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Improving Students' Eco-literacy through the Development of Electronic Interactive Teaching Materials on Climate Change

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Abstract

This study aimed to produce electronic interactive teaching material that can build students' eco-literacy of climate change. This study used ADDIE design, which began with analyzing needs as a reference and consideration for compiling electronic interactive teaching materials on climate change (e-ITMCC). This study began with analyzing needs as a reference in designing e-ITMCC. Furthermore, a feasibility test was carried out on the e-ITMCC design. Feasibility tests are conducted by material content and multimedia experts using expert judgment sheets. Research instruments use tests, questionnaires, and observations. e-ITMCC was declared suitable for use based on expert judgment and the acquisition of CVR and CVI of teacher assessment results. This e-ITMCC effectively applies them in science learning in junior high school class VII. The implementation results showed that the student's eco-literacy increased after studying climate change with e-ITMCC. Students also responded very well to the use of these teaching materials.

Keywords*:* Climate Change, Eco-literacy, Interactive Teaching Materials

INTRODUCTION

An environment where all living things live consists of biotic and abiotic components that influence each other so that if one of the components is damaged, it will disrupt the balance of the ecosystem (Schryver, 2009; Kareivaa & Carranza, 2018). The number of disasters, such as in agriculture (Iglesias, 2012), is due to the impact of climate change, such as rising surface temperatures and extreme rainfall ((Rose et al., 2016; Warren et al., 2021). It can disrupt the balance of the ecosystem. An effort is needed to increase environmental awareness. One of which is through eco-literacy education. Eco-literacy is an activity that aims to develop emotional intelligence to create education that can help the environment prosper by preserving nature and reducing environmental damage (McBride et al., 2013). Students must have good eco-literacy to realize the sustainable development that UNESCO implements in education and the environment (Locke et al., 2013).

Eco-literacy is often referred to as ecological intelligence based on cognitive aspects or a person's understanding of how life supports the lives of all living things. However, eco-literacy is related to cognitive abilities and requires skills, values, and character. People with knowledge, skills, values, and attitudes to care for the environment are expected to participate actively in solving environmental problems and controlling climate change (Putri et al., 2019; Braun et al., 2017; Ahmad, 2015).

The existence of knowledge, awareness, and life skills that are in harmony with the preservation of nature is also increasing and supports the success of eco-literacy (Muliana, 2018). The Center for Eco-literacy (Muthukrishnan, 2019) distinguishes competencies in eco-literacy within four domains that (1) encourage students to analyze, assess, think critically, and envision the long-term impacts of a behavior's impact on the environment (head-cognitive); (2) concern, love, respect, and empathy for all beings (Heart/Emotional); (3) creativity making of tools, the adjustment in energy, and actions that promote sustainability (Hands/Action); and (4) experiencing wonder and awe toward the natural world (Spirit/Connection).

Currently, eco-literacy is widely used, resulting in a decent future for successors and sustainability (Vargas-Madrazo, 2018), so eco-literacy education is essential to apply at the school level. Learning through traditional ecological knowledge (TEK) in traditional proverbs can increase eco-literacy among urban youth, especially when learning is complemented by

observational learning in the field with a continuing education approach (Kim et al., 2017). Eco-literacy can also be improved through Picture Books (Muthukrishnan, 2019), aquaponic projects (Pramesthi, 2017), web-based science learning module (Firdausi & Wulandari, 2021), environmental education at the Adiwiyata program recipient school (Adela et al., 2018), Ecopodagogy-Based Environmental Education (Okur & Berberoglu, 2018); Learning Management System (Alfianto et al., 2019), project-based learning model with eco-brick projects (Rahmawati et al., 2019), and project-based learning social studies (Putri et al., 2019).

Although some efforts have been made, eco-literacy needs to be better implemented. Some environmental problems are still found, such as scattered garbage on the road, polluted rivers, frequent forest fires, increasing levels of carbon dioxide in the air, apathy toward preserving the environment around students, and wasteful behavior in using natural resources (Chu & Karr, 2017). Education is essential in improving human qualities to become a better person. Through education, humans seek to develop potential in the development of science and technology to support eco-literacy and sustainable development (Burbules et al., 2020). One of the efforts to improve student eco-literacy is through models, methods, learning strategies, and teaching materials.

Teaching materials are based on concepts and materials that can be used independently by teachers and students according to subjects in their respective fields (Kanematsu et al., 2019). Hung et al. (2016) state that teaching materials facilitate the coding of information into working and long-term memory so that students can remember it within a certain period. Teaching materials provide opportunities for students to receive, store, and apply concepts or knowledge (Lamb et al., 2018; Kizilslan et al., 2019; Bahtiar et al., 2022). The results of the study stated that Astronomy teaching materials could improve problem-solving and generic science skills (Pujani et al., 2022), improve science literacy (Setiawan et al., 2017; Pursitasari et al., 2019), and computational thinking skills (Fakhriyah, 2019).

Along with the development of technology and the impact of Covid-19, teachers can compile teaching materials by adding digital technology features to make them more interested in learning (Chao & Chang, 2018). Khoiriah et al. (2016) have developed multimedia-based teaching materials to improve students' cognitive. Other researchers developed Phet Simulation-assisted science teaching materials to improve students'

science literacy (Bahtiar et al., 2022); storytelling-based digital teaching materials to improve students' metacognitive abilities (Dewi et al., 2018); and articulate storyline three multimedia to improve critical thinking skills and self-regulated learning (Heliawati et al., 2022). Based on the research results, no teaching material facilitates students being actively involved and interacting with their learning materials. The existing teaching materials also do not facilitate students to have good eco-literacy so that students sustainably are aware of the environment. Therefore, digital or electronic and interactive teaching materials are necessary to increase student eco-literacy.

According to Yulando et al. (2019), Liu et al. (2020), and Wahyuni et al. (2020), electronic interactive teaching materials are equipped with various videos, images, animations, graphics, digital text, and others that can be used as learning resources, and students are directly involved with the teaching materials. This will be able to help students to master a competency and concept of the material being studied. Electronic teaching materials combined with the map concept can reduce cognitive load, support working memory, and help students build new knowledge quickly (Yilmaz & Korur, 2021).

Based on the problems and backgrounds stated, this research aims to produce electronic interactive teaching materials that can improve the eco-literacy of junior high school students on climate change topics. The importance of eco-literacy for students is in line with the government's policy on green economy and sustainable development goals, which emphasize the need for understanding and awareness of human resources towards the environment to ensure the sustainability of living things and the environment.

METHOD

Research Design

This research used an analysis, design, development, implementation, and evaluation (ADDIE) design to produce electronic interactive teaching materials on well-qualified climate change materials by paying attention to three aspects: validity, practicality, and effectiveness. The five stages are:

1. Analysis. This analysis stage includes identifying a problem that occurs due to not achieving goals in the learning process, in this case, the low eco-literacy of students. The next stage is curriculum analysis, which aims to develop a competency syllabus, eco-literacy indicators, and learning objectives on climate change material based on the analysis of subject matter in the curriculum.

2. Design. This stage aims to produce the parts that must be present in the electronic interactive teaching materials and designs used so that students can achieve learning indicators and objectives. This stage prepares expert validation sheets, teacher assessments, eco-literacy instruments, and teaching material response questionnaires.
3. Develop. This stage aims to produce an electronic interactive teaching material containing climate change topics' eco-literacy component. The teaching materials that have been developed are then revised and validated by two media expert lecturers, two material expert lecturers, and ten science teachers. This expert validation aims to validate the science material, namely climate change, and the validity of electronic interactive teaching materials before implementation.
4. Implementation. This research was carried out by implementing the product of electronic interactive teaching materials on a limited basis to 40 students in class VII of one of the secondary schools in Dramaga. This implementation stage uses pre-experiment by comparing the situation before and after using learning with the electronic interactive teaching materials using the One Group Pretest-posttest Design (Fraenkel, 2012), as shown in Figure 1.

$$O_1 \quad X \quad O_2$$

Figure 1. One Group Pretest-Posttest Design with O_1 = Pretest, O_2 = Posttest; and X = e-ITMCC)

5. Evaluation. This evaluation stage aims to evaluate the effectiveness of e-ITMCC and its impact on students' eco-literacy and student response. Evaluation is also carried out with limited discussions with teachers and observers. At this stage, an assessment of students' responses to the use of e-ITMCC is also carried out, and an eco-literacy test calculation is also carried out to see the results of the increase in eco-literacy.

Research Instruments

The types of instruments used in this study are (1) validation sheets of electronic interactive teaching materials by an expert in media and content; (2) teacher assessment sheet; (3) eco-literacy tests on knowledge competencies in the form of essays and competence of attitudes, skills, and human relationships with nature in the form of questionnaires; and (4) student and teacher responses to electronic interactive teaching material in the form of questionnaires.

The assessment aspects of the Electronic Interactive teaching material are adapted based on the assessment

component with criteria for learning aspects, correctness of the content, and eco-literacy suitability. Meanwhile, the assessment aspects of electronic interactive teaching material media are adapted based on assessment components in aspects of usability, functionality, and visual communication (Pradipta et al., 2020; Pursitasari et al., 2022). The data collection technique carried out in this study was using an eco-literacy test in the form of an open essay and questionnaire with four indicators, namely knowledge, attitudes, skills, and the relationship of humans with nature (Solheri et al., 2022) as presented in Table 1.

Table 1. Eco-literacy Instrument

No	Core Competencies	Indicators	Instrument
1.	Knowledge	a. Understand basic ecological principles b. Think critically and deeply about an issue. c. Analyze the impact of human behavior and activities on the environment. d. Plan the solution of problems in the long term.	Essay test
2.	Attitude	a. Increase the sense of care for the environment b. Instill an attitude of respect for the environment. c. Not attach importance to self-interest.	Questionnaire
3.	Skills	a. Plan the tools needed for the benefit of the environment b. Utilize existing natural resources. c. Save energy and use it as necessary.	Questionnaire
4.	Human Relationship with Nature	a. Respect for the environment and its components b. Be grateful for the beautiful surroundings. c. Feel amazed and close to the surrounding environment, so try to take care of it.	Questionnaire

Data collection of teacher and student responses to e-ITMCC was carried out using questionnaires. The questionnaire is developed in several aspects with competency indicators on material, understanding, display, and motivational aspects.

Data Analysis Techniques

The data analysis technique that has been collected from the results of the following study is calculated using statistics with the following steps:

1. Feasibility analysis of e-ITMCC

The e-ITMCC that has been developed is validated by two media experts and two material expert lecturers. The questionnaire uses a Likert scale assessment with a range of values of 1–4. The score obtained is further determined by eligibility using the formula (1).

$$\text{Percentage of eligibility} = \frac{\text{observation score}}{\text{expected score}} \; x \; 100\% \; .. \; (1)$$

The percentage of eligibility calculation results are then categorized into eligibility using qualitative sentences, as shown in Table 2.

Table 2. Eligibility Criteria for Interactive Teaching Materials

Eligibility (%)	Categories
76–100	Excellent
56–75	Good
40–55	Sufficient
0–39	Not good

The results of the assessment conducted by ten teachers were calculated Content Validity Ratio (CVR) using formula (2), and CVR was obtained compared to the CVR value table at p = 0.05, as shown by Table 2 (Lawse, 1975).

$$\text{CVR} = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \; \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; (2)$$

This validation was carried out by involving ten science teachers as material experts. CVR calculation is carried out by examining each item of the question item on the instrument, which is then measured and analyzed based on criteria. After identifying each item in the validation instrument using CVR, the Content Validity Index (CVI) is then calculated to calculate the total number of items with the formula:

$$\text{CVI} = \frac{\sum \text{CVR}}{\text{number of sub-statements received}} \; \ldots . \; (3)$$

2. Analysis of improving student eco-literacy.

The eco-literacy analysis is determined using the value of N-Gain. The N-Gain score results from the difference in scores between the initial pre-test and the post-test final test scores so that the improvement is analyzed. The analysis of the N-Gain value aims to determine the improvement or

effectiveness of the results of developing electronic interactive teaching material to see students' eco-literacy in the criteria for improving the value of eco-literacy, as seen in Table 3.

Table 3. Criteria for N-gain

N-gain score	Category
N-gain ≥ 0.7	High
0.3 ≤ N-gain ≤ 0,7	Medium
N-gain < 0.3	Low

(Hake, 1999)

3. Analysis of Student and Teacher Responses to Material

The results of the questionnaire analysis of student and teacher responses to e-ITMCC that have been used can be calculated using the percentage formula. The results of the percentage of teacher and student response questionnaires are then qualified in the assessment criteria in Table 4.

Table 4. Criteria for Student and Teacher Response Questionnaire

Mean of Score (%)	Criteria
> 80	Excellent
60 < x ≤ 80	Good
40 < x ≤ 60	Fair
≥ 40	Poor

RESULT AND DISCUSSION

Analysis

The needs analysis results show that the teaching materials used in climate change studies are still in the form of printed teaching materials, do not contain aspects of eco-literacy, are too broad material and unattractive illustrations or images, and have not used interactive electronic teaching materials. The interview results show that teachers need teaching material in digital form, along with the development of technology and online learning in schools today. Teachers need good teaching materials to support the learning process, namely teaching materials that are interesting and not boring, and along with the development of technology, interactive digital teaching materials are needed to make it easier and attract the attention of students (Engerman, 2021), especially in climate change materials.

Teaching materials must also contain eco-literacy components to increase student awareness to protect and preserve the environment.

Design of e-ITMCC

This e-ITMCC was developed using the Articulate Storyline application in various formats, namely a combination of images, videos (Figure 1), text, animation, and sound regarding learning concepts and theories in climate change

materials. In this e-ITMCC, there are also concept understanding test questions, discussion questions (Figure 2), and practicum worksheets related to climate change cases that occur in the world so that students can directly apply solutions to overcoming the impacts of climate change in Indonesia and the world. This e-ITMCC was also developed by containing eco-literacy components. Thus, in addition to mastering the concept of climate change, students will be more active in solving environmental problems, improving critical thinking skills, and playing an active role in maintaining, preserving, and reducing climate change.

Figure 2. Videos and Discussions in e-ITMCC

Developing the e-ITMCC

The e-ITMCC that has been developed is then tested for feasibility by two media expert lecturers and two material expert lecturers. The aspects that media experts assess are usability, functionality, and visual communication. The results of the assessment are in Table 5.

Table 5. Result of Media Expert Assessment

Sub Components	Average (%)	Criterion
Usability	92.5	Valid
Functionality	90.6	Valid
Visual communication	93.1	Valid

Based on the overall results of media expert validation of the feasibility of electronic interactive teaching material in terms of use, function, and visual communication, a percentage was obtained, namely 92.07%, so that e-ITMCC was declared feasible. In addition, this teaching material was also validated by two material expert lecturers, with the assessment results contained in Table 6.

Table 6. Result of Material Expert Assessment

No.	Assessment Aspects	Average (%)	Criterion
1	Eligibility of Contents	91.7	Valid
2	Eligibility of Presentation	90.6	Valid
3	Language Eligibility	91.7	Valid
4	Compatibility with Eco-literacy	93.8	Valid

Based on the overall results of the material expert validation of the feasibility of e-ITMCC that have been developed from aspects of the pedagogy, the truth of the content, and conformity with eco-literacy, a percentage of 91.95% was obtained so e-ITMCC was declared feasible. Ten junior high school science teachers also assessed this e-ITMCC. The assessment of teaching materials by science teachers is presented in the form of a questionnaire based on aspects of content, presentation, and language feasibility using CVR and CVI calculations. The recapitulation results show that the number of CVRs for 19 components is 0.8–1.0. Meanwhile, the results of the recapitulation of the CVI value assessment were 0.96. Based on these results, it can be stated that e-ITMCC is suitable for use. This conclusion is in line with Lim and Poo (2021), who states that a validity result of more than 70% is considered good. In addition to providing quantitative assessments, the assessors also provide suggestions for improvements before they are implemented in learning. Suggestions and improvements made are in Table 7.

Table 7. Advice and Correction of the e-ITMCC.

Validator	Advice	Correction
Media Experts	1. The size of the background and animated characters must match the precision.	1. The background size and animated characters have been changed to be more precise/appropriate.
	2. The character animations at the opening and closing should be consistent.	2. The character animation on the opening and closing pages has been revised to be quite a magician clown character.
	3. There is a typo in "Instructions for Use."	3. Adding words to "Instructions for Use."
	4. The font color should match the background so that it is visible	4. Change the font color to darker/lighter according to the background so that it is visible
	5. Add narrated voices based on explanations to make them more interesting	5. There has been a voice narration on some material explanations
	6. The size of the photo image on the biography page is further reduced	6. Changing the layout of the biography page, resizing the photo, and adding the biography

Validator	Advice	Correction
Material Experts	1. Sentences in explaining the material should be adjusted and shortened to make it more efficient. 2. The color in the title of the climate change impact menu font is changed to a darker one. 3. The animation of the characters on the cover is changed to a male. 4. Add explanations of the weather and climate materials and examples of the country.	1. Sentence presentation of customized material more briefly and efficiently 2. Change the color of the font title on the Climate Change Impacts menu. 3. Changed the animation of the characters on the cover to male and changed the background to fit 4. Add explanations to weather and climate materials and examples of countries for each climate.
Teachers	1. Add numbers to menu pages so as not to confuse students 2. Change the image on the "cold climate" material because it breaks too much 3. Change the image on the climate change countermeasures menu to avoid breaking. 4. The order in the second case on the discussion menu is repeated from no.1	1. Add numbers to a menu page 2. Changing the image of cold climates to non-breaking 3. Resizing the image on the climate change response menu so it does not break 4. Changed no.6-10 on the discussion menu to no.1-5

Implementation of e-ITMCC

The e-ITMCC, validated by experts and teacher assessments and revised based on the advice of the assessors, is then implemented in science learning in class VII on Climate Change material. The implementation begins with a pre-test and, at the end, the post-test. The use of e-ITMCC in learning can be done by students online or offline using smartphones. Climate change materials presented on interactive digital teaching materials include weather and climate types, climate change, greenhouse effects, global warming, causes of climate change, climate change impacts, and climate change mitigation.

The meeting began with introducing e-ITMCC as the main learning resource in the learning process of climate change material. As long as students use e-ITMCC, the teacher monitors and accompanies if there are students who ask questions or experience problems using e-ITMCC. E-ITMCC also helps students solve problems about environmental problems so that students are trained to think deeply and critically

about these environmental issues. The observations on the learning process show that students actively discuss when filling out questions contained in the e-ITMCC. In addition, students also actively ask teachers questions.

When studying global warming material, a learning video is presented about the process of global warming. In addition, images of climate change are also presented in various aspects of life so that students can understand the material and motivate students that environmental issues that occur due to climate change must be reduced or addressed so that the environment remains sustainable. The observations show that students are motivated and active in learning. According to Nurlaili and Priscylio (2020), a textbook with images uses simple language and material integrated with everyday life and the natural environment to improve motivation and environmental awareness. Students gradually changed their lifestyles by throwing garbage not under the table, bringing drinks from home, and orderly cleaning the class through a picket schedule. This shows that there has been a change in student behavior to understand better and apply the importance of protecting the environment.

The content in the e-ITMCC also has a discussion menu. Students were asked about two environmental problems in the world, namely floods and melting ice at the poles. In groups, students investigated the two cases. Based on observations, students actively discuss with their groups to solve both environmental problems. Students also present the results of their group discussions and get questions and responses from other groups. In addition to the discussion, e-ITMCC contains practicum activities on the greenhouse effect. In groups, students design experiments, make observations and record observations, and answer and report experimental results orally and in writing. This activity can increase students' understanding, skills, and character towards the environment, so it is hoped that students will have a good eco-literacy.

Evaluation

Evaluation is carried out on the learning process using e-ITMCC, increasing student eco-literacy and teacher/student responses to the resulting e-ITMCC. The results of the evaluation of the learning process using e-ITMCC show: (1) learning has been carried out well; (2) e-ITMCC is practical and accessible; (3) students are active in the learning and use of e-IIMCC both inwardly and in groups; and (4) students realize the importance of protecting the environment sustainably. Students have

also shown their performance in discussing, expressing opinions, and being able to solve problems well.

Student's Eco-literacy

Increasing student eco-literacy determined before and after using e-ITMCC consists of competence of eco-literacy knowledge, attitudes, skills, and the human relationship with nature. The competence of eco-literacy knowledge is analyzed by calculating the value of N-Gain. The N-Gain value aims to analyze the increase or difference in the score difference between the pre-test and the post-test. The results of the N-Gain analysis can determine the level of effectiveness of the results of the development of electronic interactive teaching material (Hake, 1999). The N-Gain value of each indicator on knowledge competence and its average can be seen in Table 8.

Table 8. N-Gain Competency of Eco-literacy Knowledge

No.	Indicators	N-Gain	Category
1.	Understand basic ecological principles	0.61	Medium
2.	Think critically and deeply about an issue	0.71	High
3.	Analyze the impact of human behavior	0.83	High
4.	Design solutions to environmental problems in the long term	0.74	High
	Average of N-Gain	0,72	High

Table 8 shows that the increase in students' eco-literacy of knowledge competency scores is found in all indicators, with a moderate category on indicators of understanding ecological principles and a high category in the other three indicators, namely critical thinking of a problem, impact analysis, and design of solutions to environmental problems. The average N-Gain score of the four indicators is 0.72, falling into the high category and showing a significant increase in knowledge competence after studying climate change material using Electronic Interactive teaching materials. This is supported by research by Wahyuni et al. (2020) and Sinaga et al. (2022), which state that using Edmodo-based interactive teaching materials can increase students' critical thinking skills. López-Escribano et al. (2021) state that using interactive teaching materials can improve students' literacy skills in understanding the learning process. Students can easily understand the material to identify environmental problems and design solutions to problems resulting from existing environmental problems.

Competence of Attitudes, Skills, and Human Relationship with Nature.

The results of the recapitulation of N-Gain from each competency, namely the attitude, skills, and human relationship with nature and their averages, can be seen in Table 9.

Table 9. N-Gain Competence of Attitudes, Skills, and Human Relationships with Nature

No.	Core Competencies	N-Gain	Category
1.	Attitude	0.62	Moderate
2.	Skills	0.52	Moderate
3.	Human Relationship with Nature	0.71	High
	Average of N-Gain	0,61	Moderate

Based on Table 9, it can be seen that the increase in students' eco-literacy scores on the competence of attitudes, skills, and human relationships with nature is found in all competencies, with a moderate category on attitude and skill competencies and a high category on the competence of human relations with nature. The average N-Gain score of the four indicators is 0.61 in the moderate category, thus a significant increase in eco-literacy in the competence of attitudes, skills, and human relationships with nature after studying climate change material using e-ITMCC. The competence of attitudes, skills, and human relationships also needs to be improved through the learning process so that students not only understand the environment but can also apply it to attitudes, skills, and daily activities in the surrounding environment.

The e-ITMCC developed in the climate change material contains the components of eco-literacy. Thus, in addition to mastering the concept of climate change, students will be more active in solving complex problems, improving critical thinking skills, and increasing awareness to maintain and preserve the natural environment. The e-ITMCC presents various menus that can improve eco-literacy in knowledge competence and competence of attitudes, skills, and human relationships with nature. The menu of material on climate change is delivered in text form using language that is easy for students to understand. In addition, the material presented is also supported by the existence of image illustrations that follow the material presented. There are also animated illustrations to make them more interesting, and videos and narratives are added to add motivation and student interest in using e-ITMCC.

The e-ITMCC that has been developed can improve students' eco-literacy in terms of knowledge, attitudes, and skills. This is supported by research by Syofyan and Rachmadtullah (2019), who have used problem-solving models to improve student eco-literacy. Eco-literacy can also be improved through

Adiwiyata Environmental Education (Syah et al., 2021; Adela et al., 2018; Desfandi et al., 2018). This eco-literacy education aligns with government policies that implement sustainable development education to increase understanding and awareness of the importance of preserving the environment to ensure the continuity of life with the environment in the future.

Student Response Results to Teaching Materials.

Students' responses to this electronic interactive teaching material were obtained by distributing questionnaire instruments to 40 students using the Likert scale in the range of 1–4. The results of the recapitulation of students' responses to e-ITMCC are found in Table 10.

Table 10. Student Responses to e-ITMCC

No.	Aspects	Total Score	Students' responses (%)
1.	Content	704	88
2.	Understanding	686	86
3.	Display	679	85
4.	Motivation	704	88

Based on students' responses, electronic interactive teaching material has been developed and has received responses in excellent categories from all aspects, namely material, understanding, display, and motivation. Many students are motivated and interested in this Electronic Interactive teaching material during the learning process. The e-ITMCC presented various forms of text material, animation, images, videos, and voice narration to energize students during the learning process. A similar response was also obtained in the research of Setiyanigrum et al. (2022); interactive teaching materials prevent students from being bored and motivated and make it easier to receive subject matter. Overall, students responded positively to e-ITMCC. This aligns with the results of research by Sinaga et al. (2022), who found that students positively respond to EITMs that can be stored and operated on students' mobile phones.

SUGGESTION

This research resulted in e-ITMCC, which can increase the eco-literacy of grade VII students in one of the secondary schools in Dramaga and is only piloted in one class. It needs to be done in several schools. In addition to using e-ITMCC, increasing student eco-literacy can be done by increasing student environmental awareness. This is necessary so that students can be directly involved in preserving the environment

to realize education for sustainable development.

Electronic teaching materials can increase student activation and activity. Therefore, electronic teaching materials must also be developed for other science materials to enhance multiliteracy, 21st-century competence, and character.

CONCLUSION

The e-ITMCC is developed following the eco-literacy components seen in the menu, discussions, activities, and evaluation. This e-ITMCC is valid material and media expert assessment results. CVR and CVI results are also very high, so that e-ITMCC can be used in science learning in junior high schools. Learning using this e-ITMCC can increase student eco-literacy in knowledge, attitudes, skills, and human relationships with nature competencies. Students' response to electronic interactive teaching material on climate change material was very good, with a percentage score of 87%. The profiles of e-ITMSS: (1) contain an interesting visual combination of images, videos, and animations; (2) present language that is easy to understand by students; and (3) can be effectively used by students online and offline independently or in groups to motivate and engage students in the learning process.

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