ICEE-2

Development of E-Module Based on Cirebon Local Environment in Fostering Eco-Literacy of Student

Ovi Syafiatul Maulana✉[1], Hertien Koosbandiah Surtikanti[2], Amprasto[3]

[1]Biology Education Magister Program, Universitas Pendidikan Indonesia
[2,3]Faculty of Math and Science Education, Indonesia University of Education, Jl. Dr. Setiabudhi No. 229 Bandung, 40154, West Java, Indonesia
✉[1]ovisyafiatulmaula@gmail.com

Abstract. This study aims to develop e-modules based on the local Cirebon environment related to environmental changes that occur in the Cirebon region as a source of high school student learning to foster the eco-literacy of the student. The method in this research used to research and development (R&D) with the ADDIE model (analysis, design, development or production, implementation or delivery and evaluations). Data collection was conducted through observation, interviews, questionnaires, tests, and documentation. The development of e-modules was validated aspects of eligibility by material experts, technology experts, and users as measured by the validation sheet as well as student responses regarding the e-modules as measured by a questionnaire. Meanwhile, the readability test given to students is carried out to ensure the quality of the e-modules as measured by the cloze test. In addition, the eco-literacy of the student was measured by an attitude questionnaire to find out how students' awareness and concern for the surrounding environment. Data were analyzed by qualitative methods. The results showed: 1) the feasibility of the e-module based on the validation of the material experts obtained 95.68% with a very good category, the validation of technology experts with a percentage of 72% categorized as good, and the validation of the teacher, as a user, showed a percentage of 75% with a good category, 2) the results of the cloze test analysis show that e-module has a high level of readability with a percentage of 92.46%, 3) student responses regarding e-modules obtained a percentage of 78.8% with a good category, 4) eco-literacy of students are shown by the results of questionnaire obtained an index of 4.04 with a high category. Products have been revised based on suggestions and corrections from validators and limited trial results. E-module based on the Cirebon local environment in fostering eco-literacy of students can be implemented in classroom learning.

Keywords: Cirebon local environment, e-module, eco-literacy, ADDIE.

INTRODUCTION ~ Human life cannot be separated from its environment, because the two are interrelated. The environment becomes a space for humans and other creatures to grow and develop. However, in the 21st-century environmental issues have become a topic that is being widely discussed and is very highlighting attention (Zulfa, *et al.*, 2016). The environmental or ecological crisis is an increasingly widespread issue and a challenge in Indonesia. During this time, environmental problems such as environmental damage, natural disasters, and changes in air temperature occur in human life (Nurkolis, N., & Astina, I. K, 2017). Various environmental problems often occur due to human behavior and activities that have an impact on environmental quality degradation (Hidayanti, et al., 2018). Population growth and increasing living standards cause the need for natural resources to increase (Kayihan & Tonuk, 2012). The results of aggregation and interactions between natural and human processes lead to changes in environmental conditions and quality (BPS, 2016).

Crisis and ecological problems are caused by instability and disturbance of the balance of energy-material and

information exchange that causes a cyclic imbalance between an organism and its environment. Meanwhile, advances in science and technology and human activities have not made a significant contribution to anticipating phenomena that occur to the environment (Dharmawan, 2007). The complexity of environmental problems must be a common concern and responsibility in solving them. Humans must have a mutual need for the environment (Zulfa, V., *et al.*, 2016). Excessive exploitation of natural resources in a number of areas is very alarming, including West Java, especially in the Cirebon region. Perkins (1995) states that the pattern of natural resource management carried out by humans has an impact on large-scale exploitation that is with the massive degradation of natural resources (Perkins, 1995).

Environmental problems that occur in Cirebon are inseparable from the impact of human activities exploiting natural resources that are used as economic support. Exploitation by the community raises many new problems that can greatly affect the sustainability of the surrounding community. The transfer of functions of agricultural and coastal land for the benefit of industrialization is increasingly widespread in Cirebon. This causes a negative impact on the balance of the ecosystem. In addition, a phenomenon that is no less important is the problem of waste. The behavior of people who do not yet represent caring for the environment is a problem that is still difficult to solve unless there is a high awareness of oneself. It is necessary to develop an awareness of the importance of protecting planet earth as the only environment that is occupied by humans by having the potential and at the same time its limitations in supporting the sustainability of human life (Muhaimin, 2016). This awareness is what Fritjof Capra calls eco-literacy. Awareness to understand the principles regarding the web of life in each ecosystem that should be maintained (Capra, 1999).

Based on interviews and observations of coastal local communities in several areas. The environmental damage that occurs affects the stability of the ecological system. Environmental damage is caused by various pollution, one of which is water pollution. According to Sudirman & Husrin (2014) states that the condition of Cirebon waters based on quality standards for marine biota is categorized as polluted. Meanwhile, according to DLH Cirebon, air quality in Cirebon has a high level of pollution, although it is still considered safe for the health of the surrounding community.

In the context of education, students need to be prepared to respond to various ecological crises by forming attitudes and care as a form of human responsibility for a shared future and a sustainable life (Sapriya, 2011: 135). Through education and learning, students can gain knowledge and have an awareness of eco-literacy in more effective ways while

at the same time improving students' behavior towards sustainability (Muhaimin, 2015). The learning process to improve eco-literacy requires approaches, media and learning resources that invite students to be directly involved, the learning process must provide opportunities for all students so that students can develop their potential (Tamam, 2013).

E-modules as media and innovative learning resources in facilitating students to learn and understand learning material. In modern education, Suarsana (2013) (quoted in Fajaryati, 2013) states that educators need to integrate technology into the learning process. In this study, the E-module becomes a medium that is developed in the application of learning to increase eco-literacy awareness. E-modules are designed with technological capabilities so that they can be easily accessed and become better learning resources than print media modules (Solihudin, 2018). In addition, according to Suarsana and Mahayukti (2013) states that e-modules can improve critical thinking in students and get positive responses from students. This e-module is designed with multimedia technology so that it can be a better source of learning than a normally printed module.

Integration of Cirebon Local Environment in the E-Module

The integration of local contexts in learning contributes to student learning experiences. The local environment is a space around living things that affect their lives and is closely related to the conditions and phenomena that exist around these living things. At least, the environment around students can provide rapid stimulation of projections of student understanding in something that is learned because it is formed from contextual learning experiences. Utilization of the surrounding environment as a source of learning can increase the activeness of teachers and students in the learning process and improve student learning outcomes (Lustanti & Abdullah, 2013). In addition, according to Djulia (quoted in Mukhyati, 2015), raising local content in learning will increase student understanding in understanding material and increase their concern for nature and can enrich learning material.

With the increasing ease of learning technology that raises the local environment also needs to be supported by e-modules. The e-module based on the Cirebon local environment is expected to make it easier for students to meet the specified learning standards more effectively and efficiently. During this time, there are still many students who do not really recognize the condition of the environment around their residence. They tend to be indifferent to environmental problems that occur where empathy is needed from the community to provide solutions. Therefore, in the development of e-modules, it is necessary to be integrated with the local environment as an effort to increase students' eco-literacy of problems in the surrounding environment. The

importance of local environmental issues in learning is reinforced by the opinion of Tomazic (2011) that local environmental education has an important role in overcoming environmental problems, education has a function to provide understanding to the community about environmental problems and motivate the community to be able to maintain environmental health. In addition, learning that is associated with local environmental insights will provide students the opportunity to explore their curiosity and creativity to find answers and make appropriate conclusions.

Integrating the local environment coupled with the design of e-modules that can facilitate users in learning biological material becomes an advantage in the learning process. Students can easily access this e-module e-module anywhere and anytime because e-modules are designed based on websites (online). The development of this e-module is the development of a learning media that contains local environmental issues that are useful in fostering environmental awareness and concern through contextual learning direction. Loading local realities or matters relating to the local environment in learning not only made it easier for students to understand the context presented and avoid misperceptions, but also instilled a sense of belonging and respect for everything around students, so students can take appropriate attitudes and actions as well as solutions to environmental problems that occur.

Foster Eco-literacy in Education and E-modules

Eco-literacy is a new paradigm popularized by Fritjof Capra (1995), David W Orr (1992), Michael K Stone, and Zenobia Barlow (2005) initiated the movement for environmental stewardship and aims at increasing the ecological awareness of the community. Eco-literacy comes from the words eco and literacy (Keraf, 2014), where eco is derived from the word ecological, which means knowledge that discusses the mutual relationship of living things with their environment. Meanwhile, literacy means literacy, that is skilled and understands something. Capra explained that eco-literacy or ecological literacy is a high awareness achieved by humans regarding the importance of the environment.

Monaghan & Curthoys (2008) (quoted in Desfandi *et al.*, 2017) states that eco-literacy is not only a matter relating to the measurement of ecological knowledge but also to measure a person's ability and willingness to use knowledge by applying it in a sustainable lifestyle. Eco-literacy not only raises awareness and concern for the environment but also understands the principles of the ecological system in a sustainable life cycle (Mukhyati & Sriyati, 2015). Eco-literacy equips individuals with knowledge and competence in overcoming environmental problems and creating a sustainable society that does

not damage the ecosystem (Barnes in Rusmawan, 2017).

Education is an effective means of raising awareness to always preserve the environment. Informal education, environmental education is integrated into the school curriculum for each level and level. Planting eco-literacy or ecological literacy can be applied in a variety of subjects. In line with the opinion of Behrendt & Behrendt (2013) that students can be introduced to ecological literacy by their teachers by making books that integrate art, science, and technology, so as to foster awareness about the environmental environment. According to Preston (2011), teacher education in preparing students to respond to environmental issues that occur later and being around students is indeed very important. In the United States, eco-literacy is concerned with environmental education. According to Roth (1992) that the community thinks that the formal education system is responsible for the environmental education process (Rusmawan, 2017).

In Indonesia, the environmental education program has been developed through a decision of the Minister of the Environment and the Minister of National Education in 2010. As we know that environmental education is implemented in the school curriculum by integrating it in subjects and standing alone as a subject namely Environmental Education (PLH). According to Puk & Behm (2003), in the field of eco-literacy education must be the main focus in the curriculum in an effort to face the serious challenges of environmental problems in the future.

The e-modules developed must be representative and effective learning media in supporting learning objectives and needs. E-modules are teaching materials that are designed systematically based on a particular curriculum and are packaged in the form of the smallest learning units and refer to e-learning.

As stated by Jean-Eric Pelet regarding e-learning as follows:

"*e-learning is defined as the use of information technology and communication (ICT), online media and web technology for learning*".

In this era of technology, e-modules exist to facilitate students in learning, especially in understanding the surrounding environment, both the potential, management, and utilization, as well as the problems that arise. The e-module is only a teacher's intermediary tool in learning with the aim of maximizing students' abilities not only in the aspects of knowledge but also in aspects of attitudes and skills. These three aspects must be fulfilled in assessing the ability of students' eco-literacy. According to Rusmawan (2017) as part of environmental education books or e-modules can also be a means of effort to foster student eco-literacy. However, not all teaching materials have content that meets the standards regarding environmental education.

Based on the results of research from Pektas, Altunoglu, & Eksi (2013) shows that elementary books that have been available so far cover 88-95% aspects of knowledge, only 0.9% cover aspects of attitude, and a small portion of the rest cover aspects of skills.

Based on the explanation above, the development of e-modules integrated with Cirebon local content is an effort to foster student eco-literacy. Thus, students can identify problems and environmental issues that are around them. In addition, they can also determine solutions to these problems. Equally important, the feasibility of e-modules is a determining factor in their use and application to students. The feasibility of the e-module becomes the determination that the components contained in the e-module have met the appropriate quality standards of teaching materials.

METHOD

This research is categorized as a Research & Development research design from Borg & Gall using the ADDIE model. The ADDIE model consists of five steps, namely: (1) Analyze; (2) Design; (3) Development; (4) Implementation, and (5) Evaluation. The analysis phase of this study begins with identifying the problems and needs of students and teachers in learning biology. Need analysis by analyzing both primary and secondary data. Primary data is done by direct observation, interviews, and dissemination of needs analysis. At the design stage is an advanced stage of materials and data collected from the analysis stage such as the preparation of material content and exercises, collecting and organizing images, collecting or making animations that support the subject matter chosen in making e-modules. At the development stage, the action is taken, namely expert validation, revision, and small group trials. A limited trial was conducted in one school on 36 Grade X students. The validation test was conducted by material experts, technology experts, users, and readability tests. Validation of the feasibility of e-modules is carried out using a validation questionnaire, while a cloze test is used to measure the level of e-module readability. Furthermore, the implementation phase is carried out after the e-module is considered feasible to use based on the results of the development stage then the application of e-modules in the experimental class is carried out. At this evaluation stage students and teachers are given an assessment questionnaire regarding the feasibility of developing e-modules in fostering student eco-literacy. n addition, to find out eco-literacy students are given a questionnaire of attitudes about problems and environmental changes that are studied in e-modules and learning in class.

RESULTS AND DISCUSSION

Analysis Stage

This stage is carried out an analysis of development needs and product

development requirements that are tailored to the needs of users through several activities, including:

a. Preliminary Analysis

This step is carried out by means of preliminary studies and literature. The development of e-modules on the topic of environmental change that promotes the local environment of Cirebon was chosen based on an analysis of needs which was sourced from some information and observations made at the school and the problems found in the environment around students. In addition, based on the results of interviews and observations that schools have not raised any specific environmental issues as literacy discourse in the classroom. Inadequate facilities and less varied learning media make learning in the classroom boring. Environmental problems that are getting worse have become a concern of researchers as a fairly strong background in determining the development of e-modules based on the local Cirebon environment for efforts to foster students' concern for the environment. E-modules are packaged quite attractively with the use of technology and local contexts so students have high motivation in carrying out meaningful learning. In addition, teachers can easily convey information and knowledge to students effectively.

b. Analysis of Student Needs

Stage analysis of student needs is done through direct observation and literature study on student characteristics. The development of e-modules is adjusted to the characteristics and needs of students. Based on observations and literature studies conducted, most students have indifference and low awareness of the surrounding environment, especially regarding environmental issues both locally and globally. The results of needs analysis such as the characteristics and abilities of students become one of the bases in developing e-modules.

c. Curriculum Analysis

This step aims to review the curriculum used in learning. In the curriculum, there are competencies that become a reference or reference in developing e-modules. The researcher analyzes the core competencies and basic competencies required in the 2013 Curriculum, namely KI 1-4, KD 3.11, and 3.11 in broad outline regarding environmental change and is designed to foster student eco-literacy.

d. Material Analysis

The material developed in this study focuses on issues and phenomena that occur in the environment around students' homes. Many environmental problems remain obstacles such as environmental pollution, environmental changes, and poor waste management. The material is based on Cirebon local environment which is compiled based on direct observation, interviews, documentation, and literature study. The development of materials is adjusted to competencies at

the 10th-grade high school. The material developed refers to the discourse about the importance of sustainable development in the midst of exploitation and natural damage caused by human activities based on local contexts.

Design Stage

the product of the development carried out by the researcher is http://e-modulelingkungancirebon.com/ as an e-module based on the local Cirebon environment which contains the theme of environmental damage that occurs in Cirebon and is caused by human activities using a website display. This e-module consists of 3 main components namely administrators and students. The e-module features, i.e. Home icon, contain competencies, material, online questions, and assistance. In addition, there is a Profile icon to see the user's identity, as well as the Exit program icon and the Back button. The contents of the material in this e-module more or less refer to the guidelines that have been determined in the 2013 Curriculum. The researcher adopts the principles contained in the guidelines for the development of teaching materials according to the BNSP as a feasibility reference. The aspects that need to be considered in developing teaching materials are aspects of graphics, presentation aspects, content aspects, and linguistic aspects. This website-shaped e-module design is made with basic programmings such as HTML, PHP, Database, and MySQL.

Development Stage

The e-module development stage consists of the expert validation phase and product trials in limited classes. Validation by material experts and technology experts regarding the feasibility of teaching materials is adjusted to BNSP standards. The results of limited trials with a sample of 36 students were used as a reference in repairing or revising e-modules before proceeding with the implementation of e-modules in classroom learning. The results of the validation of material experts and media experts are adjusted to the standards used by BSNP covering the aspects of content eligibility, language feasibility, the feasibility of graphics, and presentation worthiness can be seen in Table 1 below.

Table 1. Results of the validation of teaching materials by material experts and learning technology experts

Material expert judgment	Rating / Score	Item	BSNP score	Percentage (%)	Categories
Content Feasibility Aspect					
Material compatibility with KI and KD	12	3	4	100	Feasible
Material accuracy	22	7	3.14	78.57	
Material updates	14	3	3.5	87.5	
Encourage curiosity	8	2	4	100	
Presentation Aspect					

Material expert judgment	Rating / Score	Item	BSNP score	Percentage (%)	Categories
Presentation technique	8	2	4	100	
Supporting the presentation	23	7	3.29	82.14	
Presentation of learning	4	1	4	100	
The coherence of thought flow	8	2	4	100	
Contextual Aspects					
Contextual nature	8	2	4	100	
Contextual component	28	7	4	100	
Average			3.79	95.68	
Content Feasibility Aspect					
Size of teaching material	6	2	3	75	
Teaching material cover design	19	7	2.71	68	
Design of teaching materials	29	10	2.9	73	
Aspects of Language Feasibility					
Straightforward	9	3	3	75	
Communicative	3	1	3	75	Feasible
Dialogue and interactive	7	2	3.5	87.5	
Conformity with the development of students	6	2	3	75	
Conformity with language rules	6	2	3	75	
Use of terms and symbols / icons	4	2	2	50	
Average			2.9	72	

Based on the table of results of the assessment of material experts and learning experts above shows that the average score of the results of the assessment of material experts is 3.79 with a percentage of 95.68% in the aspects of the feasibility of the content, presentation, and contextual with a decent category. Meanwhile, the average score of assessment by technology experts obtained 2.9 with a percentage of 72% in the feasibility aspect of graphics with a decent category. Based on the standards used by BSNP, it was concluded that e-modules based on the local Cirebon environment were worth testing. There are some important notes as suggestions and comments from material experts and technology experts in conducting assessments, including the images contained in e-modules should use personal documentation, summaries in each chapter, the library must be updated. Meanwhile, according to technology experts note that the appearance of user interface in the system is still very simple, its function is good but for novice users must be a little confused to access each function of the icon, it is better for each icon to be named in the HTML coding so that the user is easy to access. These notes become a reference in the revision of the e-module before a limited trial is conducted.

E-modules that have been validated by experts are revised according to the

suggestions and improvements given. Then the readability test is conducted on students. The readability level is measured through a cloze test. The following is the data presented on the analysis of the test results of teaching materials for students. A brief analysis of the results of the small sample overlap is presented in Table 2.

Table 2. Summary of the average readability of each part of environmental change teaching materials by small sample overlap test

Part	% Average Readability	Categories	Statement
Part 1	87.78	High	No revision needed
Part 2	97.22	High	
Part 3	96.67	High	
Part 4	89.17	High	
Part 5	91.48	High	
Average	92.46	High	

Based on the table above, the average readability level in each section shows a high category with a total average percentage of 92.46%, so it can be concluded that based on the test results the readability level on the developed teaching material does not need to be revised and considered deserves to be tested.

Implementation Stage

After validation, revision, readability test, the e-module based on Cirebon local environment which is feasible and final, is then implemented to 36 students in learning. The implementation of teaching materials is done to determine its effectiveness. After the application of the e-module, the teacher and students fill in the assessment sheet and responses related to the e-module developed. This also becomes a reference in the improvement of e-modules. The following are the results of teacher and student assessment assessments related to e-modules. Analysis of the results of the e-module feasibility assessment by the teacher in Table 3.

Table 3. Teacher feasibility assessment of e-module based on local Cirebon environment

Material expert judgment	Rating / Score	Item	BSNP score	Category
Aspects of Language Feasibility				
Straightforward	9	3	3	Good
Communicative	3	1	3	
Dialogue and interactive	4	2	2	
Conformity with the development of students	6	2	3	
Conformity with language rules	6	2	3	
Use of terms and symbols / icons	6	2	3	

Material expert judgment	Rating / Score	Item	BSNP score	Category
Presentation Aspect				
Presentation technique	6	2	3	
Supporting the presentation	11	4	2.75	
Presentation of learning	2	1	2	
The coherence of thought flow	7	2	3.5	
Ease of operation	12	3	4	
Average			2.93	
Total Score Obtained	72			
Percentage Score Obtained	75%			

The results of the feasibility assessment conducted by biology teachers showed that the average score of the aspects of language feasibility and presentation obtained 2.93 of the maximum score of 4.00, with a total score obtained of 72 from a maximum score of 96. The percentage of scores obtained from the assessment of the results of biology teachers is 75% with good interpretation. Based on the results of the assessment the Cirebon local environment-based e-module is feasible for further implementation in classroom learning. The teacher's response in the form of suggestions and comments addressed to the e-module as an improvement such as inserting apperception on students through cases based on natural student experience, should the practice questions at the end of learning include confirmation of correct answers and discussion of questions, video sorting contained in e-modules are too long so they can interfere with the effectiveness of learning in the classroom. In addition, the teacher highly appreciates e-modules that contain local environmental problems that occur around Cirebon. Student assessment of e-modules can make a good contribution, especially students as active users. The analysis of the results of the student assessment questionnaire on teaching materials from the aspects of the material, presentation, appearance, and language are as follows.

Table 4. Results of the Student Assessment Questionnaire on E-modules

Measured Aspects	Percentage (%)	Categories
Theory	78.80	Good
Presentation	79.50	Very Good
Display e-module	77.73	Good
Language	78.89	Good
Average	78.8	Good

Based on table 4. above, the results of the student assessment questionnaire on the e-module used during learning showed that the average total percentage of aspects

measured was 78.8% with a good category. This shows that e-modules implemented in learning by students can provide ease and effectiveness of learning. Some positive comments and input given by students to the e-module include learning to use e-modules more interesting and making learning more enthusiastic, e-modules can be accessed anytime and anywhere, very opening up insights about their own areas, especially environmental issues contained in around. Then, students provide input that is in terms of language that is considered less light to understand.

Evaluation Stage

The e-module developed aims to foster student eco-literacy, so after learning is implemented by applying e-modules it is hoped that there will be a positive influence on student eco-literacy. Therefore, to find out whether e-modules provide feedback to students in the form of the growth of eco-literacy in students so that it becomes the basis for raising awareness and concern for the surrounding environment. This is done by giving a questionnaire to the attitude of eco-literacy by looking at the index obtained. The results of students' eco-literacy questionnaires can be seen in Table 5.

Table 4. Results of the Student Assessment Questionnaire on E-modules

Measured Aspects	Index	Categories
Environmental issues	4.12	High
Environmental concern	4.24	High
Environmental concern movement	4.23	High
Empathize	3.69	High
Wise in utilizing the environment	4.05	High
Organize and manage the environment	3.92	High
Committed	3.96	High
Average	4.04	High

Based on the analysis of the questionnaire above, the average index was 4.04 with a high category. This shows that of all components or indicators of eco-literacy, students have high eco-literacy from the aspect of attitude. According to Oktapyanto (2017) students who have eco-literacy are expected to have comprehensive knowledge about ecological aspects, both human ecology, and the concept of environmental sustainability as a tool to solve problems. In other words, increasing eco-literacy is expected that every student has awareness, sensitivity (awareness) that the environment needs to be maintained, managed and utilized not only for now but for future generations.

CONCLUSION

Based on the results of the research conducted, it can be concluded that the e-module based on the local Cirebon environment in growing student eco-literacy is feasible to be implemented in learning. The results of the feasibility of e-modules as teaching materials are based on the feasibility test by material experts and technology experts, also received an assessment from teachers and students as users. The score obtained for content eligibility from material experts is 3.79 or obtains a percentage of 95.68% with a proper category, from technology experts is 2.9 or obtains a percentage of 72%. Whereas, the level of readability of teaching materials obtained through a readability test or an overlap test obtained a percentage of 92.46 with a high category. The teacher and student ratings each get a percentage of 75% and 78.8% with a good category. Then, the e-module developed is an attempt to foster student eco-literacy. Through the distribution of questionnaires to students, we can find out the students' eco-literacy scores, especially in the aspect of attitude which is indicated by the acquisition of an index of 4.04 with a high category. Research on the development of e-modules based on the local Cirebon environment is feasible to be implemented in classroom learning and can foster student eco-literacy.

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