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Systematic Literature Review: Feasibility of Using the E-Modules in ESD-Based Science Learning in Elementary School

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Abstract. The level of environmental care attitudes of elementary school students is currently still in the moderate category and not optimal so that integrating environment-based learning through E-Modules into the curriculum can help students understand the importance of ecosystems and the relationship between the environment and humans. This study aims to analyse the feasibility of using E-Modules in ESD-based science learning to train students' environmental awareness. This type of research is a qualitative study using a systematic literature review research design in terms of inclusion and exclusion criteria. Based on the results of the analysis conducted, 4 articles were obtained that could be studied in depth. In the research conducted, it was found that E-Modules on ESD-based science learning can train and improve environmental care attitudes in elementary school students. Recommendations that can be made for future researchers are to develop ESD-based interactive e-modules with interesting learning methods and develop other science materials.

Keywords: *E-Module, ESD, Elementary School, Science Learning*

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INTRODUCTION

The world is currently faced with various global challenges, such as climate change, environmental degradation, and social inequality. These challenges require comprehensive and sustainable solutions (Toromade et al., 2024). Education is important role in preparing the younger generation to face these challenges. Education for Sustainable Development is an educational approach that emphasises the balance between economic, social and environmental development (Simanjuntak, 2017). ESD aims to equip learners with the knowledge, skills, values and attitudes necessary for sustainable living (Alissa et al., 2022). Science is one of the important subjects in primary school that can be a vehicle for integrating ESD values.

Learning Natural Science (IPA) in elementary school is a crucial early stage in fostering students' love and understanding of the natural phenomena around them. However, there are often obstacles in the process of learning science in elementary schools that affect the interest and understanding of students in the material presented by the teacher (Kotsis, 2024). Most learners have difficulty understanding science concepts due to the abstract nature of science material (Azizah et al., 2022). In addition, students' low interest in learning because they consider science material as uninteresting and the concepts are difficult to master (Efendi & Putri, 2022). The results of the Programme for International Student Assessment (PISA) test and evaluation initiated by the Organisation for Economic Co-operation and Development (OECD) in 2022 show that the performance of Indonesian students is low. From the results of PISA science in 2022 in Indonesia showed an increase in global rankings, Indonesia rose 6

positions compared to PISA 2018 to 66th out of 81 countries in the world. However, the average science score in Indonesia dropped by 13 points and is considered a low category decline compared to other countries (OECD, 2023). Based on the following data, it shows that the ability of Indonesian students in learning science needs to be improved.

The ability of students in elementary school needs to be improved because elementary school students are the right time to instil the values of environmental awareness (Mohanty, 2018). Through sustainable education, children in primary school can learn about various environmental issues, such as climate change, environmental pollution and forest destruction (Supriatna et al., 2024). They can also learn about ways to preserve the environment, such as saving energy, recycling waste and using eco-friendly transport (Nižetić et al., 2019). Continuing education helps learners to develop a range of essential 21st century skills (Mawas & Muntean, 2019), such as critical thinking, creativity, communication, and collaboration. These skills are essential to help them solve complex problems and make responsible decisions in the future. Sustainable education can help create a better future for everyone. By instilling sustainability values in children from an early age, we can help build a more just, prosperous and sustainable world for generations to come (O'brien, 2020).

The main thing in the transformation process is to know more about the concept of Education for Sustainability Development (ESD) and analyse the potentials in education that can achieve the Sustainable Development Goals (SDGs). The importance of ESD being considered as the basis of education applied in the present and future is also due to the current social structure and economic conditions of the world in addition to the issue of environmental degradation developed to achieve sustainable development goals (Steele et al., 2015). To realise the implementation of ESD, it is necessary to integrate the mission of sustainability education in the school curriculum (Iliško et al., 2017). The school, which is an educational environment related to the learning process, directs efforts to shape the behaviour of students who care about the environment through learning models that are applicable and touch everyday life. (Ananda et al., 2023). Good knowledge of environmental care behaviour at school is expected to increase students' environmental awareness so that the level of student participation in environmental conservation is also high (Permatasari et al., 2021). Thus, implementing sustainable education-based learning in the classroom is one solution to introduce students to the impacts that will occur in the future. The problem that often occurs in the classroom is that boring learning makes students not enthusiastic in participating in learning. Monotonous learning methods can make students bored during the learning process so variations in learning methods must be given (Siregar et al., 2024).

The problem of learning science experienced by students is that teachers usually apply the lecture method by dividing students into groups but have not used the cooperative model that should be applied. In science learning, it is rare to use learning media due to limited facilities, besides the lack of interest of students to participate in science learning which causes students not to understand the material presented by the teacher properly (Safira et al., 2020). According to the findings of this study, the teacher simply explained the topic and assigned homework using traditional teaching methods like the lecture style, which decreased the students' enthusiasm in taking part in scientific classes. In line with research conducted by Andira et al. (2022) mentioned that students‘ interest in learning is very influential on students’ learning outcomes and students' lack of interest in learning science causes learning outcomes that are not optimal. Students consider science to be boring learning because students do not understand the material presented by the teacher (Anggita et al., 2023).

To make learning fun, it is necessary to develop interactive learning media. Students lack enthusiasm for learning and lack of understanding of science learning (Kurnianto et al., 2024). This happens because the learning media used has not created active learning, while science learning emphasises direct experience. Ecosystem material is abstract and broad material that cannot be observed directly as a whole at one time. Therefore, learning media is needed that encourages students to actively participate in order to have direct experience that makes it easier for students to understand ecosystem material. Referring to these problems, an interesting, fun, interactive and Information Technology (IT)-based learning media is needed that is relevant to the current level of development. One way to implement sustainable learning in interesting learning is by using innovative teaching materials, namely electronic modules or e-modules (Provvidenza et al., 2024).

An e-module is a digitised version of a learning module designed to assist students in self-learning (Kusumawati et al., 2023). Electronic modules combine various multimedia elements, including text, graphics, audio, video, and animation, thus creating an interactive and interesting learning experience. The creation of E-Modules can be tailored to the needs of students during learning so that it can help the learning process to be more effective and more easily understood by students, including science learning materials that are still abstract in nature (Febriani & Kustiyono, 2022).

The goal of this study is to review and identify related to the feasibility of e-modules on ESD-based science learning to train environmental care attitudes that have been carried out by previous researchers and published in various journals in order to learn more about how these modules can train and improve environmental care attitudes in elementary school students.

The review conducted from various sources of relevant articles aims to obtain detailed and in-depth information on the above problems.

METHODOLOGY

The Systematic Literature Review (SLR) approach was used to construct this paper by methodically going over the literature. Literature review is the process of locating, obtaining, reading, and evaluating research literature in the field of interest (Abdillah, 2021). Systematic Literature Review is a form of secondary level analysis that brings together primary findings to answer the research question (Lame, 2019). This study is carried out by examining and evaluating the findings of previous research. The articles used in the analysis will come from publish or perish and are limited to the years 2023-2024. Furthermore, the exclusion and inclusion criteria will be determined to select articles that will be analysed further. Step on the exclusion criteria, researchers will not include articles that are not relevant. Next, by determining the inclusion criteria, the researcher determines 1) Non-journal articles (thesis, proceedings and thesis), 2) Analysing articles limited to the years 2023-2024. After determining the appropriate criteria, the information from these articles will be analysed in the form of a roadmap. The results of the analysis carried out in this study are in the form of descriptive narrative.

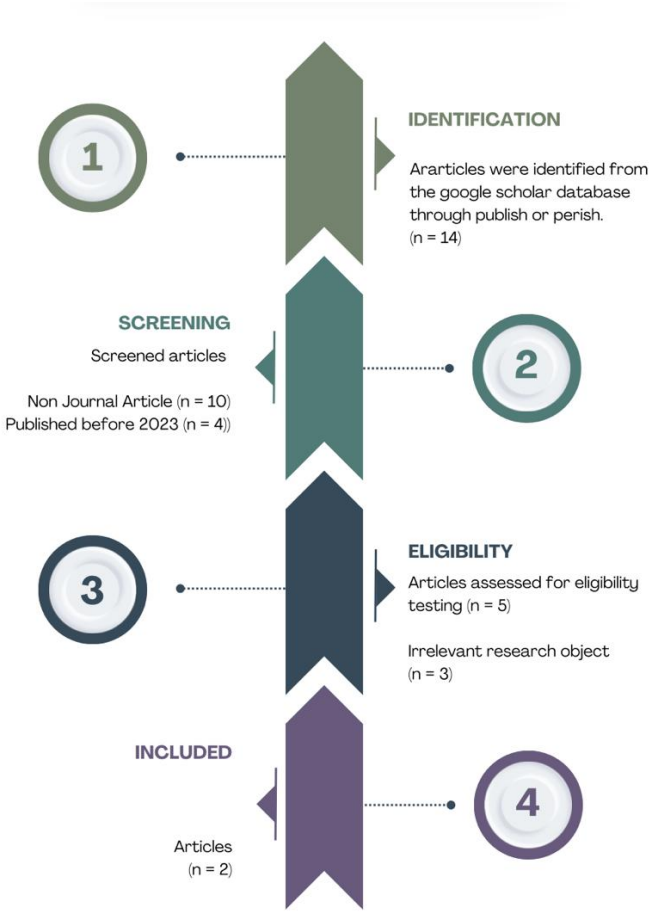

Figure 1. Stages of Systematic Literature Review

RESULTS AND DISCUSSION

The articles obtained from the search using Publish or Perish on Google Scholar criteria with the topic of ESD e-module development in the overall learning obtained are 14 articles. All articles obtained will be filtered again and get the results of 10 non-journal articles and 4 published before 2023. Articles were filtered based on exclusion provisions, so the remaining articles were 2 articles. Articles included in the exclusion provision are from Indonesia. The articles obtained discussed the development of ESD-based e-modules for primary school learning. The articles obtained discuss the development of ESD-based science learning e-modules in elementary schools which are presented in Table 1.

Table 1. Article Data on the Feasibility of E-Modules on ESD-Based Science Learning in Elementary School

E-Module Eligibility	Total
Material Validity	2
Learning Effectiveness	2

Feasibility of E-Modules from Material Validity

Development research is a research process conducted systematically to create or improve products, systems, or models in the context of education or learning (Maydiantoro, 2021). Development research must go through significant steps to produce products that can improve the quality of education and learning. From both studies, ESD-based science learning e-modules were declared valid or feasible to use. Teaching materials can be said to be feasible if they fulfil a number of criteria set by the National Education Standards Agency (BSNP). An important aspect that must be considered when making the main e-module is the feasibility of content or suitability of the material (Azkiya et al., 2022). The material validity test will be carried out by experts so that the e-module can be used properly.

The material in the e-module must be in accordance with the Core Competencies (KI) and Basic Competencies (KD). The research shows that the developed e-modules have good suitability, with the percentage of validity reaching 79% to 83% based on the assessment of the validators (Arova et al., 2024). The accuracy of the information presented in the e-module is crucial to ensure that students gain the correct knowledge. The results showed that the material accuracy value ranged from 80% to 100%, signalling that the content presented was quite accurate and did not cause confusion for students (Susanti & Ernawati, 2020). The material in the e-module must be relevant and able to stimulate students' interest and curiosity.

In the research conducted by Firda dkk (2023) with the title 'Development of E-Modules on Water Purification Topics Based on Education for Sustainable Development (ESD) in Elementary Schools' shows that through the use of e-modules in learning, critical thinking skills and student learning outcomes have increased significantly from an average of 27.6 (medium) in cycle I to 3.14 (high) in cycle II and the e-module score is 75.5. From the learning outcomes that have increased, it is evident that the material packaged in the e-module can be learned with so that the material can be learned easily. The material validation expert said that the suitability of the material with the learning indicators was correct and well presented thoroughly through improvements made by the researcher. The development of this e-module is proven to be able to improve critical thinking skills in students so that the e-module developed can be feasible to use. Appropriate teaching materials can improve students' critical thinking skills so that they can achieve the learning objectives that have been set (Alsaleh, 2020).

In the research conducted by (Berlianti et al., 2024) with the title 'Development of Global Warming E-Modules Based on Education for Sustainable Development for Elementary Schools' shows that the results of product validity are in the excellent category, thus indicating that the electronic modules in this study are classified as valid and suitable for use. The material coverage in the e-module is easy to understand and the content is in accordance with

student development by adjusting to the learning outcomes, the flow of learning objectives, and clear learning objectives. The results of material validation in the aspects of content feasibility, suitability for context and integration of ESD pillars resulted in a 'very good' category with an overall average assessment score of 3.95 from a maximum score of 4. Since it results in specific goals that serve as the standard for every learning process, the content of e-modules is tailored to the potential and indications that students must meet. Teaching materials used in learning must be adjusted to the indicators and competencies needed by students (Afriliana et al., 2023) Overall, the developed e-module presents materials that are in line with the needs of primary school students.

Since it results in specific goals that serve as the standard for every learning process, the content of e-modules is tailored to the potential and indications that students must meet. This validity is obtained through a thorough assessment of important aspects such as content suitability, material completeness, and clear presentation. A valid e-module not only ensures that the information provided is accurate and relevant, but also increases students' confidence in the learning material. Thus, e-modules that have been tested for validity can be an effective tool in the teaching and learning process, supporting students to understand concepts better and facilitating independent learning.

E-Module Feasibility of Learning Effectiveness

Learning effectiveness is one of the important aspects to improve student learning outcomes. E-Modules are proven to be effective in supporting the learning process with significant benefits felt by students (Kumalasani & Eilmelda, 2022). E-modules are often equipped with interactive elements such as quizzes, videos and animations. This makes the learning process more interesting and fun, so students are more engaged in learning. Students can access e-modules anytime and anywhere (Ghozali et al., 2024). This gives students the freedom to learn at their own pace, which can boost their confidence and interest. With e-modules, students are encouraged to learn independently. They can explore the material more deeply without relying entirely on the teacher, which can increase their intrinsic motivation to learn.

In the research conducted by Firda dkk (2023) with the title 'Development of E-Modules on the Topic of Water Purification Based on Education for Sustainable Development (ESD) in Elementary Schools' shows that student scores increase when applied to learning using e-modules. The development of e-module teaching materials with the topic of ESD-based water purification for student learning materials can be done independently and effectively used whenever and wherever students are. This is an advantage for teachers because students can learn independently making the student learning process more optimal. E-modules that

are packaged attractively can increase students' interest in learning because in the e-module there are videos, animations that relate to the material packaged.

In the research conducted by (Berlianti et al., 2024) with the title 'Development of Global Warming E-Modules Based on Education for Sustainable Development for Elementary Schools' shows that the results of the assessment of students resulted in an overall average score of 3.66 from a maximum score of 4. It can be seen that in the content of the e-module material gets an average score of 3.66 the material provided is very interesting so that it adds to the knowledge of students, then in the presentation aspect gets an average score of 3.80 e-modules provide new learning experiences for students because there are practice questions, games and videos explaining the material. And for the benefit aspect, it gets an average score of 3.52, this shows that with the e-module, students can study independently at home without the help of adults or parents because there are clear instructions for use and e-modules can motivate students.

The use of e-modules in the learning process has been proven effective in improving student learning outcomes. The study showed that the average score of students before using e-modules was 42.03, while after the application of e-modules, the average score increased to 89.62. This significant increase is reflected in the N-Gain analysis which shows a value of 0.83, which is in the high category. This indicates that the e-module not only succeeded in improving students' understanding of the material, but also made the learning process more interesting and interactive. Thus, the e-module can be said to be effective because it is able to change students' learning experience to be more enjoyable and encourage them to participate more actively in learning activities (Lukya Safira, 2021).

CONCLUSION

Overall, the ESD-based science learning e-modules for primary school students are specially designed through appropriate stages by reviewing the validity results through experts based on the material to be packaged in the e-modules. The use of e-modules in learning is not only feasible but also effective in improving student learning outcomes. The use of e-modules can increase student engagement in the learning process, making it more active, independent, and fun. E-modules can be accessed through various devices such as smartphones and computers, giving students the flexibility to learn anytime and anywhere. This strongly supports independent learning. The attractive display design also contributes to ease of use and understanding of the material. By integrating various media and learning methods, e-modules can create a more interesting and productive learning experience. Therefore, the development and application of e-modules should continue to be encouraged in the educational context to maximise students' potential. Based on the results of this literature

review, researchers suggest that future research can develop ESD-based science learning e-modules on various materials in elementary schools.

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