



Development of E-Module Ecosystem and Conservation Integrated Ethno-SETS Containing Merdeka Syntax to Increase Environmental Literacy

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ABSTRACT

This research aims to determine the characteristics, feasibility and influence of using the Ethno-SETS integrated module containing independent syntax on students' environmental literacy. This research method is R&D with the ADDIE type. The research sample used a non-probability technique with the type used being convenience sampling. The research instrument is an expert validation sheet from aspects of media, materials as well as integration and environmental literacy questions. Research data was analyzed using Aiken V to determine the feasibility of modules, t-test and N-Gain to determine the effect of using modules on environmental literacy. The research results show that the module on ecosystems and its conservation has the characteristics of presenting modules using links, presenting material on ecosystems and their preservation, presenting Ethno-SETS content which is integrated with the Rumbio traditional restricted forest, using independent syntax learning flow, presenting learning videos and presenting interactive LKPD in the form of a barcode code. The results of the module feasibility assessment using Aiken V analysis using six raters obtained validity with valid criteria and the percentage of student responses with very good criteria. Modules have a significant influence on increasing students' environmental literacy as evidenced by the t-test value. Students' environmental literacy abilities increase with high category N-Gain scores. Thus, it is concluded that the Ethno-SETS integrated ecosystem and conservation module containing Merdeka syntax can increase environmental literacy.

Keywords: *module, etno-SETS, environmental literacy, merdeka syntax*

INTRODUCTION

Environmental problems have become a global issue that is widely discussed and discussed (Pratiwi, 2019). According to the Directorate of Social Resilience Statistics (2022), environmental problems are characterized by climate change, increasing greenhouse gases, loss of biodiversity, water pollution and air pollution. Environmental needs as a habitat, natural resources to be utilized and as a place to dispose of various residues from activities influence environmental conditions which can have an impact on environmental damage.

A person's behavior towards the environment describes a person's environmental literacy (Rokhmah & Fauziah, 2021). Environmental literacy is a person's ability or skill in understanding the importance of protecting the environment for current life and future generations (Nugraha et

al., 2021). Environmental insight is the basis for a person's self-awareness to preserve the environment (Hariyadi et al., 2021). Therefore, a lack of environmental literacy can support environmental damage.

Environmental literacy is a basis that must be instilled from an early age (Maulana, 2022). Environmental literacy abilities can be seen from several aspects, namely basic knowledge about the environment, attitudes towards the environment, and sensitivity to environmental problems and conditions (Indrawan et al., 2022). Initial studies resulting from observations and interviews show that students' environmental literacy skills are still relatively low, as evidenced by the decline in students' awareness of protecting the environment. Small things can be observed through the lack of responsibility of students to carry out class picket activities, not throwing rubbish in the right place, as well as the lack of awareness of students in caring for and looking after plants. Poor environmental carrying capacity can threaten the survival of future generations (Pratama, 2020).

Efforts to overcome these problems require education by developing science learning towards investigation and the surrounding environment. The learning application used must be adaptable to natural science learning. It is the teacher's role to choose an effective learning approach so that it can develop students' environmental literacy skills. One approach that can be applied to develop environmental literacy skills is learning Natural Sciences using an Ethnoscience and SETS approach (Etno-SETS).

The Etno-SETS approach is learning based on a constructivist view, which implements learning by adapting phenomena that students encounter (Firda, 2023). SETS (Science, Environment, Technology and Society) is learning by connecting the relationships between science, environment, technology and society in every discussion. The application of learning with an Etno-SETS approach is not only in accordance with current developments and curriculum regulations in education, but also aims to instill students' knowledge and understanding of culture.

Learning activities with an Etno-SETS approach are collaborated in the form of teaching materials, teaching media, teaching resources and as other learning supports. Modules can be alternative teaching materials that are well packaged, attractive and innovative that can be integrated with Etno-SETS. The science module with the SETS approach can make students understand the surrounding environment (Chandra, 2020). Student involvement presented through the science module can encourage students to better understand the environment and increase environmental literacy.

Printed modules are familiar and proven to improve student learning outcomes (Arriany et al., 2020). However, technological developments have encouraged changes in document formats from print to digital form. The concept of digital learning has encouraged the development of abilities and made the learning process easier for students (Sariani et al., 2017). The use of digital in the learning process can be applied in the form of modules. Modules are teaching materials that can help students study material independently using electronics (Wulansari et al., 2018).

In general, the science learning process focuses on the content dimension, and tends to ignore the process and context dimensions of science, which causes students' low environmental literacy. The concept of ecosystem material and its conservation is the focus of this research, because this material can provide cognitive knowledge in formal learning. Increasing formal learning is an effort to increase students' environmental knowledge which has an impact on environmental care behavior and reducing environmental damage (Hadzami et al., 2019). The science material in phase D in the Merdeka curriculum that contains the most environmental literacy components and sub-components is the ecosystem and its conservation, because this material is closely related to the environment (Aprilia et al., 2023).

The Merdeka curriculum is a curriculum with diverse intracurricular learning where the content will be more optimal so that students have enough time to explore concepts and strengthen

competencies (Windayanti et al., 2023). The implementation of an Merdeka curriculum has characteristics, one of which is flexible learning, namely providing freedom for teachers to carry out learning in accordance with learning outcomes and student development and adapting to local context and content (Kemendikbudristek, 2023; Nurhayati, 2023). However, in reality, curriculum changes actually create new problems at the implementation stage. There are several problems, one of which is teachers' difficulties in the process of implementing the Merdeka curriculum, this is due to teachers' lack of knowledge of the concept of the Merdeka curriculum, and limited references so that teachers have difficulty referring to the implementation design of the Merdeka curriculum (Windayanti et al., 2023). The results of the initial study of interviews with teachers, he said that the school had implemented an Merdeka curriculum in class VII, but teachers had not been able to implement an Merdeka curriculum in the classroom.

Based on the problems that have occurred in the world of education, this research is focused on developing an integrated Etno-SETS module containing independent syntax which is expected to increase environmental literacy. Research on the development of this module is needed to assist teachers in implementing the Merdeka curriculum and increasing students' environmental literacy. The aim of this research is to determine the characteristics of the module being developed, determine the feasibility of the module and the influence of the module on students' environmental literacy. The novelty of this research is the effort to develop digital-based teaching materials oriented towards conservation and local wisdom. This study produces an e-module developed through the Ethno-SETS approach, which uses the Rumbio Indigenous Protected Forest as a contextual case study.

METHODOLOGY

Research design

This research is R&D (Research and Development) research with the ADDIE development model. The ADDIE model has 5 stages, namely Analyzing, Design, Development, Implementation, Evaluation. Analysis is a stage to determine the learning environment, teacher and student needs obtained through interviews. Design is the stage of designing the required module and research instruments. Module designed using publisher and Heyzine. Publisher functions in preparing modules. Heyzine is a website that is used to change modules in the form of links so that they can be accessed easily and helps make modules more interactive.

The development phase is the stage where the module begins to be developed which is tested by experts, to get input so that the module is suitable for use in learning. Implementation, at this stage the module is implemented. Finally, evaluation, reflection is carried out starting from the analysis stage to implementation which aims to identify deficiencies and errors in the development process.

Research subject

The research subjects were class VII students at MTs GUPPI Bandar Sungai using a sample of one experimental class totaling 30 students. The sample selection technique in this research uses a non-probability technique with convenience sampling type. Product implementation will produce students' environmental literacy results obtained through pretest and posttest in the experimental class and control class. The research procedure was carried out in eight meeting sessions, consisting of one pretest session, six open module implementation sessions, and one posttest session.

Research Instrument

This development research instrument uses interview guidelines, questionnaires and questions. The interview guide contains a format for questions asked orally to determine

environmental conditions and learning needs. The questionnaire in the research instrument aims to determine students' needs, expert validation, and an environmental literacy questionnaire. The questions in the research instrument aim to determine students' environmental literacy abilities. The environmental literacy instrument consists of two environmental literacy indicators, namely attitudes and behavior towards the environment.

Table 1. Environmental Literacy Sub-Indicators

Environmental Literacy Indicators	Sub-Indicators
Ecological Knowledge	Ecological knowledge and environmental conditions
	Problem-solving knowledge related to environmental issues
Cognitive Skills	Environmental Issue Identification
	Environmental Issue Analysis
	Environmental Problem Investigation Action Planning
Attitude towards the environment	Student interest in the environment
	Student sensitivity or concern for flora, fauna, and the environment
	Responsibility for environmental balance
	Intention to act to maintain
Environmental attitude	real commitment

(Aini *et al.*, 2021)

The environmental literacy question instrument consists of two environmental literacy indicators, namely ecological knowledge and cognitive abilities. The environmental literacy questions have been tested for validity and reliability.

Validity test

Measuring the validity of questions uses Aiken's V with a number of raters of 6. The question instrument is said to be valid if $V_{\text{count}} \geq V_{\text{table}}$. 0,78. The results of the analysis of the question instrument are presented in Table 2:

Table 2. Analysis of the Validity of Question Instruments

Criteria	Question Number	Total	Explanation
Valid	1,2,3,9,10,12,13,15,17,19, 20,21,24,26,30	15	used
	4,5,6,7,8,11,16,18,22,23,25, 27,28,29	15	not used

Reliability Test

Based on the results of the overall reliability test of the question items using Cronbach's alpha r_{11} , it was obtained at 0.788, which means that the question items have high reliability.

Difficulty Level Test

The results of the analysis of the difficulty level of the test questions can be seen in Table 3.

Table 3. Analysis of the Difficulty Level Test

Criteria	Question Number	Total	Explanation
hard	27, 28, 29	3	used
currently	1,2,3,9,10,12,13,15,17, 19,20,21,24,26,30	15	used
currently	14,16,18,22,23,25	6	Not used
easy	4,5,6,7,8,11	6	Not used

Different Power

The results of the analysis of the different power of the questions are presented in Table 4.

Table 4 Analysis of the Different Power

Criteria	Question Number	Total	Explanation
accepted	1,2,3,9,10,12,13,15,17,19, 20,21,24,26,30	15	used
accepted	4,5,6,7,8,11,16,18,22,23,25, 27,28,29	15	Not used

Data analysis

The aim of this research is to determine the characteristics, feasibility and influence of modules on environmental literacy. The characteristics of the module were analyzed using descriptive methods based on the results of the product feasibility test. Product feasibility was analyzed using Aiken's V with 7 raters. The effect of using modules was analyzed using the t test and N-Gain. Students' environmental literacy results will be analyzed using the independent sample t-test and N-Gain. The independent sample t-test aims to determine the comparison or difference in the averages of two populations, namely the control and experimental classes. This t-test was carried out using a significance level (2 tailed) of 0.05 (Magdalena & Angela Krisanti, 2019). If the sig value. (2-tailed) < 0.05, then the module has a significant effect on students' environmental literacy. The t test formula is as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r\left(\frac{s_1}{\sqrt{n_1}}\right)\left(\frac{s_2}{\sqrt{n_2}}\right)}} \quad (1)$$

$\bar{X}_1$: average score of sample group 1

$\bar{X}_2$: average score of sample group 2

S_1 : standard deviation of sample group 1

S_2 : standard deviation of sample group 2

n_1 : number of sample 1

n_2 : number of sample 2

The N-Gain test aims to identify the magnitude of the increase in students' environmental literacy. The calculation of the N-Gain score can be expressed in the following formula (Sriyati et al., 2022):

$$(g) = \frac{(S_f) - (S_i)}{100 - S_i} \times 100\% \quad (2)$$

$\langle g \rangle$: gain ternormalisasi (N-Gain)

$\langle Sf \rangle$: scor *posttest*

$\langle Si \rangle$: scor *pretest*

Interpretation of values $\langle g \rangle$ obtained using criteria Hake (1999) with classification: if $\langle g \rangle < 0,30$ (low), if $0,30 \leq \langle g \rangle \leq 0,70$ (currently), and if $0,70 \leq \langle g \rangle \leq 100$ (high).

RESULT AND DISCUSSION

Results of environmental analysis, student and teacher needs. The school implements the Merdeka curriculum for class VII and the 2013 Curriculum for classes VIII and IX. However, the implementation of the Merdeka curriculum cannot be fully implemented in the learning process, this is because teachers have not yet mastered the implementation of the Merdeka curriculum. Therefore, modules were developed using independent syntax to make it easier for teachers to implement Merdeka curriculum learning

Analyzing the needs of students and teachers, it is still hoped that the development of modules will overcome the limitations of teaching materials used by students, especially with the aim of increasing environmental literacy. Analysis of student needs shows that the material on ecosystems and their conservation is material that is quite difficult for students. Therefore, a learning process using direct observation is needed so that it is easy for students to understand.

The development of teaching materials in the form of modules with integrated Etno-SETS is a solution developed to help students master ecosystem material and its preservation as well as increase environmental literacy. Attribution to ecosystem materials and their preservation is based on material competence, namely the components that make up ecosystems, interactions between living things and the influence of human activities on ecosystems. The competency elements in this module are closely related to everyday human life in the surrounding environment (Aulia et al., 2023).

Characteristics Module

The Etno-SETS integrated ecology and conservation module with independent syntax was implemented for class VII students at MTs Guppi Bandar Sungai. The module developed aims to measure environmental literacy skills. This module contains parts that are combined so that it becomes a work that can be used in the learning process on ecosystem material and its conservation. The characteristics of the module are presented in Table 5

Table 5. Characteristics Module

		Characteristics
Component		Description
1. Presented online via link		Students access the module via a link
2. The module identity includes:		
a) Cover		The cover contains the title, class, compiling and creating a picture of the Rumbio traditional forbidden forest
b) Preface		Contains goals and hopes in creating the module as well as thanks
c) Table of contents		Loads sub-chapter title page and Merdeka syntax
d) Module instructions		Contains how to use the module as well as an explanation of the Merdeka syntax
e) Characteristics Module		Contains an explanation of the characteristics of the module
f) Material Diagram		Contains the main topic points to be studied
g) Learning outcomes and learning objectives		Contains learning outcomes and goals that students must achieve

		Characteristics
Component		Description
	h) Learning flow	Contains an explanation of the activities to be carried out in sub-chapters according to the Merdeka syntax
	i) Material description	Contains material concepts
	j) Assessment	Contains questions to measure students' understanding
	k) Enrichment	Contains questions for deepening the material
	l) Reflection	Contains questions as a form of learning evaluation
	m) Summary	Contains important points for each sub-chapter of material
	n) Bibliography	A collection of sources that serve as references for preparing modules
	o) Glossary	A collection of sources that serve as references for preparing modules
	p) Author bio	Brief information about the author
3.	Presents material on Ecosystems and conservation	Sub-material includes: the influence of ecosystem changes on the environment, interactions between components that make up the ecosystem, the influence of human activities on the ecosystem
4.	Presenting Etno-SETS content integrated with the Rumbio traditional forbidden forest	Contains knowledge of local wisdom and traditional prohibited forest vegetation in Rumbio
5.	Presenting the MERDEKA syntax	Learning follows a flow starting from self, concept exploration, collaboration space, contextual demonstration, elaboration of understanding, connection between matter, real action
6.	Presents videos that can be directly played via a link	Learning videos can be played directly in each sub-chapter
7.	Presents LKPD that is connected to a live worksheet which is presented in code bacode	LKPD can be clicked or scanned directly on the module which leads directly to the live worksheet

The characteristics of the Etno-SETS integrated module which is developed in digital form can be accessed by students via a link. It has the advantage of being easy to use by students which can be accessed directly via smartphones and laptops online. The development of this practical and effective module is an application of technology in learning activities with learning conditions that can be done anywhere. Learning using modules will enable students to have a high learning speed. This is because modules can be accessed by students anytime and anywhere via a link (Asrial et al., 2021). The advantage of modules is that they are interactive, can contain images, audio, video and animation and are equipped with formative tests that allow immediate, automatic feedback (Wirganata et al., 2019). Modules are designed with covers that attract students' attention so that students have an interest in reading and studying them well. The image on the cover is adapted to the material and integration of Etno-SETS, namely the Rumbio traditional forbidden forest. The display of the ecosystem module and its integrated conservation Etno-SETS downloading the Merdeka syntax can be seen in Figure 1.



Figure 1. The Etno-SETS Integrated E-Module Display Contains Merdeka Syntax

Modules are presented using independent syntax with a learning flow starting from self, concept exploration, collaboration space, contextual demonstration, connections between materials, elaboration of understanding and real action. Starting from self-containing students' initial understanding regarding the sub-chapters to be studied, concept exploration containing material descriptions, collaboration space containing student discussions which are integrated with Etno-SETS of the Rumbio traditional prohibited forest, contextual demonstrations containing barcode codes that are connected to Google Drive function for students to send the results of their assignments. Real action contains student observations that are in accordance with the sub-chapters that have been studied.

Starting from self in independent syntax contains trigger questions. A trigger question is a question that is used to increase student participation so that it can be included in the learning topic (Pandu et al., 2023). Implementation starts from the self in an module which contains trigger questions aimed at exploring students' initial knowledge in the environment related to the sub-chapters of the material. This trigger question contains an invitation to look at the surrounding environment, as well as the question "what do you see? What do you feel? Can you see the biotic and abiotic components of the surrounding environment?" so that this self-starting activity provides students with an overview of the material to be studied. Students' initial knowledge through questions and initial memories helps students form learning concepts (Yunarti, 2009) which will be deepened through concept exploration.

Exploration of concepts in the module is the second stage carried out by students. Exploration contains learning concepts that cannot be separated from theories as references in learning (Sari et al., 2022). The activities carried out by students at this concept exploration stage are reading and understanding the material presented. Understanding a concept is a sufficient requirement for students to be able to solve problems (Fitriana, 2017). Understanding this concept

is an important thing for students to do to make it easier to solve problems (Fitriana, 2017) which will be discussed in the collaboration room.

The collaboration space in the module contains an integrated Etno-SETS study of the Rumbio traditional Banana forest. Discussion activities were carried out by students by connecting ethno-science, environment, technology and society found in the Rumbio traditional forbidden forest. Through discussion activities in this collaboration space, it instills students' understanding of environmental knowledge, namely the management of the Rumbio traditional restricted forest which can be utilized by the community. Discussion activities are carried out as a cognitive process for students to identify existing problems, thereby generating ideas or decisions that are responsible and work towards solving or preventing environmental problems (Muhammad & Subekti, 2023). The purpose of the discussion is also to combine lessons with real life, increasing the sense of responsibility for implementing discussion decisions (Roti & Dole, 2021).

The final activity in the independent syntax flow is the real action. Real action contains direct observation activities carried out by students in each sub-chapter, thus providing a deep understanding of the concepts that have been studied. Observation activities provide direct experience to students as an effort to increase environmental literacy (Ahmadi, 2022). Direct learning experiences through interaction with the environment train students' identification and analysis skills (I'liyin, 2023). Learning by utilizing the environment, brings students to carry out activities directly to identify questions, carry out experiments and conclude experiments based on what they observe. The environment helps students to learn in a real way and realize the things they have learned in concept exploration and collaboration spaces.

The material in the Module consists of 3 sub-chapters, namely the influence of environmental changes on an organism, interactions between components that make up an ecosystem, and the influence of human activities on ecosystems. The influence of environmental changes on an organism contains the components that make up the ecosystem, namely biotic and abiotic components that influence the ecosystem. Interactions between components that make up an ecosystem contain material about interactions between biotic components and interactions between biotic and abiotic components. And the influence of human activities on ecosystems includes several human activities that can damage ecosystems as well as forms of conservation in the school or home environment.

The module that has been developed integrates the Etno-SETS of the Rumbio traditional prohibited forest within the collaboration space. Etno-SETS integration is found in each sub-chapter in the module which is described according to the material content in each sub-chapter. The module integrates Etno-SETS with the Rumbio traditional restricted forest which is presented in each sub-chapter. The module presents plant and animal vegetation in the Rumbio traditional forbidden forest, local wisdom, community use and the use of technology in maintaining the Rumbio traditional forbidden forest. The Etno-SETS content that has been presented in the module is linked to ecosystem material and its conservation which aims to help students' understanding of environmental literacy which is linked to students' experiential knowledge. The learning process presented by the process of student discovery and experience can last a long time, is easy to remember and improves students' reasoning (Khasanah, 2015). Ethnoscience learning can be easily felt and encountered by students in everyday life so as to provide meaningful learning, and teaching with SETS can develop students' critical thinking so that it can improve students' decision-making skills (Winarto et al., 2022).

Module development aims to increase students' environmental literacy. The assessment aims to measure students' understanding in each sub-chapter, and the final assessment contains environmental literacy indicators. Each sub-chapter also contains reflections as feedback on the students' learning process. The module created contains learning videos that can be watched directly by students. Learning videos are useful for students to get the essence of the material and

provide direct examples in learning, as well as increasing students' enthusiasm for learning. The use of learning videos can increase understanding of material including knowledge and practices related to the environment (Fitriyah et al., 2022).

Student observation practice is contained in the form of LKPD in an module which can be accessed directly by students. The LKPD that has been created is connected to an interactive live worksheet. Interactive LKPD is an alternative media used to support learning which consists of questions (Herawati et al., 2016). Student worksheets are presented in the independent syntax, real action section and start from the self, containing observations and questions about the surrounding environment. This aims to make it easier for students to observe environmental conditions directly. The use of interactive student worksheets can help students explore the environment to increase students' environmental literacy insight.

Feasibility of the E-Module

The module development stage is considered feasible and its validity is tested by experts. Testing the feasibility of modules by experts according to the respective criteria according to aspects. Feasibility with media aspects includes cover design and content design, and feasibility with material aspects includes suitability of content, accuracy of material, up-to-dateness, stimulating curiosity, presentation of material and language. Meanwhile, in the integrity aspect, the feasibility of the module is assessed through the Ethno-SETS study of the module.

The Ethno-SETS integrated module with independent syntax has been validated before use to determine the validity of the module. Validation of the module was carried out by 4 lecturers and 3 science teachers with several aspects, namely material aspects, media aspects and integration aspects. Validation analysis was carried out using Aiken's V with 7 raters. The expert validation results are presented in Table 6

Table 6. E-Module Validation Results

No	Aspect	Validity	Categori
1	Media	0.952	Valid
2	Theory	0.955	Valid
3	Integration	0.937	Valid

Validation of the module with media aspects through experts obtained an assessment of 0.952 which was analyzed using Aiken's V. The media aspects that were assessed by experts were cover design, image layout, content design containing type of letters, illustrations, suitability of illustrations and material substance. The presentation of the cover design on the module uses an image of the Rumbio traditional prohibited forest, which indicates that the module created is integrated into the Ethno-SETS of the Rumbio traditional prohibited forest.

Suggestions from validators on media aspects include: 1) type of writing, 2) adding interactive media, 3) adding images, 4) changing the image on the cover. The validator's suggestions aim to improve the module before the teaching materials are tested. The improvements made are, 1) changing the type of writing which was originally times new roman to tw cent mt, 2) adding interactive media in the form of a live worksheet which is presented in barcode form and can be clicked on the module as well as adding diagnostic tests that lead to on word and wall, 3) adding images to each explanation in the module, 4) changing the image on the cover to an image of the Rumbio traditional prohibited forest.

The material aspects in the module are declared appropriate according to several indicators, namely the appropriateness of the content in the form of breadth, depth and suitability of the material, accuracy of the material, up-to-dateness, stimulating curiosity, presentation of the material and language. The material aspect through expert validation obtained an assessment of 0.955 which was analyzed using Aiken's V, which means it received valid criteria. The material presentation

indicators in the sub-indicators give rise to feedback in the module presented in the form of reflection. According to the validator, the module product that has been developed can stimulate students' curiosity through collaboration and observation space activities. The products that have been developed can also create interactive communication through learning videos and interactive student worksheets that can be opened directly by students.

Suggestions from the validator on the material aspect are, 1) changing the type of observation, 2) adding interaction material, 3) changing the term symbiosis, 4) adding conservation efforts in the home or school environment. Improvements to the module are made before it is implemented for students. The improvements made to the material aspect are, 1) changing the type of observation in the sub-chapter on ecosystem components and the influence of human activity, to observations on the effect of acid rain and the effect of water salinity on fish, 2) adding material to the interaction sub-chapter, namely relationship material. interdependence, and food pyramid, 3) removing the term symbiosis, according to the validator the term symbiosis will only occur if two living things cannot be separated so in the module the term symbiosis is removed, 4) adding conservation efforts in the school or home environment in the sub-chapter the influence of human activities on ecosystems.

Validation of the module with the integration aspect obtained an assessment of 0.937 which was analyzed using Aiken's V, thus the integration aspect was declared valid by the validator. Indicators of feasibility in using modules are assessed through Etno-SETS studies, suitability of Etno-SETS materials with materials, integration of Etno-SETS which can increase students' environmental literacy. The integration of Etno-SETS in the module includes the Rumbio traditional forbidden forest, thereby guiding students in solving problems in the surrounding environment. The results of the Module validation on the integration aspect as a whole show that the category is valid.

Suggestions from validators on the integration aspect are: provide a box for each title in the Etno-SETS info section. Suggestions from validators have been corrected before the module was implemented. The improvements made to the integration aspect include grouping Etno-SETS information according to its subtitles, so that students can read it clearly in each section of the Etno-SETS study.

The Effect of Using E-Modules on Environmental Literacy

Efforts to measure the effect of implementing the module were also carried out posttest after treatment and t-test and N-Gain tests were carried out to determine the differences between the control class and the experimental class and to identify the magnitude of the increase in students' environmental literacy. The t-test in the research aims to find out whether the implementation of the Etno-SETS integrated module containing independent syntax has an effect on students' environmental literacy. The independent sample t-test aims to determine the comparison or difference in the averages of two populations or groups (control and experimental classes) before and after treatment. The t test results can be seen in Table 7.

Table 7. Result of T-Test Analysis

		t-test for equality of means		
		t	df	Sig. (2-tailed)
Environmental Literasy Results	<i>Equal variance assumed</i>	9.196	58	0.00
	<i>Equal variance not assumed</i>	9.196	55.227	0.00

Table 7 shows that the sig. (2-tailed) is greater than 0.05. The basis for making independent sample t-test t-test decisions is if the sig value. (2-tailed) is smaller than 0.05, this means that partially the independent variable has a significant influence on the dependent variable, meaning that there

is an influence of the Etno-SETS integrated module containing independent syntax on increasing environmental literacy. The effect of implementing the Etno-SETS integrated module containing independent syntax was also proven through the N-Gain test. The N-Gain test aims to identify the magnitude of the increase in students' environmental literacy. The results of the experimental class N-Gain test analysis can be seen in Table 8.

Table 8. N-Gain Test Analysis

Class	Average		N-Gain Average	criteria
	Pretest	Post-test		
Experiement	64	85	0.736	High

Table 8 shows the average (mean) N-Gain value of 0.736, which means the N-Gain value is greater than 0.76. Based on the N-Gain interpretation table, if the N-Gain is greater than 0.7 then it is in the high category. The increase in all aspects of environmental literacy shows that the Etno-SETS integrated module containing independent syntax is able to help students increase environmental literacy significantly. The process of improving students' environmental literacy through the implementation of the Ecosystem and Conservation e-module is carried out in stages through various interconnected learning activities. Literacy improvement does not occur instantly, but rather through a learning process involving stages ranging from self-awareness, concept exploration, collaborative spaces, contextual demonstrations, elaboration of understanding, and concrete action.

Each sub-chapter from the effects of environmental change on organisms, interactions between ecosystem components, to the impact of human activities on ecosystems—encourages students to observe, discuss, analyze, and apply concepts in real-world contexts. The integration of the Ethno-SETS (Ethno-Science, Environment, Technology, and Society) approach fosters ecological awareness based on local culture, such as through the case study of the Rumbio Customary Forbidden Forest.

Through this process, students experience gradual development in their understanding of the relationships between ecosystem components and the impact of human activities on the environment. Pretest and posttest results indicate that the systematic use of the e-module significantly contributes to improving environmental literacy, achieved through active, collaborative, and contextual learning processes. The graph of the increase in students' environmental literacy in each aspect can be shown in the Figure 2.

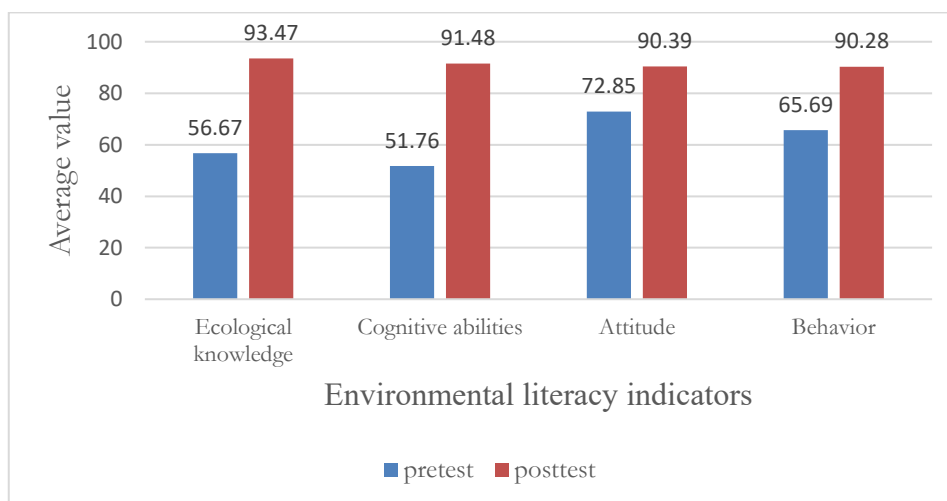


Figure 2. Increasing Environmental Literacy

The addition of Etno-SETS content in the module which is integrated with the Rumbio traditional restricted forest provides real science concepts. Students can understand the material about ecosystems and their preservation through the context that exists in everyday life. Etno-SETS is an acronym for local wisdom, science, environment, technology and society (Winarto et al., 2022). Learning using Etno-SETS integration is not learning with wishful thinking on paper, but actually discusses something that is real, can be understood, can be seen and a solution can be found. Instilling environmental literacy requires experiential learning and real participation in the environment (Widowati, 2011).

Independent syntax that contains real actions in modules can also train students' environmental literacy directly. Learning by presenting real problems can help students solve a problem. Activities to identify problems and solve problems are included in environmental literacy indicators. The problems presented in a lesson can also encourage students to construct knowledge and make decisions (Winarto et al., 2022). Learning by utilizing the environment and bringing students to activities outside the classroom through direct observation can increase students' environmental literacy (Ahmadi, 2022).

The N-Gain environmental literacy results obtained by students vary in each aspect. The environmental literacy indicator in the aspect of students' environmental care attitudes obtained an N-Gain score in the medium category. Attitude towards the environment is a form of awareness or intention of students in taking actions and decisions that care about the environment. The questionnaire with aspects of attitudes towards the environment contains statements about students' interest in the environment, sensitivity and concern for the environment, responsibility for environmental balance and intention to act in maintaining environmental balance. When someone has sensitivity to the environment, they see the environment from an empathetic perspective (Rokhmah & Fauziah, 2021).

Environmental literacy indicators in the aspects of ecological knowledge, cognitive abilities and behavior towards the environment obtained an N-Gain score > 70 , which means it is in the high category. Ecological knowledge is students' knowledge of the environment. In this research, the knowledge aspects assessed include the components of ecosystems, interactions between living things and the influence of human activities on ecosystems. The instrument for measuring aspects of ecological knowledge contains questions about the biotic and abiotic components that make up the ecosystem, the interactions between marine animals and land animals, the influence of felling trees and the use of chemicals on the ecosystem.

The Etno-SETS integrated module which contains material on ecosystems and their conservation contains material on the components that make up ecosystems, interactions between living things and the influence of human activities on ecosystems. The material prepared in the module provides students with ecological knowledge, thereby helping to increase students' environmental literacy. Sufficient knowledge of the environment helps create a caring attitude towards preserving the environment (Lusiani, 2018).

Cognitive ability is the application of environmental knowledge after going through the reasoning process. Sub indicators in the cognitive ability aspect are identifying environmental issues, analyzing environmental problems and planning actions to resolve environmental problems. The instrument for measuring students' cognitive abilities contains reading in the form of facts related to current environmental problems, and students are asked to identify and analyze problems as well as the causes and impacts of environmental problems. The ability to analyze environmental issues involves interpreting and using new knowledge and information to determine relationships between environmental problems (Rokhmah & Fauziah, 2021). The ability to plan actions to solve environmental problems is related to designing activities to act to solve environmental problems. The instruments in this sub-indicator contain appropriate efforts to solve the environmental problems presented in the text.

Behavior towards the environment has an N-Gain score of 0.71 in the high category. This behavioral aspect is a real commitment of students to protect the environment. Instruments for measuring student behavior contain statements of actions that students usually take for the environment. Through the results of the analysis, there was an increase between the pretest and post-test of the experimental class on student behavior. Apart from pretest and post-test activities, progress in student behavior is also reflected through student activities in the classroom, namely that students are reluctant to use plastic. Students provide shelves containing plates and glasses that are used to buy snacks during breaks, so that this activity reduces the use of plastic.

Each environmental literacy indicator is interrelated. Ecological knowledge indicators are related to students' cognitive abilities. In carrying out identification, analysis and action planning activities, students first carry out ecological knowledge reasoning (Indri Safitri et al., 2020). Attitude indicators are also related to behavior towards the environment. Attitude is the basis for determining responses or behavior so that students' attitudes influence behavior towards the environment.

The limitation of this study lies in the fact that the developed e-module was designed exclusively for junior high school students. Consequently, its application remains constrained by the cognitive development characteristics and learning context specific to that educational level. Therefore, further development and adaptation of the e-module are recommended for other educational levels, such as senior high school or higher education, to ensure broader applicability and to optimize both learning outcomes and the enhancement of environmental literacy

CONCLUSION

The *Ecosystem and Its Conservation* e-module integrated with the Ethno-SETS approach and the Merdeka syntax features interactive characteristics. It is presented in a web based format, incorporates ecosystem materials related to the Hutan Larangan Adat Rumbio, and includes instructional videos as well as interactive student worksheets accessible via barcode links. The module was validated as appropriate by experts in terms of content, media, and integration, and received very positive responses from students. The t-test result (0.046) indicates a significant effect of the Ethno-SETS integrated e-module with the Merdeka syntax on students' environmental literacy, with an N-Gain score of 0.67 categorized as moderate

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