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Learning instructional using webbed models based on local potential "Pulau Kembang" to enhance ecological literacy skill

Desy Purwasih[*1], Insih Wilujeng[1], Vietgar Membalik[2], Suhandi Hasan[3]

[1]Department of Science Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

[2]Department of Plant Science, Wageningen University and Research, Wageningen, Netherland

[3]Department of Educational Leadership and Policy, Boston University, Boston, United States

*correspondence: desypurwasih.2020@student.uny.ac.id

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Abstract: The research is developing a webbed integrated science learning model based on the local potential "Pulau Kembang" discovery learning (DL) model to improve ecological literacy skills. The purpose of this research is to produce a product that is feasible, practical, and effective for use in learning. The type of research is educational research design by adapting the Borg & Gall development model, consisting of ten stages. Media experts, material experts, and practitioners conducted the feasibility assessment, totaling five people. The effectiveness was obtained from a limited trial with a pretest experimental design and a posttest control group design. There is one control class and one practical class with 49 students. The effectiveness analysis used the Analysis of Variance (ANOVA). The product practicality test provides a response questionnaire with a 4-Likert scale, totaling 27 statements. The results show that the average lesson plan is 1.00 in the excellent category, the student worksheets are on average 3.56 in the excellent category, the handout is on average 3.44 in the excellent category, and the assessment instrument with a V-Aiken value of 1.00 is in an excellent category. The results of the ANOVA test get a p-value < 0.005 and an effect size of 0.171 in the large category. Practicality test with an average of 3.08 suitable type. Overall, it shows that the webbed integrated model of science learning instructional based on local potential "Pulau Kembang" is feasible and practical to use in learning.

Keywords: Ecological literacy, Learning Instructional, Local Potential, Webbed Model

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INTRODUCTION

Wetlands have soil characteristics that are saturated with water either seasonally or permanently. Wetland areas occur where water meets the soil, such as peatlands, swamps, rivers, deltas, rice fields, and the coast. Wetlands are found in every country with different climate zones, from the poles to tropical areas such as Indonesia (Notohadiraprawiro, 2006). The largest wetland area is South Kalimantan, with around 1,194,471 hectares or 32.39% of the total land area. However, this area does not include offshore wetlands so it may be more expansive than the data presented (Gumbricht et al., 2017). Areas geographically dominated by wetland areas have an essential role in the current environmental problems. Wetlands that provide various ecosystems are one of the significant carbon sinks on the order of 830 Tg/year worldwide. Another role is to improve water quality, disaster mitigation, coastal protection, and the safety of living things (Mitsch et al., 2013).

Banjarmasin is a city where most of its area is dominated by wetlands such as rivers, swamps, peatlands, and deltas. These conditions affect people's living habits in daily activities such as bathing, washing clothes, and others in the river. In addition, the river is also a means of water transportation in Banjarmasin (Putra et al., 2016). These habits certainly cause environmental problems, especially in decreasing river water quality. Based on the research results, microplastics, heavy metals, and bacteria were found along rivers in Banjarmasin City (Arisanty et al., 2017; Mawardi & Annisa, 2021; Sofarini et al., 2021). If these contaminants are allowed to continue without any follow-up, prevention, and control, they can harm the ecosystems directly or indirectly. Polluted ecosystems will be damaged and disrupt the balance of the ecosystem. (Chae & An, 2018).

Human interactions with the environment influence the balance of the ecosystem. Human activities that always involve nature for an extended period indirectly disrupt the balance of the ecosystem. It is undeniable that the survival of humans and wildlife cannot be separated because humans and wildlife depend on each other. Humans are fully responsible for solving problems regarding the balance of the ecosystem. Solving problems regarding the environment requires a unique and sustainable design. Education becomes a place for a process of consciously changing the behavior of a person or group towards maturity and improving the quality of self, both knowledge and character. Education in schools involving continuous learning is the right place to practice skills to deal with environmental problems (Liu et al., 2020). In particular, students are prepared to adapt and formulate appropriate solutions for the survival of humans and nature in a balanced way without compromising.

Ecological literacy is one of the abilities that can encourage humans to adapt and be aware of the importance of the environment. Ecological literacy has various definitions, generally related to the component of knowledge about ecology to make decisions based on information through scientific principles. The results of previous studies indicate that human behavior, both activities, and decisions made, dramatically influences the sustainability of the environment (Bruyere, 2008; Lewinsohn et al., 2015). Practicing ecological literacy must start from an early age through environmental education, especially material on ecosystem balance through science learning. Science learning is essential in elementary and secondary schools because the topics discussed closely relate to nature.

In designing the learning process in the classroom, teachers must consider the characteristics of students and the learning environment. The design of the learning process is entirely represented in the learning instructions. Learning instructions contain several points such as lesson plans, teaching materials in worksheets, handouts, or modules as learning resources, and assessment instruments for tests or non-tests. (K. Dewi et al., 2013). Interviews with teachers regarding learning instruction used in schools concluded that learning instruction was prepared through a discussion in the subject teacher deliberations forum. According to previous research, the learning instructions were designed for general conditions, and these learning instructions were only intended to meet the minimum requirements in the curriculum. It is sporadic, or even nonexistent that innovations are made regarding the development of student competencies. (Dwianto et al., 2017; Febriyanti et al., 2021). As a result, during the implementation of learning, students are only fixated on the textbooks used.

Learning that focuses on textbooks as the primary learning resource is the right thing as long as the books provide comprehensive insight and knowledge. Unfortunately, the material presented in the textbooks limits students from exploring the knowledge due to a lack of instructions. Thus, many students are confused about connecting subject matter with everyday life. In fact, learning should be carried out based on needs and student-centered. Therefore, the characteristics of learning must be able to guide students to learn the context well. Research from Suryawati & Osman (2017) states that context-based learning (contextual teaching and learning) makes it easier for students to interpret learning and facilitates student-centered learning.

Implementing contextual learning can take advantage of the local potential around the environment where students live. Local potential can be in the form of regional uniqueness with high economic value and cannot be found in other regions. Several studies have shown that local potential related to science material is more easily presented in themes, one of which is by using the webbed integration model. (Dewi, 2017; Hidayat et al., 2016; Oktaviani & Halim, 2021; Suryadi et al., 2020). Previous research tends to develop thematic learning models for the elementary school level. Whereas in the 2013 curriculum, science learning at the junior high school level must also be presented in an integrated manner using the integration model. In addition, thematic learning has not shown integration between lesson plans, teaching materials, worksheets, or student handouts. Therefore, this research focuses on developing learning tools, namely lesson plans, worksheets, and handouts related to each other. In addition, the learning tools developed are also based on the local potential of “Pulau Kembang” (Kembang Island).

Kembang island is a sedimentary delta in the middle of the Barito River, which also functions as a nature tourism park and is dominated by the Rambai (*Baccaurea motleyana*) mangrove forest ecosystem, which is the habitat of long-tailed macaques and proboscis monkeys (*Nasalis larvatus*). Thus, from the context of scientific material, Pulau Kembang contains the concept of ecology. Besides,

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activities in the Kembang island area cause various environmental impacts related to environmental pollution. In addition, the process of forming Kembang island is unique; the river sedimentation is very compatible with the layer of earth material. Therefore, in its integration, the learning instructions use the webbed model and carry a theme easily recognized by students: "My Environment, Kembang island Tourism Park." This study aims to develop a webbed integrated learning model based on the local potential of Kembang island to improve the ability of Ecological literacy that is feasible, practical, and effective to use in learning.

METHOD

The research is the type of educational design research from Borg and Gall that have ten stages of procedures. The procedure according to this model is depicted in Figure 1. The development procedure begins with the first stages, research and information collection. Information collection is done by conducting a preliminary study to analyze the needs of both students and teachers. Based on the preliminary study, it was found that the learning model still uses direct learning with a scientific approach. Teachers also use contextual learning but have not used the local potential found in the local area.

The next step is product characterization, content analysis, and context analysis. The product characterization in this study is in learning instruction consisting of lesson plans, teaching materials such as worksheets and handouts, and test instruments for ecological literacy. The product is developed based on the local potential of Kembang island, located in South Kalimantan. In addition, the learning model used is discovery learning (DL), with six stages of learning.

Furthermore, content analysis was carried out to characterize the material used in the developed product (Yuberti, 2014). The content analysis results show that the researchers obtained three essential competencies following the product's characteristics. These three basic competencies, namely KD 3.7, KD 3.8, and KD 3.10, were integrated into a single theme, "My Environment, Kembang Island Tourism Park." The sub-themes based on KD integration using the webbed model can be seen in Figure 1.

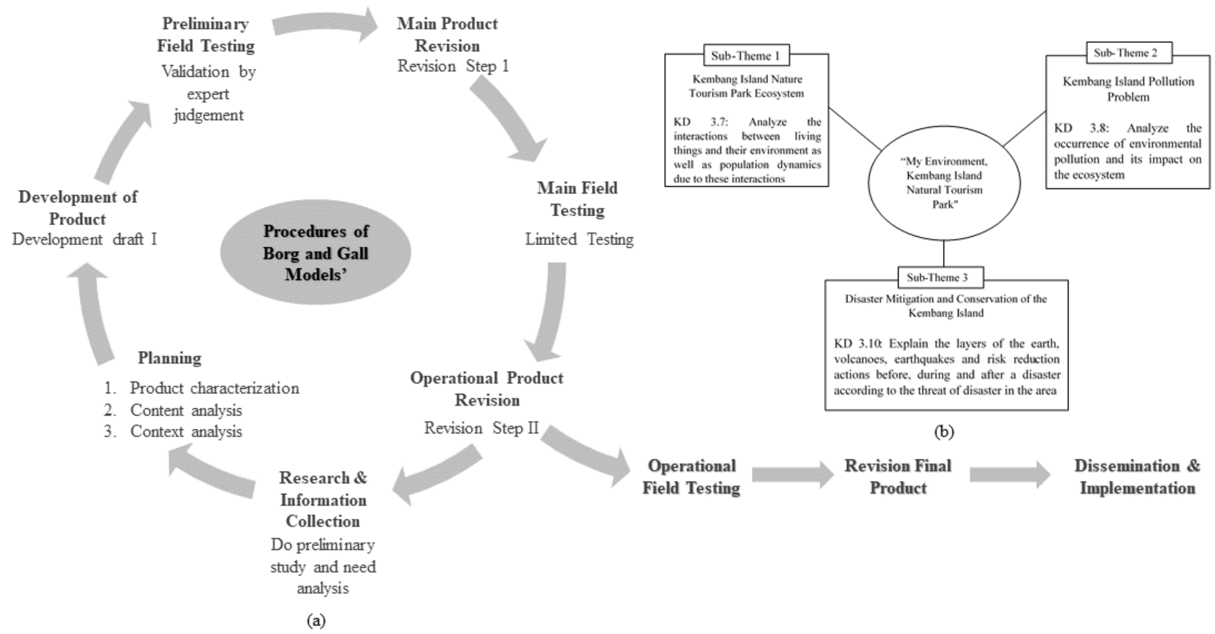

Figure 1. (a) Development Procedure, (b) Webbed Integration Model Chart

The themes in Figure 1 are the main topics in the product being developed. Context analysis is then carried out by analyzing the documents used during learning, such as curriculum, lesson plans, etc. The results at the planning stage become the basis for the next stage, namely the initial product development. The initial product then proceeds to the next stage, namely product quality testing with feasibility testing by media experts, material experts, and practitioners from four experts. Expert judgments are tabulated using the standard deviation ideal (Sb_i) and categorized according to Table 1.

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Table 1. Sb_i Category Interpretation

Interval	Categorized
$X > \overline{X} + 1.80Sbi$	Excellent
$\overline{X_i} + 0.060Sbi < X \leq \overline{X_i} + 1.80Sbi$	Good
$\overline{X_i} - 0.60Sbi < X \leq \overline{X_i} + 0.60Sbi$	Enough
$\overline{X_i} - 0.60Sbi < X \leq \overline{X_i} - 0.60Sbi$	Less
$X \leq \overline{X} - 1.80Sbi$	Poor

In the next stage, we conducted a pilot test to analyze the feasibility of the learning instructional. The pilot test was carried out using a quasi-experimental design with an experimental pretest and posttest control group design, as shown in Table 2.

Table 2. Research Design

Class	*N*	Before Learning	Treatment		After Learning
			Lesson Plans	Teaching Material	
Control	26	O_1	X_1	X_1	O_2
Eksperiment	23		X_2	X_2	

Table 2 explains the research design. The control class uses regular instructional learning, lesson plans, and teaching materials. In contrast, the experimental class uses integrated learning instructions with material on the local potential of Kembang island. The data was collected and analyzed using the ANOVA statistical test, and the effect size looks at partial eta-squared results. Categorize of effect size is $\eta^2 = 0.01$ indicates a small effect; $\eta^2 = 0.06$ indicates a medium effect; $\eta^2 = 0.14$ indicates a significant effect (Cohen, 2013).

In addition, students were given a questionnaire in the form of a response questionnaire compiled using a 4-Likert scale in the form of Strongly Agree (SA) = 4, Agree (S) = 3, Disagree (DA) = 2, and Strongly Disagree (SDS) = 1. The test subjects involved in this study were class VII students who had high, medium, and low academic abilities based on the results of the pretest assessment (Pretest) in one numbered 49 people with high, medium, and low abilities, the age range of students is 12-13 years.

RESULT AND DISCUSSION

This research produced learning instructions with an integrated webbed model based on the local potential Kembang island, which was developed using the DL model. Three Basic Competencies (KD) are integrated into learning instructions: KD 3.7, KD 3.8, and KD 3.10 from the K-13 curriculum. These three KD are contained in one theme, namely "My Environment, Kembang island Tourism Park" with an integration scheme as shown in Figure 1. The product developed aims to improve the ecological literacy skills of seventh-grade students. Based on the expert's judgment in the fifth stage of the development procedure, the learning instructions are feasible if the data processing results in empirical and pilot tests are valid and reliable. In addition, experts provide recommendations that can be considered for product improvement.

Learning instruction consists of lesson plans, student worksheets, handouts, and assessment instruments. The lesson plans, handouts, and student worksheets were tabulated using the mean and then categorized using the Sbi. In contrast, the test instrument in the form of questions on ecological literacy was analyzed using V-Aiken. The results of the feasibility product are obtained results which can be seen in Table 3.

Table 3. Result of the Feasibility Learning Instructional

Component	Average	Categorized
Lesson Plans	1.00	Excellent
Handout	3.44	Excellent
Worksheets	3.56	Excellent
Test Instruments	Aiken Score = 1.00	Valid

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Table 3 shows that, in general, learning instructions are good and can be used in learning with some improvements considering the suggestion from experts. The suggestion refers to the indicators that must show intense integration. In addition, the organization of material should be delivered by the cluster so that lithospheric can be delivered simultaneously with abiotic components to the ecosystem on Kembang island.

The subsequent analysis is the validation of handouts. Handouts are teaching materials used by students to find information as alternative learning sources (Nerita et al., 2018). The handout contains integrated natural science material based on the local potential Kembang island. Topics are presented in the form of the main theme divided into three sub-themes and an exercise on ecological literacy at the end of each chapter. It aims to familiarize students with recognizing literacy problems and develop students' thinking skills in solving problems in the environment.

The other product is student worksheets. Student worksheets are teaching materials that guide students in solving problems or discovering a concept through scientific principles. The student worksheet feasibility instrument contains the same four aspects as the handout assessment. The results showed that the overall student worksheet feasibility assessment obtained an average of 3.56, with an excellent category. The worksheet contains three main sections according to the sub-themes in the handout by considering the learning activities of the DL model. The stages include stimulation, problem statement, data collection, processing, verification, and generalization. Pulau Kembang, the central theme in product development, is also integrated into this student worksheet. Each stage of DL is intended to stimulate students' thinking skills in finding a concept. In addition, at the DL stage, it discusses matters relating to Kembang island. Even though it has met the minimum standards, student worksheets need to be improved to adapt to the revision of the lesson plans. In addition, an important note in preparing worksheets is the use of sentence structures and terms that must be adapted to students' thinking abilities.

The products developed in this research are not only lesson plans and teaching materials but are also equipped with assessment instruments. The assessment instrument developed is a test instrument with ecological literacy questions, multiple-choice questions, and essays. This test instrument contains three aspects with five indicators of ecological literacy ability. The feasibility assessment on the instrument test was tabulated using the V-Aiken equation, where the index V was 1.00 > 0.75, which is the minimum standard for the V-Aiken coefficient. It means that the test instrument in the form of a question on ecological literacy is feasible.

After all learning instructions are feasible, then the next stage is the pilot test. The pilot test stage used the pretest-posttest randomized experimental design. Learning is carried out with the design shown in Table 2. The control class uses the DL model lesson plans and regular teaching materials. Besides, the experimental class uses lesson plans with the DL model and teaching materials that are worksheets and handouts based on local potential.

The learning took place in three meetings, with the first meeting containing material on ecosystems and their components. The second meeting studied material related to environmental pollution, and the third meeting studied natural disasters and environmental conservation. In addition, students in both the control and experimental classes were given pretest and posttest questions, totaling ten questions consisting of nine multiple-choice questions and one essay question. The measurement results show that students' ability is classified as low, medium, and high. The distribution of students' abilities is presented in Table 4.

Table 4. Distribution of Students' Ability in Each Class

Class	Ability	Mean	Std. Deviation	N (%)
Control	High	55.38	16.67	19.23
	Medium	50.25	17.65	57.69
	Low	44.87	20.30	23.08
Experiment	High	66.03	16.06	20.00
	Medium	75.00	18.00	48.00
	Low	58.65	15.89	32.00

Table 4 shows that the student's ability in each class is normally distributed. In the control and experiment classes, the number of students with high abilities was five, while for the low abilities, there

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were six people in the control class and eight people in the experimental class. Students with moderate ability are normally distributed in the control and experimental classes.

The research was conducted in two classes: the experimental and control classes. Students are given two different treatments. The control class learns by using the learning instructions from the teacher while the experimental class does the learning using the instruction from the researchers. The meeting was held three times, and at the end of the meeting, a measurement of the ability of ecological literacy will be conducted. The questions given are compiled based on indicators of ecological literacy. Based on the average results in the control and experimental class, the results are presented in Figure 2.

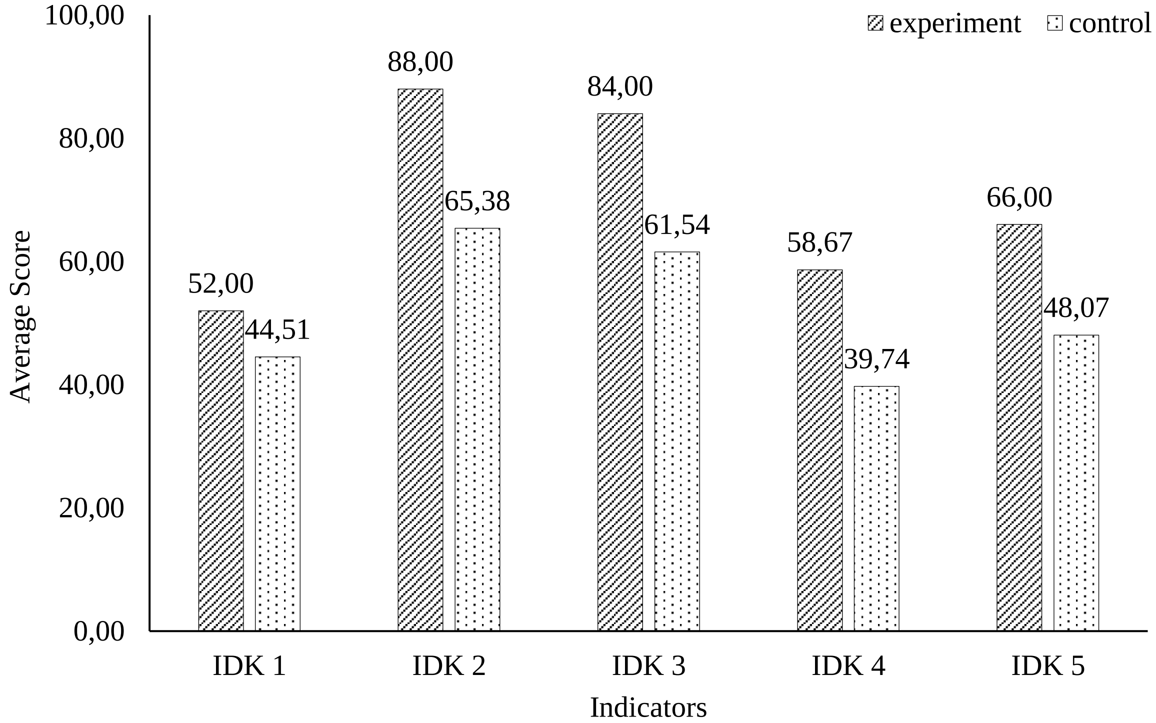

Figure 2. Average Score Ecological Literacy in Control and Experiment Class

Figure 2 shows the average score of ecological literacy for each indicator in the experiment and control classes. The indicator value in the experimental class is higher than the indicator value in the control class. Ecological literacy measured in this study has five indicators: understanding the concept of ecology (IDK 1), observing the phenomena (IDK 2), collecting data (IDK 3), analyzing data (IDK 4), and making decisions (IDK 5). Each indicator that will be measured is practiced at each meeting using students' worksheets. However, not all indicators get high scores. The results in Figure 3 show that the indicator with the highest score is the second indicator, namely observing the phenomena (IDK 2). The activities presented on the student worksheet observe phenomena or events around Kembang island. In the student's worksheet, a stimulus is presented, making it easier for students to sort out what to observe (Cairns et al., 2021; Radišić et al., 2021). Therefore, the data collection results on indicator three obtained the second-highest score.

Meanwhile, students cannot analyze data (IDK 4) and make conclusions (IDK 5). Students still need guidance in analyzing the data even though discussion points have been provided that can assist in data analysis and making conclusions (Lim & Poo, 2021). The difference in the results obtained from the control and experimental classes shows that learning instruction can assist students in developing ecological literacy skills.

Further explanation of the effect size between the control and experimental classes was then analyzed inferentially using ANOVA (Analysis of Variance). Data analysis was conducted to determine the effectiveness of learning instruction on students' ecological literacy skills. In this study, data analysis using ANOVA used prerequisite tests, namely normality, and homogeneity. The prerequisite tests are presented in Table 5.

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Table 5. Normality Tests Results

Class	Df	*p*-value	
		Normality	Homogenous
Control	26	0.145	0.833
Experiment	25	0.277	

The results showed that the significance value of the control and experimental classes was > 0.05. The significance value obtained shows that the control and experimental classes in this study are normally distributed. Then proceed with the next prerequisite test, namely the homogeneity test. Based on the homogeneity test, it is known that the value of sig. Levene's test for equality of variances is 0.833. *p*-value 0.833 > 0.05, it can be concluded that the control and experimental class data are homogeneous.

The two prerequisite tests showed that the tests had met the requirements for the further test, namely ANOVA. The results of the ANOVA test are presented in Table 6.

Table 6. Test of Between Subjects Effects

	Mean Square	F	Sig.	*Effect Size*
Class	2873.690	9.301	0.004	0.171
Ability	547.104	1.771	0.182	0.073
Class*Ability	243.859	0.789	0.460	0.034

Based on the results of the ANOVA test, the F value is 9.301, with a significance value of 0.004. Based on the results of inferential analysis where the value of sig *p*-value 0.004 < 0.05 indicates a difference in the posttest value of ecological literacy after learning by using a webbed integrated model learning instructions based on the local potential of the Kembang island. The *p*-value shows significant results, which means that the analysis of the impact of treatment on the dependent variable does not show how much influence the treatment has had on the results obtained. Data analysis using ANOVA was conducted to see the effect of class, but also whether the ability of students was affected. Based on the analysis results, the p-value 0.182 > 0.05 indicated that the preliminary ability does not influence students' ecological literacy. It means that the learning instructions developed can be used by all students with high, medium, or low abilities.

The effect of the treatment on the results obtained was analyzed using the effect size result. Based on the partial eta squared, the effect size value is 0.171. The interpretation of the effect size refers to $\eta^{2,}$ which indicates a large effect (Cohen, 2013). Implementing a limited trial also aims to see how students respond to the use of learning using science learning instructional with a webbed integration model based on the local potential of Kembang island. The overall results by aspect are presented in Table 7.

Table 7. Student Response Results

Aspect	Average	Categorize
Learning Implementation	3.01	Excellent
Readability of teaching materials	3.16	Excellent
Average	3.08	Excellent

Table 8 shows the results of student responses to the use of learning instructions during learning. Overall, the average student response to the learning carried out was 3.08, with a good category. Based on the analysis of the effectiveness of learning instruction, it was found that the implementation of learning instructions got results with large effect sizes. Some factors cause the influence of learning instructions on students' ecological literacy skills to only be in the weak category. One factor that influences learning outcomes is when the learning process occurs. Both the control and experimental classes took place using the DL models. The learning model influences student outcomes (Simanjuntak & Silalahi, 2022; Suendarti, 2017). Both classes use the DL model with six stages of learning. At each stage of the DL model, familiarize students with seeking information about the material concept. The information is then processed and verified between the teacher and students. Thus, students in control and experimental classes are accustomed to searching, processing, and inferring information related to the material being taught. Research by Tyas et al. (2020) states that the DL-based integrated science learning model of local snacks effectively improves observing, classifying, predicting, drawing conclusions, and communicating, and five aspects of integrated science process skills, namely

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interpreting data, controlling variables, making hypotheses, operationally defining, and conducting experiments.

The difference between the control and experimental classes is in teaching materials. The teaching materials used by the control class are textbooks commonly used in schools. In contrast, the experimental class used teaching materials like handouts and student worksheets based on local potential Kembang island. The impact of using learning instruction is larger, so the average value of the ecological literacy abilities of students in the experimental class is higher than the control class. Teaching materials provide a new atmosphere for learning because students in the control class are introduced to Kembang island. Long-tailed monkeys (*Macaca fascicularis*) and Bekantan (*Nasalis larvatus*) live in this mangrove forest ecosystem.

A worksheet allows students to write their thoughts on a topic discussed. The topics presented relate to Kembang Island, which is close to the student's residence area. Student worksheet, compiled based on DL steps in the experimental class, helps students develop thinking skills to find concepts independently (Misbah et al., 2018; Puspitasari & Handziko, 2018; Zahara et al., 2020). At the first meeting, students in the experimental class experienced difficulties working with worksheets because they were still unfamiliar with DL-based worksheets. For example, the worksheet asks students to ask questions related to the stimulation and then find the answers by gathering information. Information gathering can use handouts based on local potential as a learning resource for students. The handout is presented in the form of a theme that has three sub-themes containing material on ecosystems, pollution, and conservation. Teaching materials and handouts provide a meaningful learning experience to build and explore concepts based on the specified topic. Handouts make it easy for students to collect the desired information. Handouts are made clearly and specifically on the taught material (Petrich & Montague, 1981; Rahmawati et al., 2020). Although the students were not used to it initially, they began to get used to the existing learning process after entering the second and third meetings. This process gives the difference in the results of the average score in the control class and the experimental class.

The results of student responses are seen from two aspects: learning implementation and teaching materials' readability. The implementation of learning is intended to review how students, as characters involved in learning, react to the learning setting using the developed product. The implementation of the DL model with six stages aims to familiarize students active during the teaching and learning process. Students are asked to work in groups to find the concept through discussion during learning. In addition, students must present the discussion results in front of the class boldly. Implementing learning focused on students expressing everything that happens during learning. An active learning process encourages students' motivation so that the results in the aspects of the implementation of learning get a good response from students (Fuadati & Wilujeng, 2019; Hamilton & Levenson Gingiss, 1993; Kurnia & Suryadharma, 2016).

Teaching materials that are components of learning instruction consist of student worksheets and Handouts. These teaching materials are presented with an attractive appearance and use communicative language to make it easier for students to understand every direction and information. The convenience obtained by students gave an excellent response to the handouts and the student worksheet developed. Overall, the responses show that the learning instructional shows good results. Therefore, learning tools have proven practical and feasible to be used in massive learning (Parmentier et al., 2021; Putra et al., 2016; Ravista et al., 2021). However, it is necessary to improve the shortcomings after implementing learning and expert suggestions. The improvements were related to students' difficulties understanding the steps for using DL-based worksheets. Student worksheets must be compiled using general sentences commonly used by students. Improvements related to terms and the coherence of concepts need to be made in the handout. It makes it easier for students to understand the questions discussed with the group.

CONCLUSION

Based on the research results, the product use was declared feasible based on the feasibility test results from the experts with good categories. The use of learning instruction has a good impact on increasing the ecological literacy skills of students, as indicated by the results of the significance test with a p-value < 0.005, which shows that there are differences in the results of ecological literacy abilities before and after learning. However, the impact value of using the developed learning instructions is moderate. Furthermore, the pilot test was carried out by looking at student responses to

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the learning instructions. The pilot test shows that the learning instructions are practical, with an average of 3.08 in the good category. The pilot test showed that the webbed integrated science learning model based on the local potential of Kembang island was feasible and practical for learning. However, it is still necessary to improve the suggestions and inputs given.

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