Effectiveness of Interactive E-Book Global Warming and Climate Change Integrated Socio Scientific Issues Peat Ecosystem

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Abstract: Efforts to overcome global warming and climate change are integrated with science learning with the socio-scientific issues method. Materials on global warming and climate change are included in an interactive e-book that integrates the peat ecosystem's socio-scientific issues (SSI). This study aims to determine the effectiveness of the Integrated Interactive E-book SSI Ecosystem Peat on learning outcomes and students' environmental care attitudes. The research subjects were 30 grade VII students of SMPN 5 Palangkaraya, Central Kalimantan. The result is that SSI's integrated interactive e-book is effective in improving learning outcomes. The results of the SPSS test with a significance value of 0.05 showed a value of 0.008. There is a difference in the mean of the pretest and posttest results, with an N-gain value of 1.66 with low criteria. SSI's Integrated Interactive E-book is effective to improve students' environmental care attitude with an average score of 89.8% with the criteria of being very caring.

Keywords: Socio-Scientific Issues; Interactive E-book; Learning Outcomes; Environmental Care Attitude

Citation: Asi, M., Retnoningsih, A., & Irsadi, A. (2021). Effectiveness of Interactive E-Book Global Warming and Climate Change Integrated Socio Scientific Issues Peat Ecosystem. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 240–244. https://doi.org/10.29303/jppipa.v7iSpecialIssue.1039

Introduction

The issue of global warming and climate change is now a topic of global concern because it is the main factor in environmental disasters (Azfin, 2020) One of the biggest causes is forest and land fires (Altman, et al., 2020). Forest and land fires in Indonesia occur on peat soils caused by the conversion of land into oil palm plantations which are the main factors in greenhouse gas emissions (Maas, 2019; Sari, et al., 2017).

Efforts to prevent the impact of global warming and climate change due to forest and peatland fires need to be carried out early on through education and training to the community(Ramdhan & Siregar, 2018). This effort needs to be supported in the world of education by integrating it into learning materials. Education is

expected to add insight and concern in students to protect the environment (Hekmah, et al., 2019).

Integration of knowledge about peat ecosystems in Standart Competence 3.9 regarding global warming and climate change in junior high schools using the socio-scientific issues (SSI) method is an approach in learning where students are involved in discussing and making decisions regarding issues related to learning materials (Genisa, et al., 2020; Ilfiana, et al., 2021; Kahn & Zeidler, 2019; Zo'bi, 2014). The SSI approach in science learning provides an understanding of learning materials by reviewing an issue or a learning topic from various points of view (Genisa, et al., 2020; Kabatas & Ezberci Cevik, 2017; Nida et al., 2020).

Materials on global warming and climate change that are integrated with socio-scientific issues of the peat ecosystem are included in an interactive e-book.

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Interactive e-books use more than one media, namely text, images, video, animation, and audio, so students have control over the media in the learning process (Deta, et al., 2021; Tsvyatkova & Storni, 2019). The use of interactive media helps students understand the material quickly and enhances an effective learning process in the classroom (Rusilowati, et al., 2016; Susanti, et al., 2021).

The research results by Ilfiana, Widodo, and Setiarso (2021) show that interactive multimedia that students can access through gadgets can increase flexibility in learning. Students can re-learn material that has not been understood repeatedly and improve students' critical thinking skills. Students' cognitive understanding of the environment positively influences environmental care attitudes (Taufiq, et al., 2014). People who have environmental awareness will direct attitudes and understanding of the importance of a clean, safe and healthy environment and are willing to maintain actual behavior (Laksmi, 2015; Zsoka, et al., 2013).

This study aims to determine the effectiveness of interactive e-books integrated with socio-scientific issues of Central Kalimantan's peat ecosystem. The effectiveness of e-books is measured based on: 1. Cognitive learning outcomes of students; 2. Environmental care attitude.

Method

This research is an experimental study. The method used in this study is a quasi-experimental method with a research design of one group pretest and posttest design (Sugiyono, 2012) to determine the effectiveness of an interactive e-book on global warming and climate change integrated SSI peat ecosystem. Effectiveness is measured based on cognitive learning outcomes and students' environmental care attitudes after using interactive e-books. The research subjects were 30 grade VII students of SMPN 5 Palangka Raya. Data collection instruments in the form of tests and questionnaires on environmental care attitudes.

The test instrument is in the form of multiple-choice questions with 20 questions to measure students' cognitive learning outcomes. Learning outcomes data were obtained based on the pretest results conducted before the student's learning activities and posttest. Learning outcomes data were analyzed using the T and N gain test using SPSS and described in the criteria (Table 1.) to determine the increase in cognitive learning outcomes before and after learning using interactive e-books (Rosida, Noor and Jalmo 2017; Sari, et al. 2017).

Environmental care attitude data was obtained based on student responses to the survey questionnaire given at the end of the lesson using an interactive e-book.

Environmental care attitude questionnaire using a Likert scale with four answer options: 1) disagree 2) disagree, 3) agree, 4) strongly agree (Jeramat, et al., 2019; Talakua, et al., 2020). The environmental care attitude questionnaire was developed in 2 aspects: 1. Environmental care aspect; 2. Aspects of planning Actions on the environment. The analysis of the attitude of caring for the environment uses the technique of percentage categories and descriptions on Table 1.

Table 1. Categories of N-gain and Environmental Care

Data	Persentase Score	Category
N-Gain	$g \geq 0.7$	High
Learning Outcomes	$0.3 \leq g < 0.7$	Medium

Result and Discussion

Learning Outcomes

The effectiveness of the interactive e-book was reviewed based on the T-test and the gain of student learning outcomes on the pretest and posttest. The pretest and posttest aim to determine students' understanding of the material on global warming and climate change which is integrated with the SSI peat ecosystem before and after learning using an interactive e-book. The pretest and posttest questions are in the form of multiple-choice with a total of 20 questions.

The T-test results using SPSS with a significance value of 0.05 showed a result of 0.008 (Figure 1). The results showed that there was a significant difference between the mean pretest and posttest results. The results of the pretest and posttest showed a learning gain of 1.66 in the low category.

Table 2. T-test result

| Mean	Standar Deviation	t	df	sig
10.833	20.889	2.841	29	0.008

The results of the SPSS test show a significant difference between the pre-test and post-tests results, so it can be concluded that learning using interactive e-books integrated with socio-scientific issues of the peat ecosystem is effective for improving student learning outcomes. Several factors, including one, support this effectiveness. The material in the e-book is relevant to the actual state of the peat ecosystem. The SSI material contained in the e-book is relevant to environmental issues regarding peat ecosystems and global warming. Students' e-book material is easy to understand based on presentation, content, and language equipped with interactive pictures and videos. The increase in learning outcomes using e-books is because students learn the material first using e-book media before the material is

given by the teacher so that learning becomes a more optimal (Rahmi, et al., 2021; Sri, et al., 2021).

The results of the pre-test and post-tests showed that there was an increase in classical learning completeness from 7 to 33%. This classical improvement does not meet the minimum classical mastery of learning, which is 80%. The mean pre-test and post-test results increased from 48.50 to 59.30 see in Table 3.

Table 3. N-gain Results

	Pre-test	Post-test
Score Min	15.00	20.00
Score Max	75.00	90.00
Completeness	7.00	33.00
Not Complete	28.00	20.00
Average	48.50	59.30
N-gain	1.66	low
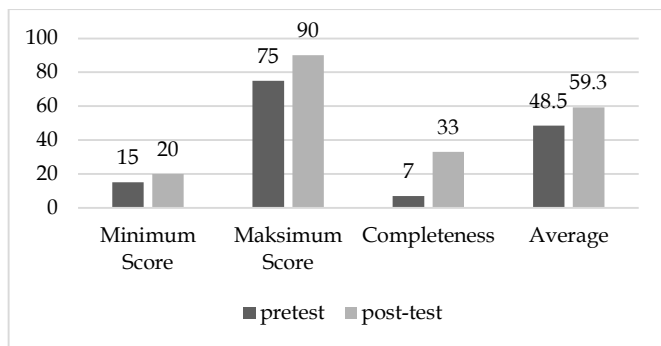
Figure 1. Pre-test and Post-test result

Learning outcomes are influenced by intrinsic factors (from within students) and extrinsic factors (from outside). Intrinsic factors can be in the form of student motivation to learn and extrinsic factors in facilities and carrying capacity in learning. The results of the study (Ekantini, et al., 2020) show that student learning outcomes offline (face to face) are better than online learning (online). Online learning has weaknesses in student participation in learning so that students often do not take part in learning in class.

The low gain in learning outcomes is influenced by the low participation of students in learning. Students work on pre-test and post-tests questions but lack participation in learning. Student participation in online learning is reviewed based on: 1. student attendance in virtual classes; 2. active in learning in class by asking and discussing; 3. Engage in problem-solving; 4. Try the given concept (Mahayanti, 2016; Yulianci, et al., 2021).
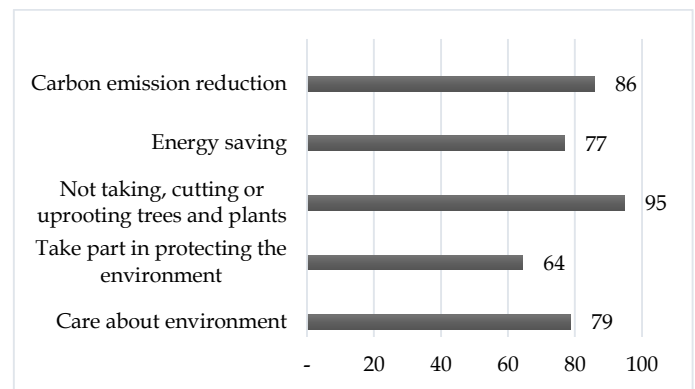
Environmental Care

Environmental care attitudes are attitudes and actions that seek to prevent damage to the surrounding natural environment and make efforts to repair the damage that has occurred (Saptiani and Astawan, 2020). Environmental care attitudes in this study were assessed

based on a questionnaire to see the level of students' awareness of environmental problems due to human behaviour. The assessment of the attitude of caring for the environment consists of the following aspects: 1. Caring for the environment; 2. Action planning on the environment. Questions with odd numbers contain positive statements, and even number questions contain negative statements.

The environmental care attitude questionnaire was given at the end of the lesson using google forms. The results of data analysis of the attitude of caring for the environment showed that the aspect of caring for the environment got a percentage of 84.20% with the criteria of being very concerned. Aspects of planning Actions on the environment get a score of 95.40%, with the criteria of being very concerned in Table 4.

Table 4. Results of Environmental Care Attitude Assessment

Aspects	Score (%)	Criteria
Environmental care	84.20	Very care
Environmental action planning	95.40	Very care

Figure 2. Percentage of Environmental Care Attitude Indicators

Environmental care attitudes are attitudes and actions that seek to prevent damage to the surrounding natural environment and make efforts to repair the damage that has occurred (Saptiani and Astawan, 2020). The results of data analysis showed that the environmental care aspect score got a score percentage of 84.2%, with the criteria of being very concerned. The environmental care aspect consists of two indicators: (1) Reducing carbon emissions with a score of 91.7% (very concerned); (2) —energy-saving 77.23% (care).

Aspects of action planning on the environment is an aspect to find out the actual actions taken by students in responding to environmental problems, especially on global warming and climate change. An aspect of action planning on the environment with a score of 95.4% and the criteria of very caring Indicators on the planning aspect of the environment consists of 1. not taking,

cutting, or uprooting trees and plants with a score of 98.21% (very concerned); 2. Energy-saving with a score of 91.7% (very concerned); 3. Reducing carbon emissions with a score of 96.8% in the (very concerned) category.

An interactive e-book that integrates socio-scientific issues of the peat ecosystem is effectively used in science learning. The application of Socio Scientific Issues learning with issues originating from events around students makes learning a meaningful (Ilfiana et al., 2021). In line with research conducted by Talakua et al., (2020), interactive media can increase students' awareness and care for the environment. Research conducted by Wilantika, et al., (2019) shows that learning Socio Scientific Issues with the material on global warming and climate change that is integrated with ecosystems is effective in increasing students' environmental care attitudes.

Conclusion

Integrated Interactive E-book Socio-Scientific Issues Central Kalimantan Peat Ecosystem is effective for improving learning outcomes. The results of the SPSS test with a significance value of 0.05 showed a value of 0.008. There is a difference in the mean of the pre-test and post-test results, and the N-gain value is 1.66 with low criteria. The Integrated Interactive Socio-Scientific Issues E-book is practical to improve students' environmental care attitude with an average score of 89.8% with the criteria of very caring.

Acknowledgments

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