Local Potential of West Kalimantan’s Mangrove Ecosystem as A Study Material in Biology Education at Mangrove Area School

Mendala¹, I G P Suryadarma²

¹Graduate Program of Biology Education, Yogyakarta State University, Indonesia
²Biology Education Departement, Faculty of Mathematics and Natural Science, Yogyakarta State University, Indonesia

*mendala95@gmail.com

Abstract. West Kalimantan has the local potential of mangrove ecosystems to become a source of biology education. Utilizing the local potential as a source of learning provides opportunities for students to understand phenomena directly from nature so that they can foster environmental care attitude. This research aims to create a study material in the form of student worksheets or Lembar Kerja Peserta Didik (LKPD) based on the local potential of the mangrove ecosystem in West Kalimantan. The method used in this research was the Four-D (4D) Research and Development model proposed by Thiagarajan. The data were collected through validated questionnaires and student response questionnaires. The results showed that the developed LKPD was feasible to use, seen from the results of the validator’s assessment with an average value on each aspect at 87.60% (very valid category) as well as the practicality value of the students’ responses with an average value on each aspect at 86.14% (very good category). The developed LKPD can also enhance the understanding in biology education about mangrove ecosystems and fostering an environmental care attitude and scientific attitude. Hence, it becomes a solution to anticipate environmental damage in Indonesia, especially through the mangrove forest conservation area in West Kalimantan.

1. Introduction

A local potential is a resource specifically owned by only a certain area in the form of natural resources, human resources, technology and culture [1]. Local potential has many benefits, and one of them is in the education field [2]. Some previous studies have succeeded in exploiting the local potential for advancement in education. Sahlberg in 2007 wrote about the success of Finland utilizing its potential of local natural resources for economic and social development through education [3]. Zoller in 2013 also did a research on the use of local potential through the SETS approach (Science, Environment, Technology, and Society) which can increase HOTS (Higher Order Thinking Skills) [4].

West Kalimantan is a province in Indonesia that has a lot of local potentials, one of which is mangrove forest conservation. Mangrove forest in West Kalimantan ranks the second largest of the total area of mangrove forests in Indonesia after Irian Jaya, which is 978,200 hectares (28%), with high biological diversity and a very varied structure [5].

Mangroves have unique and distinctive ecosystems because they are found in tidal zones at coastal areas, beaches and small islands [6]. Mangrove ecosystem describes a natural system in which there is the life of interacting organisms [7]. Mangrove ecosystem also has many benefits for human life, animals, and ecological balance [8]. Some of the benefits include keeping the coastline stable, protecting from abrasion, spawning and growing sources of postlarvae of fish, shrimp, crabs, shellfish...
and other biodiversity, sources of fuelwood and building wood, and having conservation, education, ecotourism and cultural identity [9], [10], [11].

Although the mangrove forest ecosystem has many benefits, it cannot be fully protected from damage. The main factors causing damage to the sustainability of mangrove forest ecosystems are human activities such as aquaculture, human settlement, plantation, and industry. It is proven that the mangrove forests in Indonesia were damaged around 68% or 5.9 million hectares of the total area of 8.6 million hectares [12]. The damage occurred in the mangrove forest area is a real example of the lack of public awareness for the environment. Then, to develop this attitude is slightly difficult and needs a long time [13].

The dynamics above require a special strategy, one of which is in the field of education by teaching students to early care for the environment. One of the potential subjects to learn is biology [14], because biology education can utilize the environment as a learning source, in accordance with one of its basic competencies analyzing data on environmental changes, causes, and their impact on the life [15], [16]. In order to make a biology education process more focused, students can easily explore the surrounding environment, and study materials that can be used are student worksheet or Lembar Kerja Peserta Didik (LKPD) [17].

LKPD is one of the study materials that can assist and facilitate teaching and learning activities so that there will be an effective interaction [17]. In addition, the use of LKPD in the learning process using the real object (West Kalimantan's mangrove ecosystem) can fulfill study material which is suitable for the 2013 curriculum [18]. At the end of the recent research, a modified LKPD based on the local potential of West Kalimantan, particularly the mangrove forest ecosystem can foster a sense of environmental care and character.

2. Methodology
The method of this research was the method of Four-D (4D) Research and Development model by Thiagarajan [19]. The 4D development model by Thiagarajan has four stages, namely: Define, Design, Develop, and Disseminate. However, this study focused more on the stages of the Develop. This research was conducted at Batu Ampar Public High School, Kubu Raya, West Kalimantan.

2.1 Research Procedure
The procedure for the 4D research and development model has activities at each step of its development [20]. These activities include: (a) Define; this research was carried out with several analyzes, namely analysis of core competencies and basic competencies at the current curriculum, analysis of student’s characteristics in the school where the research was conducted, analysis of study materials as a basis for understanding the scope of material included in the LKPD, and task analysis to identify types of the teacher’s assignment when implementing the LKPD and identify learning objectives specifically, so that the learning objectives in the LKPD are in accordance with the objectives proposed in the curriculum. (b) Design; this activity needs an LKPD design in the form of a prototype for students. In the design phase, the materials included in the LKPD were modified with the local potential of West Kalimantan, especially the conservation of mangrove forest ecosystem. (c) Develop; this phase involves a validation process to assess the feasibility of LKPD and the process of analyzing the practicality using student’s responses. The LKPD validation in this study was carried out by media expert, study material expert, and teachers by providing validation questionnaires. Besides, the analysis of the practicality of the LKPD was examined by providing a response questionnaire for 30 students.

2.2 Data Analysis
Data analysis in this study is as follows: (1) validation analysis of student worksheet; (2) practicability analysis of developed student worksheet; and (3) effectiveness analysis of developed student worksheet. The detail of the analysis we conducted is as follows:

2.2.1 Analysis of LKPD Development Validity
To measure the level of validity of the LKPD development products, the researchers used the following formula [21]:

\[ P = \frac{\sum x}{\sum x_i} \times 100\% \]

Note
- \( P \): Percentage
- \( \sum x \): Number of respondents’ score in 1 item
- \( \sum x_i \): Ideal score in item
- 100 \%: Constanta

To make decisions in revising the LKPD, the following assessment criteria were used [21]:

| Achievement Level (%) | Criteria for Validity | Description |
|-----------------------|-----------------------|-------------|
| 80 – 100              | Very valid            | No revision |
| 66 – 79               | Valid                 | No revision |
| 56 – 65               | Quite valid           | No revision |
| 40 – 55               | Less valid            | Revision    |
| 30 – 39               | Not valid             | Revision    |

2.2.2 Analysis of LKPD Development Practicability

Analysis of LKPD development practicability used the following steps [22]:

- Create a score for answer choices using Likert scales.

| Table 2. Likert Scale’s Score |
|------------------------------|
| **Answer Categories** | **Scores for Items** |
| -----------------------|---------------------|
| Positive | Negative |
| STS | 1 | 4 |
| TS  | 2 | 3 |
| S   | 3 | 2 |
| SS  | 4 | 1 |

Note: STS (Strongly Disagree), TS (Disagree), S (Agree), SS (Strongly Agree)

- Look for the percentages using the following formula below after calculating the total score of student’s responses for each statement item.

\[ \% NRS = \frac{\sum_{i=1}^{n} NRS}{\text{Maximum NRS}} \times 100\% \]

Note
- \( \% NRS \): Percentage of Student Response Score (NRS)
- \( \sum_{i=1}^{n} NRS \): Total Score of Student Response (NRS) for each question
- Maximum NRS: \( n \times \) best choice score
  \( n \times 4 \), where \( n \) is the number of total respondents

- Interpret student’s response using the following assessment criteria:

| \% NRS | Category |
|--------|----------|
| 0\% ≤ \%NRS < 25\% | Very Less |
| 25\% ≤ \%NRS < 50\% | Less |
| 50\% ≤ \%NRS < 75\% | Good |
| 75\% ≤ \%NRS ≤ 100\% | Very Good |
3. Result and Discussion

The product of the research and development is a modified LKPD of biology education based on the local potential of West Kalimantan, particularly the mangrove forest ecosystem. To create this, there were several processes, especially in the initial concept, namely requesting validator’s responses from media expert, study material expert, and teacher. Then, the researchers revised the LKPD based on the validators’ feedbacks. Besides, the researchers also asked the students to respond to the practicality of the developed LKPD. The results of the responses from the validators and students can be seen in the following table:

| No. | Aspect               | Validity (%) |
|-----|----------------------|--------------|
| 1   | Content feasibility  | 87.25        |
| 2   | Language             | 87.57        |
| 3   | Presentation         | 90.23        |
| 4   | Graphic              | 85.33        |
|     | Average value        | 87.60        |
|     | Categorized to       | very valid   |

Based on table 4, about the results of validators’ responses, it can be seen that the category of each aspect was very valid at an average value of 87.60%. Then, the analysis results of the practicality of the LKPD using students’ responses can be seen in Table 5.

| No. | Aspect                  | Students’ Response (%) |
|-----|-------------------------|------------------------|
| 1   | Ease of understanding   | 89.16                  |
| 2   | Independence in learning| 85.83                  |
| 3   | Activity in learning    | 82.91                  |
| 4   | Learning interest       | 87.78                  |
| 5   | LKPD presentation       | 84.33                  |
| 6   | LKPD use                | 86.87                  |
|     | Average value           | 86.14                  |
|     | Categorized to          | very good              |

Based on table 5, regarding the results of the LKPD practicality analysis showed an average aspect at 86.14%. Thus, the criteria for the practicality of LKDP was very good.

The results of validation and analysis of the practicality of LKPD developed by utilizing the local potential of West Kalimantan, particularly the potential of mangrove ecosystem, can answer the question of this current study. Local potential has a very large contribution to the education field, especially biology education in which the local potential becomes an interactive learning resource. In addition, the results of the interviews with several biology teachers in the West Kalimantan mangrove forest area have not fully utilized the local potential in the learning process and still use study materials prepared by the government. The learning resources prepared by the government are general, have not reflected yet the characteristics of the region where the learners live and are able to have an impact on the learning process that is less meaningful. Meanwhile, Appendix IV of the Minister of Education and Culture Decree Number 81 A in 2013 stated that study materials must support the achievement of Basic Competencies (KD) with implications for the relevance of the characteristics of each region [23].

LKPD developed by utilizing local potential as a source of biology education in the schools around mangrove forest has represented a study material that is feasible to use, seen from the results of validation analysis which includes aspects of the feasibility of content, language, presentation, and graphics and has very valid categories of each aspect. The results of practicality analysis on several
aspects including aspects of the understanding, independence, activeness, interest, presentation, and its use also showed very good category.

Apart from being a source of learning, the use of local potential can also help students foster environmental care attitudes [21], [24] which must be developed early. This statement is in line with the handbook of the development of cultural and national character education published by the Ministry of National Education in 2010. The environmental care attitudes enable the students to have a sense of responsibility to prevent the environment from damage in that Indonesia suffered a lot of environmental damage due to human factors nowadays [25]. Inevitably, the destruction of the mangrove forest ecosystem in West Kalimantan becomes a clear indicator of the lack of the community’s environmental care attitude towards the environmental sustainability and balance.

Developing an environmental care attitude to individuals requires a very long, careful, and systematic time [26]. Various groups of people need to have active roles to help them develop this attitude, and one of them is through the school environment. Moreover, utilizing the local potential in each region as a source of biology education, which is the developed LKPD, provides opportunities for students to directly observe the phenomena that occur in nature or what is known as the outdoor learning process. It is in line with the 2013 curriculum which emphasizes the learning process that should be based on the implementation in daily life. The offered learning context also involves students to real objects in the form of the local potential of each region in the study material [15]. Thus, if there is a direct interaction between students and the environment, it can help foster environmental care attitude and generate scientific principles [24].

The learning process which is based on scientific principles provides an insight to the students to recognize and understand the concepts, laws, and principles related to phenomena or events around them [27]. The scientific approach is a part of a pedagogical approach to the implementation of learning that can produce graduates who are able to think critically, logically, systematically, and scientifically that have influences on the students’ attitude developments (affective domain), skills (psychomotor domain), and knowledge (cognitive domain) [28].

4. Conclusion

The development of study materials in the form of LKPD by utilizing the local potential of West Kalimantan showed the feasibility seen from the aspect of validity with a very valid category and practicality with very good categories. Besides, the developed LKPD can also enhance the understanding in biology education about mangrove ecosystems and fostering an environmental care attitude and scientific attitude, hence, it becomes a solution to anticipate environmental damage in Indonesia, especially through the mangrove forest conservation area in West Kalimantan.

References

[1] P. Hariyadi, “Penguatan Industri Penghasil Nilai Tambah Berbasis Potensi Lokal Peranan Teknologi Pangan untuk Kemandirian Pangan,” *J. Pangan*, vol. 19, no. 4, p. pp 295-301, 2010.
[2] S. Sarah, “Peningkatan Keterampilan Berpikir Kreatif Melalui Pembelajaran Fisika Berbasis Potensi Lokal,” *JIPFRI (Jurnal Inov. Pendidik. Fis. dan Ris. Ilmiah)*, vol. 2, no. 2, p. pp 84-94, 2018.
[3] P. Sahlberg, “Education policies for raising student learning: The Finnish approach,” *J. Educ. Policy*, vol. 22, no. 2, p. pp 147-171, 2007.
[4] U. Zoller, “Science, Technology, Environmental, Society (STES) Literacy for Sustainability: What Should it Take in Chem/Science Education?,” *Educ. Quim.*, vol. 24, no. 2, p. pp 207-214, 2013.
[5] I. N. N. S. Yus Rusila Noor, M. Khazali, *Panduan Pengenalan Mangrove di Indonesia*, Kedua., no. 13507033. Bogor: PHKA/WI-IP, 2010.
[6] R. Novianty, S. Sastrawibawa, and D. J. P., “Identifikasi Kerusakan dan Upaya Rehabilitasi Ekosistem Mangrove di Pantai Utara Kabupaten Subang,” *J. Perikan. dan Kelaut.*, vol. 3, no. 1, p. pp 41-47, 2012.
[7] S. Winarno, “Strategi Pengelolaan Mangrove Melalui Analisis Tingkat Kerusakan (Studi Kasus : Kecamatan Teluk Bintan, Kabupaten Bintan),” IPBr, Bogor, 2016.
[8] R. Maulana, “Struktur Komunitas Gastropoda pada Ekosistem Mangrove di Kawasan Pesisir Batu Ampar Kalimantan Barat,” Bogor, 2004.
[9] C. Bann, *Economy and Environment Program for Southeast Asia The Economic Valuation of Mangroves: A Manual for Researchers*, 1st ed. Singapore: IDRC-Lib, 1998.
[10] S. C. S. Lawrence S. Hamilton, *Handbook for Mangrove Area Management*, no. 1984. Switzerland: IUCN, Avedu Mont-Blanc, 1984.
[11] K. winarno Ahmad Dwi Setyawan, “Conservation problems of mangrove ecosystem in coastal area of Rembang Regency, Central Java,” *Biodiversitas, J. Biol. Divers.*, vol. 7, no. 2, p. pp 159-163, 2006.
[12] N. F. Edi Mulyadi, “Konservasi Hutan Mangrove Sebagai Ekowisata,” *J. Ilm. Tek. Lingkung.*, vol. 2, no. 1, p. pp 11-18.
[13] S. Khanafiya and D. Yulianti, “Model Problem Based Instruction Pada Mengembangkan Sikap Kepedulian Lingkungan,” *J. Pendidik. Fis. Indone. (Indonesian J. Phys. Educ.)*, vol. 9, no. 1, p. pp 35-42, 2013.
[14] B. S. Adi Pasah Kahar, Nuryani Rustaman, “A Study of Mangrove Forest Potency in Parit Belida and Ecosystem Teaching Material Development,” in *Seminar Nasional XII Pendidikan Biologi FKIP UNS*, p. pp 360-364.
[15] R. P. Situmorang, “Analisis Potensi Lokal Untuk Mengembangkan Bahan Ajar Biologi Di SMA Negeri 2 Wonosari,” *J. Pendidik. Sains*, vol. 4, no. 1, p. pp 51-57, 2016.
[16] Permendikbud, *Kompetensi Inti dan Kompetensi Dasar Pelajaran Pada Kurikulum 2013 Pada Pendidikan Dasar dan Pendidikan Menengah*, no. 1. 2016, pp. 1–7.
[17] M. Nurul Azmi, Puji Prastowo, “Analisis Kesesuaian Lembar Kerja Peserta Didik (LKPD) Biologi Kelas X yang Digunakan MAN Rantauprapat Kabupaten Labuhan Batu,” *J. Pelita Pendidik.*, vol. 6, no. 2, p. pp 65-70.
[18] A. L. Alvina Putri Purnama Sari, “Pengembangan Lembar Kegiatan Peserta Didik (Lkpd) Berbasis Scientific Approach Siswa Sma Kelas X Pada Materi Fungi,” *J. Bioedukasi Pendidik. Biol. Univ. Muhammadiyah Metro*, p. pp 41-48, 2016.
[19] Thiagarajan and M. I. S. Sivasaailam,Dorothy Semmel, *Instructional Development for Training Teachers of Exceptional*, no. Mc. Indiana: Indiana University, Indiana, 1920.
[20] E. Mulyatiningsih, *Terapan Riset Bidang Pendidikan & Teknik*. Yogyakarta: UNY Press, 2011.
[21] S. Ilma and F. Wijarini, “Development of Environmental Education Textbook Based on Local Potencies,” *Indones. J. Biol. Educ.*, vol. 3, no. 3, p. pp 194-201, 2017.
[22] M. Rizky Wahyu Indriyani, “Penerapan Model Pembelajaran Ideal Problem Solving dalam Menyelesaikan Masalah Matematika pada Materi Keliling dan Luas Persegi Panjang bagi Siswa Kelas VII SMP,” *J. Ilm. Pendidik. Mat.*, vol. 2, no. 5, p. pp 1-9, 2016.
[23] Depdiknas, *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 81 A, Tahun 2013 Tentang Implementasi Kurikulum*. 2013.
[24] Y. T. Ramli Utina, Abubakar Sidik Katiili, Elya Nusantari, “Coastal Ecosystems Capacity as a Study Material in Biology Learning in the Coastal Areas,” *Aust. J. Basic Appl. Sci.*, vol. 11, no. 13, p. pp 122-127, 2017.
[25] P. Inur Tivani, “Pengembangan LKS Biologi Berbasis Masalah untuk Meningkatkan Kemampuan Pemecahan Masalah dan Karakter Peduli Lingkungan,” *J. Inov. Pendidik. IPA*, vol. 2, no. 1, p. pp 35-45, 2015.
[26] R. P. Kurnia and I. G. P. Suryadarma, “Perangkat Pembelajaran Biologi Kegiatan Ecotourism untuk Mengasah Keterampilan Proses Sains dan Sikap Peduli Lingkungan Biological Learning Kits for Ecotourism Activity for Sharpening Science Process Skills and Attitude of Environment Awareness,” *J. Inov. Pendidik. IPA*, vol. 2, no. 2, p. pp 230-240, 2016.
[27] R. S. Dwi Putri Julianti, “The Development of Student Worksheet Based on Scientific Approach on Environmental Pollution Topic For Junior High School Student Grade VII,” *Int. J. Progress. Sci. Technol.*, vol. 10, no. 1, p. pp 11-18, 2018.
[28] N. MusfIQon, *Pendekatan Pembelajaran Saintifik*. Sidoarjo: Nizama Learning Center, 2015.