



Development of GAVIAMORIDA E-Booklet based on Diversity of Gastropods and Bivalves Research at Mangrove Morosari Demak as Alternative Source of Learning

Mar'atush Sholihah Romadhoni[✉], Priyantini Widiyaningrum, R. Susanti

Pascasarjana, Universitas Negeri Semarang, Indonesia

Article Info

Article History:
Received December 2020
Accepted January 2021
Published December 2021

Keywords:
E-Booklet, Research
Learning, Gastropoda,
Bivalvia

Abstract

The Mangrove Morosari Demak was once a densely populated area, but due to the abrasion process of the Java Sea, the area was eventually submerged. This condition affects the survival of Gastropods and Bivalves. This study aims to develop an e-booklet based on the research of Gastropods and Bivalves' Diversity in the Mangrove Morosari Demak. The e-booklet is named GAVIAMORIDA which stands for Gastropods and Bivalves in the Mangrove Morosari Demak. This development research uses the ADDIE method with 5 stages: Analyse, Design, Develop, Implement and Evaluate. This research resulted a kind of e-booklet "GAVIAMORIDA" with detailed information about 11 types of Gastropods and 1 Bivalves which found in the Mangrove Morosari Demak. The average value of diversity index (H') is 2.116 (moderate), evenness index (E) is 0.912 (high), and dominance index (C) is 0.131 (stable). The results of the validation from two kinds validators (experts and users) were 85.61% which were classified as "very valid" and "Feasible to produce with revisions according to suggestions". The results of the effectiveness of the GAVIAMORIDA e-booklet showed a high N-Gain value of 0.73. The conclusion of this study is the GAVIAMORIDA e-booklet feasible and effective as an alternative source of learning for high school students.

[✉] correspondence:
JalanKelud Utara III No.37, Kota Semarang, Jawa Tengah,
Indonesia 50237
E-mail: ms.romadhoni19@gmail.com

INTRODUCTION

Biology as the branch of science is sciences dealing with the study of life in the universe (Ibrahim & Nur, 2002). Biology learning implements the of investigating, exploring, and discovering a natural phenomenon. Biology is more than just a collection of facts or concepts, as in biology there is also a series of processes and values that can be applied to a scientific attitude (Saptono, 2009). The goal of learning biology is to develop intellectual competences such as independent learning, problem solving, decision making, and critical thinking (Barak & Shakhman, 2008). Apart from being able to help students understand about facts, concepts, and principles of biology, it can also develop their scientific attitude.

Scientific studies are closely related to the inquiry learning approach (Permendikbud No. 22/2016). The inquiry learning approach has a similar stage to research which contains a series of investigative activities. Wulandari et al. (2017) composes research as the basis for making student learning resources. The result shows that students get more information than school books. Research-based learning resources can also have a positive impact on improving creative thinking and student learning outcomes (Margunayasa et al., 2019). Especially if the research carried out is contextual, it has a strong potential to improve the quality of learning and stimulate notification to keep abreast of scientific developments (Rahmatih et al., 2017). However, there are a few research studies on type of resource-based learning and raise the local potential.

Research results can be published in journal form, but can also be used as *e-booklets*. E-booklet is one of the learning resources by design that can be used to support the learning process if the contents are adjusted to Core Competencies and Basic Competencies (Yani, 2018). Informative e-booklets with attractive designs may foster students' curiosity, so it can improve their understanding of the material (Pralisaputri, 2016).

Permendikbud 65 in 2013 also mentions that the environment can be used as an alternative source of learning. This is in line with the opinion of Suhardi (2008) that the environment can be appointed as a source of learning biology. There are several natural potentials in the Semarang area that can be used as a learning resource, one of which is the Morosari Demak Mangrove area. The area forms an estuary area with a mangrove forest ecosystem.

The variety of Gastropods and Bivalves species as bioindicators in aquatic ecosystems can be used as

an alternative source of more contextual learning (Macintosh et al., 2002). Some of the purposes of this research are: (1) To study the diversity of Gastropods and Bivalves in the Morosari Mangrove forest to be used as a learning resource for students, (2) Develop a valid research-based GAVIAMORIDA e-booklet, (3) Analyze the effectiveness of the GAVIAMORIDA e-booklet as an alternative. learning resources for high school students.

METHODS

The research design used was Research and Development (R&D). The type of product produced in this study was a e-booklet which named GAVIAMORIDA (Gastropods and Bivalves in Mangrove Morosari Demak). This research and development used the ADDIE model consisted 5 phases, namely Analysis, Design, Development, Implementation and Evaluation (Figure 1.).

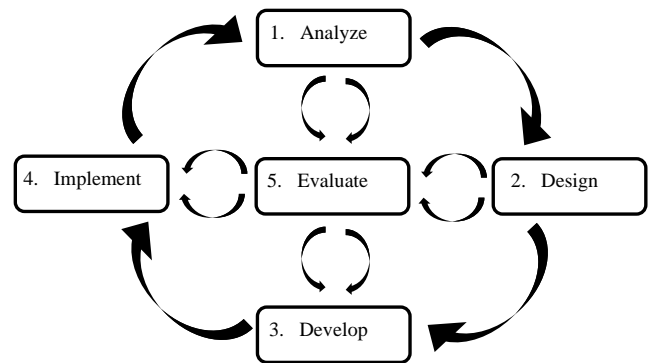


Figure 1. ADDIE Model of Research and Development (Adoobie, 2015)

1. Analyze Phase contains research activities to study the diversity of Gastropods and Bivalves in the Morosari Mangrove Forest. The sampling technique uses line transects with 5 stations. Also measured abiotic factors such as temperature, pH, salinity, and the kind of substrate. The data taken is the counting of the number of Gastropod and Bivalvian species found in each square. Analysis of biodiversity data are calculated using 3 different types of formula according to Fachrul (2007):

a. Diversity Index by Shannon – Wiener:

$$H' = - \sum P_i \cdot \ln \cdot P_i$$

Equation 1, where:
 H' = diversity index
 n_i = value of each individual
 N = the total number of all

with, $P_i = \frac{n_i}{N}$

b. Evenness Index

$$E = \frac{H'}{\ln(S)}$$

Equation 2, where:
 E=Evenness index
 H'=Diversity index
 S=species number

c. Simpson Dominance Index

$$C = \sum(P_i)^2 \quad \text{with} \quad P_i = \frac{n_i}{N}$$

Equation 3, where:
 C=Dominance index
 n_i= value of each individual
 N= the total number of all

2. Design Phase, namely the processes of product design, both determining the software, size requirements, and content of the materials used in designing the e-booklet GAVIAMORIDA (Gastropods and Bivalves in Mangrove Morosari Demak). The e-booklet structures consist of: (1) Title/Identity of the e-booklet, (2) Foreword, (3) Table of contents, (4) KI and KD, (5) Mangrove Morosari Demak, (6) *Phylum Molusca*, (7) The Class Gastropoda, (8) The Class Bivalvia, (9) Sampling Technique, (10) Gastropods and Bivalves in Morosari Demak Mangrove, (11) Exercise Questions, (12) Bibliography, (13) Author Biography. Data analysis using descriptive qualitative.
3. Develop Phase, namely developing the GAVIAMORIDA e-booklet in the form of a soft PDF file with the eligibility standards of BSNP (2006). The requirements for the eligibility component include the feasibility of content, language, presentation and graphics. The results of the e-booklet are then tested for validity by two types of validators (expert experts and users). Expert experts include media experts and subject matter experts, while users include biology teachers and students. The instrument used to collect data was an online questionnaire from *Google Form* in the form of a *liner scale* (score levels from 1 to 4). The data were then analyzed descriptively quantitatively in the form of a percentage with the formula:

$$P = \frac{f}{n} \times 100\%$$

Equation 4, where:
 P = Percentage

E-booklet products are valid if the percentage of validity is above 62.6%.

4. Implementation stage (Implement), namely testing the use of the GAVIAMORIDA e-booklet product as an alternative learning resource. The trial was

carried out on 40 students in learning activities. Learning activities are carried out online using the Google Classroom application. The trial design uses One Group Pre-Test - Post Test Design, which means that it is only applied to one group without a comparison group.

The first meeting included introductions and giving pretest with an online question at this link <https://www.liveworksheets.com/2-vm317727lc>. At the second meeting, the students were given lesson about Gastropods using GAVIAMORIDA e-booklet. At the third meeting, the students were given an online posttest with the following link <https://www.liveworksheets.com/2-dm324242ze>. The types of pretest and post test questions were interactive questions that were done in two ways, namely drop-down selected box and drag and drop.

The results of the student's answers are then sent to the teacher's e-mail. Student scores are processed automatically by the system so that when the teacher opens the e-mail, the student's answer sheet is completely marked. The analysis was carried out by quantitative descriptive by calculating the N-Gain value from the pretest and posttest. The normalized gain can be calculated with the following equation:

$$g = \frac{S_{posttest} - S_{pretest}}{S_{max} - S_{pretest}}$$

Equation 4, where:
 g =N-Gain
 S = score

Table 1. N-Gain Criteria (Hake, 2002)

Gain Index	Category
$0.71 \leq g \leq 1,00$	High
$0.31 \leq g \leq 0.7$	Moderate
$g \leq 0.3$	Low

5. Evaluation Phase is an evaluation that is carried out in two ways, namely formative and summative evaluation. Formative evaluation is an evaluation that is carried out internally at each stage of the step (ISFET, 2020). Formative evaluation aims to revise the product based on the legibility aspects. Refinements are made on the basis of assessments from subject matter experts, media experts and user responses (teachers and students). While summative evaluation is measured in terms of its function in learning. This can be seen from the increase in learning outcomes before and after using the GAVIAMORIDA e-booklet. The refinement of formative and summative evaluation results a viable and an effective product.

Table 2. Diversity, Evenness and Dominance of Gastropod Species in Morosari Mangroves

No	Spesies	Station					Mean
		I	II	III	IV	V	
1	<i>Cerithidea cingulata</i>	32	40	37	38	42	38
2	<i>Cassidula nucleus</i>	33	39	41	35	35	37
3	<i>Telescopium telescopium</i>	28	31	25	28	26	28
4	<i>Cerithidea obtusa</i>	35	28	33	30	31	31
5	<i>Terebralia sulcata</i>	24	27	28	30	31	28
6	<i>Littorina carinifera</i>	33	28	25	20	26	26
7	<i>Cerithium kobelti</i>	20	22	25	18	21	21
8	<i>Bellamya javanica</i>	9	8	5	3	4	6
9	<i>Pila scutata</i>	5	4	7	3	0	4
10	<i>Pila ampullacea</i>	6	4	0	3	2	3
11	<i>Pleuroploca filamentosa</i>	8	4	3	0	0	3
	Total of individual	233	235	229	208	218	225
	Total of spesies per station	11	11	10	10	9	10
	H'	2.229	2.167	2.111	2.059	2.015	2.116
	E	0.929	0.904	0.917	0.894	0.917	0.912
	C	0.118	0.126	0.131	0.139	0.141	0.131

RESULTS AND DISCUSSION

a) Diversity of Gastropods and Bivalves in Morosari Demak

Research on the diversity of Gastropods and Bivalves in the Morosari Mangrove area identified 11 species of Gastropods and 1 Bivalvia. One species of Bivalvia found is *Mytilus viridis*. The identification results of diversity, uniformity, and dominance species of gastropods are shown in Table 2.

The calculation results show the mean of H'(2.116), E (0.912), and C (0.131). Diversity index is classified as moderate if the value range is between 1.0 - 3.0 (Fachrul, 2007). If the value of evenness $E \approx 1$, the evenness of species is high (Odum in Fachrul, 2007). This indicates that the distribution of species is evenly distributed and no one dominates. The dominance index supports this, with a value of 0.131. According to Odum in Fachrul (2007), if the dominance index ranges from $0 < C < 0.5$, then no species will dominate (stable).

Abiotic parameters were measured at the same time as the sampling time. The results of measurements of water temperature at 5 stations ranged from 27-30oC, water pH 6-7, and salinity 26-30ppt. There are variations in numbers between stations due to differences in measurement time. The optimal temperature range to support the body's metabolism from Gastropods according to Suwondo, et.al. (2006) are in the range 25 - 35oC. The degree of acidity (pH) that supports the life of gastropods according to Wijayanti (2007) is in the range of 5.8 -

8.3. The optimal salinity for gastropod survival ranges from 20 - 36 ppt (Ariestika, 2006). The results of the abiotic parameters in the Morosari Mangrove area were classified as normal and good for the growth and reproduction of Gastropods

b) Results of the Validity of GAVIAMORIDA E-booklet Product Development

The product developed is a soft PDF file with a size of B5 and a total of 30 pages. The results of the validation recapitulation from experts and users are shown in the Table 3.

Table 3. Validation Result of E-booklet

Validator	Score	Score Max.	%	Mean
Media's expert	34	40	85.00	85.61 very Valid
Material's expert	39	48	81.25	
Teachers	86	96	89.58	
Students	589	680	86.62	

The validation results show the mean percentage of 85.61% (very valid). The conclusion of the feasibility given by the media expert, subject matter expert, and 2 biology teachers is "feasible to be produced with revisions". The development of the GAVIAMORIDA e-booklet did not stop until the stage was declared feasible, but continued with revisions according to suggestions. The results of the revised display of the GAVIAMORIDA e-booklet were then shown again to the four validators to get approval so that they could be used in learning as an alternative source of student learning.

c) The Effect of GAVIAMORIDA E-booklet on Student Learning Outcomes

The GAVIAMORIDA e-booklet that had passed the feasibility test will then be tested for its effectiveness. The effectiveness test was conducted to investigate the effect of the GAVIAMORIDA e-booklet on improving student learning outcomes on Gastropods and Bivalves material. The increase in student learning outcomes was calculated from the Gain Pretest and Posttest scores. Student scores will be automatically processed by the system so that when the answers have been sent to the teacher's e-mail, the results of the scores will appear. The maximum score for student work is 10. The result of the N-Gain value is 0.73 (high). This shows that the GAVIAMORIDA e-booklet is effective in improving student learning outcomes.

$$g = \frac{S_{Post\ test} - S_{Pre\ test}}{S_{max} - S_{Pre\ test}} = \frac{8.97 - 6.48}{10 - 6.48} = 0.73$$

Figure 2. Calculation of the N-Gain Score

CONCLUSION

This research resulted a kind of e-booklet "GAVIAMORIDA" with detailed information about 11 types of Gastropods and 1 Bivalves which found in the Mangrove Morosari Demak. The average value of diversity index (H') is 2.116 (moderate), evenness index (E) is 0.912 (high), and dominance index (C) is 0.131 (stable). The results of measurement of abiotic parameters showed that the water temperature at 5 stations ranged from 27-30°C, the pH of the water was 6-7, and a salinity of 26-30ppt. The abiotic parameter values are classified as normal and good for the growth and reproduction of Gastropods. The results of the validation from two kinds validators (experts and users) were 85.61% which were classified as "very valid" and "Feasible to produce with revisions according to suggestions". The results of the effectiveness of the GAVIAMORIDA e-booklet showed a high N-Gain value (0.73). This means that e-booklets are effective for improving student learning outcomes.

REFERENCES

Aldoobie, N. (2015). ADDIE Model. American International Journal of Contemporary Research, 68-72.

- Ariestika. (2006). Karakteristik Padang Lamun dan Struktur Komunitas Moluska (Gastropoda dan Bivalvia) di Pulau Burung, Kepulauan Seribu. Bogor: Institut Pertanian Bogor.
- Barak, M., & Shakhman, L. (2008). Reform-based science teaching: Teachers' instructional practices and conceptions. *Eurasia Journal of Mathematics, Science & Technology Education*, 4 (1), 11-20
- BSNP. (2006). Instrumen Penilaian Buku Teks Pembelajaran Pendidikan Dasar Menengah. Jakarta: Depdiknas
- Fachrul, M. F. (2007). Metode Sampling Bioekologi. Jakarta: Bumi Aksara.
- Hake, R.R. (2002). Analyzing Change/Gain Score. Indiana: Indiana University
- Ibrahim, M., & Nur, M. (2002). Pembelajaran Berdasarkan Masalah. Surabaya: UNESA University Press
- ISFET. (2020). ADDIE MODEL for Instructional Design. Retrieved from ISFET(International Society for Education Technology)
- Macintosh, D., Ashton, E., & Havanon, S. (2002). Mangrove Rehabilitation and Intertidal Biodiversity: A Study in the Ranong Mangrove Ecosystem, Thailand. *Estuarine, Coastal and Shelf Science* 55, 331 – 345
- Mahendrani, K & Sudarmin. (2015). Pengembangan Booklet Etnosains Fotografi Tema Ekosistem untuk Meningkatkan Hasil Belajar pada Siswa SMP. *Jurnal UNNES*, 4(2), 866-872
- Margunayasa, I. G., Dantes, N., Marhaeni, A. A. I. N., & Suastra, I. W. . (2019). The Effect of Guided Inquiry Learning and Cognitive Style on Science Learning Achievement. *International Journal of Instruction*, 12, (1), 737-750.
- Permendikbud, N. 6. (2013). Standar Proses Pendidikan Dasar dan Menengah. Jakarta: Menteri Pendidikan dan Kebudayaan Republik Indonesia.
- Permendikbud, N. 22. (2016). Standar Proses Pendidikan Dasar dan Menengah. Jakarta: Menteri Pendidikan dan Kebudayaan Republik Indonesia
- Pralisaputri, K. H. (2016). Pengembangan Media Booklet Berbasis SETS pada Materi Pokok Mitigasi dan Adaptasi Bencana Alam untuk Kelas X SMA. *Jurnal GeoEco*, 2 (2), 147 – 154
- Rahmatih, Aisa, Ari Yuniastuti, R. Susanti. (2017). Pengembangan Booklet Berdasarkan Kajian

- Potensi dan Masalah Lokal Sebagai Suplemen Bahan Ajar SMK Pertanian. *Journal of Innovative Science Education, JISE* 6 (2).
- Saptono, S. (2009). *Buku Ajar Strategi Belajar Mengajar Biologi*. Semarang: UNNES
- Suhardi. (2008). *Diklat: Pengembangan Sumber Belajar Biologi*. Yogyakarta: Jurdik FMIPA
- Suwondo, E, Febrita F, Sumanti. (2006). Struktur Komunitas Gastropoda pada Hutan Mangrove di Pulau Sipora Kabupaten Kepulauan Mentawai Sumatra Barat. *Jurnal Biogenesis* 2(1), 25-29.
- Wijayanti, H. (2007). Kualitas Perairan di Pantai Kota Bandar Lampung berdasarkan Komunitas Hewan Makrozoobenthos (Tesis). Semarang: Program Pasca Sarjana Universitas Negeri Diponegoro.
- Wulandari, Priyantini Widiyaningrum, Ning Setiati. (2017). Pengembangan Suplemen Bahan Ajar Biologi Berbasis Riset Identifikasi Bakteri untuk Siswa SMA. *Journal of Innovative Science Education, JISE* 6 (2).
- Yani, A. M. (2018). Efektivitas Pendekatan Saintifik dengan Media Booklet Higher Order Thinking terhadap Hasil Belajar Siswa SMA di kabupaten Wajo. *Jurnal Biology Science & Education*, 1, 1-12