Makanan	12
2.3. Aliran Energi	14
2.4. Hewan Sebagai Bagian Ekosistem	15
2.5. Karakteristik Hewan Dan Habitatnya	16
Bab III Faktor-faktor Lingkungan Abiotik	19
3.1. Suhu	20
3.2. Cahaya	21
3.3. Curah Hujan	22
3.4. Air	23
3.5. Oksigen	24
3.6. Angin/Udara	24
3.7. Kadar Garam	24
3.8. Ph dan Potensial Redoks	25
3.9. Lingkungan dan Kelimpahan	25

Picture 4. Example of Display of Contents E-Book of Animal Ecology Textbook

5) Bibliography view

This section displays a bibliography which is a reference for making e-book products for animal ecology textbooks. The references used in the development of animal ecology textbook e- books are official books in English and Indonesian, international journals and national journals. Bibliography view aims to see the references used and helps students to find references that match the material being studied. The bibliography is written using Comic Sans MS writing type with the writing size 12. The writing " **Bibliography** " is in bold with the writing Comic Sans MS size 14 and is given a background equivalent to the writing in green. Bibliography can be seen in Figure.



Picture 5. Example of Bibliography Display in Animal Ecology Textbook E-book

6) Author Profile Display

The author's profile display is located on the last page of the animal ecology textbook e-book . Author profile section contains a photo of the author and a brief identity about the author. The inscription of " **Author Profile** " is in bold, with the words Comic Sans MS italicized with a size of 16 and given a background to match the writing in green. The description of the author's profile uses Comic Sans MS writing type with an writing size of 12.

After the process of designing and making animal ecology textbook e-books has been completed, then proceed to the process of developing prototype II.

b. Prototype II development results

At the prototype II development stage, the formative evaluation activity carried out was self-evaluation . In this activity, a review of the important components in the animal ecology textbook e-book has been completed. Evaluations carried out in self-evaluation activities use a checklist containing a number of items that must be included in the animal ecology textbook e-book based on the formulated aspects. After the animal ecology textbook e-book has been revised itself, it will be continued at the prototype III development process stage.

c. Result of prototype development III

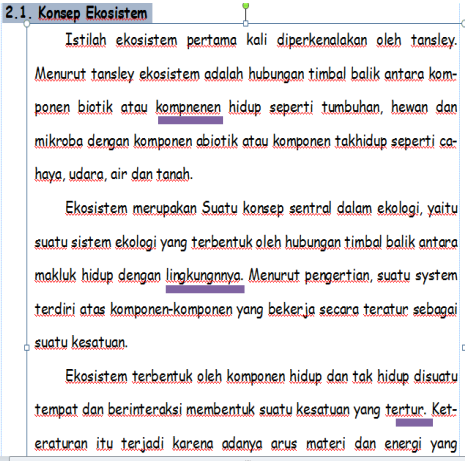
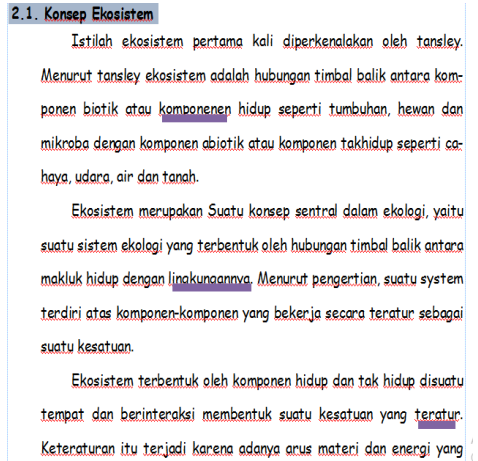
The third prototype development stage carried out evaluation activities carried out by experts, namely seeing the validity of animal ecology textbook e-books based on validator assessments which included didactic, construct, and technical aspects. Formative tool that is used in the form of sheet validation e-book textbook ecology hewan.Validator provide constructive suggestions for improvement e-book textbook developed animal ecology.

Based on the assessment given by the validator, it can be seen that the e-book validation of animal ecology textbooks for the three aspects assessed includes didactic, construct, and technical aspects, the score is 78,84 with valid criteria. This shows that e-book books Animal ecology teaching can be used in the process of animal ecology lectures.

In addition to the evaluation stage of the validation of the expert or expert review, the development of an e-book on animal ecology textbooks in prototype III was also carried out by a one-to-one evaluation (one-to-one evaluation). At this stage three students with different abilities (high, medium, and low) were asked to assess the animal ecology textbook e-book that had been developed. After the researchers explained about the e-book textbook ecology of animals that have been developed, students are asked to give an assessment instrument to complete a one-to-one evaluation of the e-book textbook of animal ecology. The results of the one to one evaluation instrument sheet can be seen in the Appendix.

From the results of filling in the one to one evaluation instrument carried out by students, it was known that all the indicators needed in the animal ecology textbook e-book developed already existed. Students also provide comments on animal ecology textbook e- books to make it even better. Students are of the opinion that the language used is simple and clear so that it is easy to understand, the presentation of textbooks is neat and structured, and attractive. In addition to comments on animal ecology textbooks e- books, students also provided suggestions for improvements to animal ecology textbooks e- books. Suggestions and revisions from students on the results of the one to one evaluation test can be seen in Table 1

Tabel 1. Suggestions and Revisions from the One to One Evaluation Test

Suggestion	Revision
There are still typing errors that must be corrected 	Fixed some incorrect writing at the time of typing 

Then, a revision of the animal ecology textbook *e-book* was carried out based on the suggestions given by the validators and students, as well as taking into account the student's assessment of the one- to-one evaluation. After the revision was done, it was continued in prototype IV.

d. Result of prototype development IV

The development of the prototype stage IV is an evaluation activity carried out, namely the *small group evaluation*. The results of the small group evaluation obtained from the practicality of the *e-book* animal ecology textbooks developed were based on the aspects of ease of use, time, interpretation and equivalence, the average value of practicality was 84.13% with very practical criteria.

The animal ecology textbook *e-book* that has been developed has a value of 84.13 with very practical criteria. *E- books* are practical animal ecology textbooks because the use and material contained in the *e-books* can be understood clearly, so that the learning time becomes more effective.

Improvements to the *e-book* animal ecology textbooks by students in small groups, namely the wrong writing. The results of the revision of the small group evaluation stage can be seen in Table 2. After the animal ecology textbook *e-book* has been revised, it will be continued at the assessment stage with large groups (*field test*)

Tabel 2. Suggestions and Improvements from Small Group Evaluation.

Sugestion	Revision
digambarkan dengan Indeks Deversitas. Indeks diversitas mungkin hasil dari kombinasi kekayaan dan kesamaan species .Ada nilai indeks diversitas yang sama didapat dari komunitas dengan kekayaan yang rendah dan tinggi kesamaan kalau suatu komunitas yang sama didapat dari komunitas dengan kekayaan tinggi dan kesamaan rendah . Jika hanya memberikan nilai indeks diverstas, tidak mungkin untuk mengatakan apa pentingnya relatif kekayaan dan kesamaan species . dengan lebih mudah secara ekologi $NA = S (Pi) 1/(1-A)$ Dimana Pi = ukuran individu (atau biomas, dll) yang dimiliki oleh satu species. menunjukkan bahwa urutan 0, 1, dan 2 dari jumlah diversitas. Jumlah Diversitas adalah: Jumlah 0 : $NO = S$ dimana S adalah jumlah total species Jumlah 1 : $N1 = e^H$ dimana H adalah indeks Shanon Jumlah 2 : $N2 = 1/I$ dimana I adalah indeks Simpson. Jumlah diversitas ini dalam unit-unit . jumlah species dihitung disebut oleh Hill sebagai jumlah species efektif yang ada dalam sampel. Jumlah species efektif ini adalah suatu hitungan untuk kelimpahan sebanding yang didistribusikan diantara species. Lebih 34 Writing on the backward community <u>U</u> and on the backward diversity <u>I</u> because of a typo	digambarkan dengan Indeks Deversitas. Indeks diversitas mungkin hasil dari kombinasi kekayaan dan kesamaan species .Ada nilai indeks diversitas yang sama didapat dari komunitas dengan kekayaan yang rendah dan tinggi kesamaan kalau suatu komunitas yang sama didapat dari komunitas dengan kekayaan tinggi dan kesamaan rendah . Jika hanya memberikan nilai indeks diversitas, tidak mungkin untuk mengatakan apa pentingnya relatif kekayaan dan kesamaan species . dengan lebih mudah secara ekologi $NA = S (Pi) 1/(1-A)$ Dimana Pi = ukuran individu (atau biomas, dll) yang dimiliki oleh satu species. menunjukkan bahwa urutan 0, 1, dan 2 dari jumlah diversitas. Jumlah Diversitas adalah: Jumlah 0 : $NO = S$ dimana S adalah jumlah total species Jumlah 1 : $N1 = e^H$ dimana H adalah indeks Shanon Jumlah 2 : $N2 = 1/I$ dimana I adalah indeks Simpson. Jumlah diversitas ini dalam unit-unit . jumlah species dihitung disebut oleh Hill sebagai jumlah species efektif yang ada dalam sampel. Jumlah species efektif ini adalah suatu hitungan untuk kelimpahan sebanding yang didistribusikan diantara species. Lebih 34 Typing errors have been fixed

2. Assessment stage

At this stage of the assessment, the activity carried out was an *e-book* assessment of animal ecology textbooks in actual conditions with one class through a large group test (*field test*). At this stage of the assessment, a practicality test was carried out by lecturers and students. The purpose of the large group assessment is to see the practical extent of the animal ecology textbook *e-book* .

a. Practicality Test by Lecturers

Practicality data of animal ecology textbook *e- books* by lecturers were obtained from practicality questionnaires given to lecturers. The results of the practical data analysis of the *e-book* animal ecology textbooks by lecturers can be seen in table 3.

Table 3. Results of Practical Data Analysis of Animal Ecology Textbook E-Book

No.	Aspect	Score (%)	Criteria
1	Ease of Use	84.09	Very practical
2	Time	100	Very practical
3	Easy to interpret	87.5	Very practical
4	Choosing equivalent	75	Practical
Average Practicality Value		86.64	Very practical

From the table above, it can be seen that the average practicality value of the animal ecology textbook *e-book* by the lecturer is 86.64 with very practical criteria. This shows that animal ecology textbook *e- books* can be used by lecturers in the implementation of lecture activities. After the practicality test by the lecturer, a practicality test was also carried out by students.

b. Practicality Test by student

Practicality of the *e-book* animal ecology textbook by students was obtained from the results of the practicality questionnaire analysis. The results of practical data analysis of animal ecology textbook *e-books* based on the aspects of ease of use, time, interpretation and equivalents were obtained an average practical value of 83.78% with very practical criteria. This shows that animal ecology textbook *e-books* can help students understand the material in implementing animal ecology lectures.

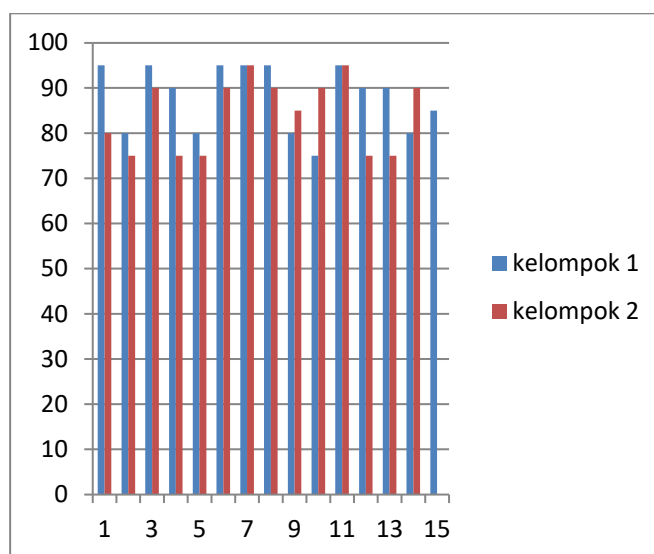
c. Effectiveness Test

The results of the effectiveness test are used as a guide in determining the effectiveness of the product in the form of an *e-book* of animal ecology textbooks being developed. Effectiveness data is obtained from student learning competencies including knowledge competencies, attitude competencies, and skills competencies. Student knowledge competencies are obtained through test techniques in the form of essay questions. Student attitude competence is obtained from non-test techniques in the form of attitude observation sheets and rubrics. Student competency skills are also obtained from non-test techniques in the form of making papers and *power points* (PPT) along with rubrics.

1) Knowledge Competence

The knowledge competency data in this study were obtained through a final test in the form of a written test in the form of essay questions given to students on midterm examinations. The midterm exam was carried out in one class of the Biology Study Program of FMIPA UNP which was divided into 2 groups, the first group used the animal ecology textbook *e-book* and the second group did not use the animal ecology textbook *e-book* in the lecture process. This assessment is used to determine the effectiveness of the animal ecology textbook *e-book* that has been developed. The results of the knowledge competency data analysis from the results of the students' midterm examinations can be seen in Table 4.

Table 4. Results of Student Knowledge Competencies



Based on the results of the competency of knowledge, it can be seen that 100% of students pass (those with grades in categories B- to A). The results of the knowledge competency assessment show that the animal ecology textbook *e-book* is effective in helping students achieve the desired competence.

2) Attitude Competence

The results of the data analysis on the competency assessment of students' attitudes in animal ecology lectures can be seen in Table 5.

Table 5. Student Attitude Competency Results

The aspects assessed by the observer	Group I%	Group II%	Average	Criteria
Responsible	84.44	82.73	83.58	Very effective
Cooperate	83.33	81.54	83.43	Very effective
Appreciate	86.66	84.52	85.59	Very effective
Average	84.81	82.93	83.87	Very effective

Based on Table 5, it is known that the total score of student attitudes competence obtained an average of 83.87% with very effective criteria. Judging from the average value of all aspects of attitude competency assessment through lectures, the effectiveness has been well fulfilled. Based on the results of attitude competency, it is known that this animal ecology textbook *e-book* is effective in helping students achieve the desired competencies.

3) Skills competency

Skills competencies include student skills in making papers and *power points* (PPT). In summary, the results of the skills competency assessment can be seen in Table 6.

Table 6. Results of Student Skills Competencies

Indicator	Group I%	Group II%	Average	Criteria
The suitability of the paper with the material	87.22	83.03	85,125	Very effective
Paper view	85.55	81.81	83.68	Very effective
PPT view for group discussion	86.11	83.63	84.87	Very effective
Average	86.29	82.82	84.55	Very effective

Based on Table 6, it is known that the total average score of students' competency skills obtained an average of 84.55 with very effective criteria. It can be said that in general, seen from the average value in all aspects of the skills competency assessment through writing papers and *power points* (PPT), it has been fulfilled properly.

B. Discussion

Animal ecology textbook *e-books* for students are developed through a series of processes in accordance with the existing research stages in *research development*. The development research consists of three stages, namely the initial investigation stage, the development stage and prototyping, and the assessment stage.

During the development process, this animal ecology textbook *e-book* was revised so that it obtained a valid, practical, and effective animal ecology textbook *e-book*. Nieveen in Plomp (2013: 28) states that the criteria for getting good product quality are determined from the validity, practicality, and effectiveness assessment in terms of several aspects of each assessment. The discussion of the animal ecology textbook *e-book* that was developed in relation to each stage of the *development research* of the product is described as follows.

1. The Process of Developing Animal Ecology Textbook *E-Book*

Animal ecology textbook *e-book* designed to be used by lecturers and students during the learning process. The process of developing an *e-book* for animal ecology textbooks starts with an analysis of the problems and needs of students which is carried out by interviewing lecturers and students and distributing questionnaires to UNP biology education students.

According to Sugiyono (2012: 137) the interview is a data collection technique used in a preliminary study to find problems that must be researched. This is supported by Maolani and Cahyana (2015: 153) the interview is one of the most important parts for researchers because the interview aims to obtain information obtained by asking respondents directly and is a preliminary study to find problems that must be investigated. The result of this analysis is that the available materials are less practical for students to obtain so that the motivation to learn from students is low. Meanwhile, the student needs analysis found that animal ecology textbook *e-books* were not available that were easily accessible to students anytime and anywhere.

E-books or *electronic books* are textbooks that are converted into digital format, *e-books* also have the meaning of a learning environment that has applications that contain a multimedia database of instructional resources that stores multimedia presentations on topics in a book (Restiyowati, 2012). The application of animal ecology textbook *e-books* in the lecture process can solve the problems of students who have difficulty getting access to learning materials. So that the existence of *e-books* can make it easy for students to get learning material.

Making animal ecology textbook *e-books* begins with observing the syllabus and seeing the materials taught to students in that semester. Next, collect the materials taught during the animal ecology lecture so that during the lecture students do not get ambiguous material from animal ecology lectures

2. Validation of Animal Ecology Textbook *E-Book*

Data analysis from the validation sheet of this animal ecology textbook *e-book* was reviewed from didactic, construct, and technical aspects. The results of the data analysis validation of the *e-book* animal ecology textbooks developed were valid. This is in accordance with the opinion of Riduwan (2009: 88) which states that the validation results with valid criteria range from 81-100%. This is also in line with the opinion of Sugiyono (2012: 363) which states that validation is the degree of accuracy between the data that occurs on the object of research and the actual data

a. Didactic Aspects

Didactic aspects of the *e-book* animal ecology textbook is very valid by the validator. The validation results indicate that the subject matter of lecture activities contained in the *e-book* of animal ecology textbooks is in accordance with the syllabus used. Lecture activities contained in animal ecology textbook *e-books* are in accordance with the objectives to be achieved. This can be seen from the material discussed and the appropriate evaluation of *learning outcomes* which can make students better understand the material. Didactic requirements are requirements relating to the process of determining the correct concepts according to the syllabus and *learning outcomes*. According to Lufri (2007: 113) validation is subject to the accuracy, meaningfulness and usefulness of a conclusion made by the researcher. This didactic requirement regulates the use of universal animal ecology textbook *e-books* that can be used properly for low, medium, and high ability students

b. Construct Aspects

The construct aspect of the animal ecology textbook *e-book* was declared very valid by the validator. Based on this, it can be concluded that the animal ecology textbook *e-book* already uses language that is easily understood by students, uses language that is in accordance with Indonesian principles that are good and correct and in accordance with enhanced spelling (EYD), and has clear sentences.

In the *e-book* animal ecology textbooks have presented material systematically in accordance with the *learning outcomes* on the syllabus. After conducting lectures according to the material, students answer evaluation questions that are in accordance with the *learning outcomes* so that students understand the material better

c. Technical Aspect

The evaluation of the technical aspects assessed by experts in animal ecology textbook *e-books* was declared very valid by the validator. The results of the validation indicate that all components in the technical aspects including writing, pictures, and

graphics have been fulfilled properly. Very valid values are given by the validator based on several indicators. First, use a clear type of writing, use the right font size, and use punctuation appropriately.

The second indicator, the suitability of the presentation of the image. This is evidenced by the pictures contained in the *e-book* animal ecology textbooks that can be seen clearly. The images presented can support understanding of the material, and are in accordance with the concepts presented. This is in line with the opinion of Prastowo (2013: 124) that the presentation of images is needed to support and clarify the content of the material, then it can increase the attractiveness of students to learn it. The third indicator is graphics which can be seen from the *e-book* design of the animal ecology textbook being developed. The colors on the cover and appearance of the animal ecology textbook *e-book* can make readers interested in knowing about the material discussed, this is because of the attractive color combination and good color combination. According to Trianto (2009: 2) Technical requirements regarding writing, pictures, and appearance in making animal ecology textbook *e-books*.

The three aspects of the evaluation of the *e-book* validation of animal ecology textbooks above are a complete and mutually supportive unity to develop a good animal ecology textbook *e-book* according to the regulations. The *e-book* validation of animal ecology textbooks is very important. Arikunto (2013: 58) states that if a tool produced from a product is valid, it can be said that the product being developed has provided a description of the development goals correctly and in accordance with the actual situation. A valid assessment of the animal ecology textbook *e-book* developed can be used as teaching material in learning, namely as a guide or guide in carrying out animal ecology lecture activities

3. Practical E-Book Animal Ecology Textbook

The practicality of this animal ecology textbook *e-book* is related to the ease of using animal ecology *e-books* by lecturers and students in carrying out lecture activities. The following describes the practicality of lecturers and students regarding the *e-book* animal ecology textbooks being developed.

a. Practical E-Book Animal Ecology Textbook by Lecturers

During the lecture process, the lecturer plays an important role as a facilitator. It is necessary for the practicalities of the *e-book* textbook ecology of these animals so that the *e-book* textbook animal ecology into practical for use by both lecturers and students. The results of the analysis of lecturers' practicality test data on animal ecology textbooks *e-books* have very practical criteria. This shows that the *e-book* of animal ecology textbooks as a guide in conducting lecture activities can make it easier for lecturers to guide students in carrying out lectures.

The *e-book* aspect of animal ecology textbooks has very practical criteria. This shows that the animal ecology textbook *e-book* that is used as a lecture guide can make it easier for lecturers to guide students during lecture activities. With the *e-book* animal ecology textbooks, it makes it easier for lecturers to make students more active during lectures.

The aspect of time efficiency required in the implementation of lectures, *e-book* animal ecology textbooks has very practical criteria. This shows that the use of animal ecology textbook *e-books* is in accordance with the available time efficiency so that it can be said that this animal ecology textbook *e-book* is effective to use. According to Sukardi (2011: 52) states that practicality can be seen from the implementation time which should be short, fast, and precise.

Aspects of having a useful *e-book* animal ecology textbook have very practical criteria. This shows that the animal ecology textbook *e-book* has material that is relevant to the material provided in the lecture process. The results of data analysis prove that animal ecology textbook *e-books* are good to be used as a medium for learning animal ecology in lectures. According to Sukardi (2011: 52) learning media that have the same benefits can be used as a guide in learning activities

b. Practical E-Book Animal Ecology Textbook by Students

The results of the practical data analysis of the *e-book* animal ecology textbook by students have very practical criteria. This shows that animal ecology textbook *e-books* make it easy for students during the lecture process. Judging from the aspect of ease of use of *e-books*, animal ecology textbooks have very practical criteria. From the criteria obtained, it can be seen that the animal ecology textbook *e-book* makes it easy for students because the textbook uses a type of writing that is easy to read. The material presented is in accordance with *learning outcomes* and uses language that is easy to understand. Depdiknas (2008: 24) states that the language and concepts used in textbooks must be easily understood by students.

The efficiency aspect of the animal ecology textbook *e-book* has very practical criteria. Judging from these criteria in mind that *e-book* textbook animal ecology can make students more active in lecturing activities. In accordance with the opinion of Sudjana (2011: 99) that the right learning media will increase student motivation.

The aspects of the benefits of animal ecology textbook *e-books* have very practical criteria. This shows that animal ecology textbook *e-books* have material that is relevant to the material provided during lectures as well as material that is in accordance with *learning outcomes*. Overall, animal ecology textbook *e-books* have very practical criteria in each of the assessed aspects

4. The effectiveness of Animal Ecology Textbook *E-Book*

The effectiveness test was carried out to determine the results on the use of animal ecology textbooks *e-books* in lecturing activities on attitudes, knowledge, and skills competencies. Attitude competences and skills were assessed using student observation sheets by the observer during the lecture. Knowledge competency is assessed through midterm test results after lecture activities. According to Trianto (2009: 235) that the learning outcome test is a test item that is used to determine student learning outcomes after lecture activities. The following is an explanation of the results of the effectiveness test that has been carried out

a. Knowledge Competence

The use of animal ecology textbook *e-books* has a positive effect on students' knowledge competencies. This is because *the e-book* textbook contains material of animal ecology that can sharpen the ability of students. In this *e-book*, the material animal ecology textbooks are presented in accordance with the animal ecology learning syllabus. Thus, students' understanding of the concepts from learning animal ecology can be achieved properly.

b. Attitude competence

The results of the observations on attitude competence made by the observer got good results. Assessment of the competence of student attitudes during lecture activities with indicators that include hard work, discipline, respect, and curiosity. This attitude assessment will be assessed by the observer when lecture activities take place.

The relationship between lecturers and students during the lecture process is needed to guide students and assess attitudes during the lecture process (Maphosa, 2007). According to Ifeom (2016), the attitude competency assessment can be seen from the components of how to work and the preparation of students.

From the value of observing student attitudes, it can be concluded that the attitude of students during college activities is very good. This means that *e-book* textbook animal ecology student is able to build a scientific attitude.

In lecture activities, it is not only knowledge competence that is important to be assessed from students, but attitude aspects are also very important to pay attention to. Attitude (*attitudes*) refers to the tendency of a person to the response related to a person's likes and dislikes of an object is given

c. Skill Competence

Skills are an important assessment during the lecture process. However, skills competency is difficult to assess due to several factors (Succi, 2019). Nowadays, students must continue to gain knowledge and develop skills to remain competitive (Sheikh, 2008).

Skills competency assessment in the animal ecology textbook *e-book* is in the form of assessment of the suitability of the paper with the PPT material and appearance. The results of the skills competency research in terms of the suitability of the paper with the material show that the animal ecology textbook *e-book* developed is effective. According to Fatchan (2015: 142), observing students can find the fact that there is a relationship between the object being analyzed and the learning material. The results of the skills assessment showed that the animal ecology textbook *e-book* developed was effective

C. Research Limitation

The limitation of this research is that the researcher only examines one class where the students are divided into 2 groups and the researcher does a formative research because of the limited time of the study.

V. CONCLUSION

Based on the development and testing of the animal ecology e-book, it can be concluded that the results of the development of the animal ecology e-book are as follows. The validity of the animal ecology e-book developed has very valid criteria. The practicality of the animal ecology e-book developed according to the lecturer is very practical, and according to students it has very practical criteria. The effectiveness of animal ecology e-books developed according to knowledge competencies is obtained by very effective criteria, according to attitudinal competence, it is obtained with very effective criteria, and according to competency skills obtained by very effective criteria.

REFERENCE

- [1] Andina, E. 2011. *Buku digital dan pengaturannya*. Jurnal Aspirasi, 2(1), 79-95.
- [2] Andina, E. 2011. *Buku digital dan pengaturannya*. Jurnal Aspirasi, 2(1), 79-95.
- [3] Anonim. <https://www.pikiran-rakyat.com/nasional/pr-01289944/daya-konsentrasi-generasi-milenial-hanya-18-menit-414758>. access 29 Oktober 2020
- [4] Anonim. <https://jurnalsoreang.pikiran-rakyat.com/pendidikan/pr-101886310>. access 29 Oktober 2020
- [5] Badudu J. S., dan Zain, S. M. 1996. Kamus Umum Bahasa Indonesia. Jakarta: Pustaka Sinar Harapan.
- [6] Campbell, neil A dan jane B. Reece 2008. "Biology edisi kedelapan jilid 3". Jakarta: Erlangga
- [7] Depdikbud, 1994. *Kamus Besar Bahasa Indonesia*. Jakarta: Balai Pustaka
- [8] Depdiknas. 2008. *Kumpulan Permendiknas*. Jakarta: Dirjen Dikti.
- [9] Lufri. 2007. *Kiat Memahami Metodologi Melakukan Penelitian*. Padang: UNP Press.
- [10] Lufri. 2014. "Metodologi Penelitian: Penelitian Kuantitatif, Penelitian Tindakan Kelas, Penelitian Pengembangan". Bahan ajar Tidak Diterbitkan. Padang: UNP.
- [11] Munadi, Y. 2010. Media Pembelajaran sebuah Pendekatan Baru. Jakarta: Gaung Persada Press.
- [12] Plomp, T dkk. 2013. *Educational Design Research*. Enschede, University of Twente.
- [13] Prastowo, A. 2011. *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.
- [14] Prastowo, A. 2013. *Panduan Kreatif Membuat Bahan Ajar Inovatif: Menciptakan Metode Pembelajaran yang Menarik dan Menyenangkan*. Jakarta: Kencana.
- [15] Restiyowati, I. 2012. Pengembangan E-Book Interaktif Pada Materi Kimia Semester Genap Kelas Xi Sma (Ebook The Matter Of Interactive Even Semester Chemical Class Xi High School). *Unesa Journal of Chemical Education*, 1(1).
- [16] Sander, A. 2014. "The Development of Learning Video for English Speaking Ability Teaching by Using Movie Maker Program at Eleventh Grade of SMA Negeri 1 Banyuasin II". *Proceeding the 2nd SEA-DR*.
- [17] Sugiyono. 2008. *Metode Penelitian Pendidikan (Pendekatan kualitatif, kuantitatif, dan R dan D)*. Bandung: Alfabeta.
- [18] Sukardi. 2011. *Evaluasi Pendidikan Prinsip dan Operasionalnya*. Jakarta: Bumi Aksara.