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DEVELOPMENT OF NATURAL SCIENCE TEACHING MATERIALS BASED ON SOCIO-SCIENTIFIC ISSUES: LITERATURE REVIEW

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Abstract

Socio-scientific issues are important in science learning because they link social issues with science, encouraging students to understand real issues critically and contextually. The purpose of this study was to identify and analyze studies relevant to the Development of Socio-Scientific Issue-Based Junior High School Science Teaching Materials. This research uses the systematic literature review method by following the PRISMA guidelines. Data analysis techniques involve collecting, organizing, and synthesizing literature to identify the main themes in related research. The results showed that the dominant research model was ADDIE, followed by Borg & Gall, 4D, and PLOMP. The class that was most often the subject of research was grade VII, indicating the focus of learning development at that level. The most commonly developed Socio-Scientific Issue-based Science E-Modules imply that this approach is effective for integrating real issues into learning, increasing student engagement, and promoting critical and contextual understanding of science concepts. In conclusion, the ADDIE model is most dominantly used, focusing most research on grade VII. Socio-Scientific Issue-based Science E-Modules are the most developed teaching materials.

Keywords: *Teaching Materials; Natural Science; Socio-Scientific Issues*

INTRODUCTION

In formal education, Natural Sciences is a subject at the junior high school/Islamic junior high school level (Yani et al., 2019) . Natural Sciences is a science that studies living things and all their life processes (Sakila et al., 2023) . Natural Sciences (IPA) is a very important field of science in the world of education, especially in elementary schools, because it helps students understand the physical world and natural phenomena around them (Sukmawati, 2019) .

The objectives of science learning in the curriculum are often reduced to the process of transferring knowledge and memorization, as well as achieving written test scores. In fact, science not only provides an understanding of the principles of nature, but also trains critical thinking skills, analytical skills, and scientific attitudes in solving problems. Therefore, science learning should be designed to develop basic knowledge about the universe, improve scientific discussion skills, and form awareness of environmental and social issues that are relevant to real life (Mufidzah & Mufidzah, 2024; Sukmawati et al., 2021) .

In learning activities, teaching materials are very important for both educators and students. Educators will have difficulty in increasing the effectiveness of their learning without complete teaching materials and students will also have difficulty in learning

without teaching materials. One of the requirements for achieving effective and efficient learning is the availability of teaching materials. Without the availability of teaching materials, both educators and students will find it difficult to achieve learning goals (Aisyah et al., 2020) .

Teaching materials affect the success of students in the learning process in addition to the role of a teacher, therefore it is necessary to formulate teaching materials that can support the implementation of good education. Types of teaching materials are grouped into four. according to Majid in Yulandari & Mustika (2021) , namely (1) Printed materials including handouts, books, modules, student worksheets, pictures. (2) Hearing teaching materials (audio) such as cassettes, radio, and audio CDs. (3) Hearing-visual teaching materials (audio visual) such as video CDs, films. and (4) Interactive teaching materials such as interactive CDs. These four types of teaching materials will be very useful in the learning process if used appropriately according to the learning objectives to be achieved.

Socioscientific issues (SSI) involve the deliberate use of scientific topics that require students to engage in dialogue, discussion, and debate. The issues are typically controversial in nature but have the added element of requiring a degree of moral reasoning or evaluation of ethical issues in the decision-making process regarding possible resolutions to the issues. The goal is for the issues to be personally meaningful and interesting to students, require the use of evidence-based reasoning, and provide a context for understanding scientific information (Zeidler & Nichols, 2009) .

Based on the previous description, it is important to develop teaching materials that are integrated with socio-scientific issues (*Socio-Scientific Issue* / SSI) in order to increase the activeness, independence, and collaboration of students in developing critical thinking and problem-solving skills. SSI-based teaching materials present real problems that are relevant to the lives of students and society, thus encouraging them to be more active, reflective, and sensitive to environmental issues, health, and technological developments based on science. The application of this teaching material has been proven to improve analytical skills, decision making, and foster a scientific attitude in dealing with complex problems.

In line with this, this study is compiled in the form of *a literature review* entitled "Development of Science Teaching Materials Based on Socio-Scientific Issue (SSI): Literature Review" . The purpose of this study is to show that SSI-based teaching materials provide a positive contribution to science learning, especially in improving science literacy and high-level thinking skills of students. The results of this study are expected to be a reference in developing learning strategies that are more contextual, interactive, and relevant to the needs of the 21st century, especially in science education.

METHOD

This study uses a literature review method. Research with a literature review is research that is carried out through the stages of identifying, reviewing, evaluating, and interpreting all reference articles that have been collected (Afsari et al., 2021) . A literature review can be broadly described as a more or less systematic way to collect and synthesize previous research (Baumeister & Leary, 1997) .

In the framework of this systematic review, the author obtained articles using Google Scholar as a search source. Literature search relevant to the research topic .

The inclusion and exclusion criteria in this literature are shown in Table 1.

Table 1. Inclusion and Exclusion

Inclusion Criteria	1) Research articles published in 2015 - 2025 2) Research topics include teaching materials based on Socio-Scientific Issues and science learning. 3) The general research subjects are junior high school students.
Exclusion Criteria	1) Research articles that are not fully accessible 2) Literature from thesis/dissertation

After determining the inclusion and exclusion criteria, the next step is to select articles to process for articles shown

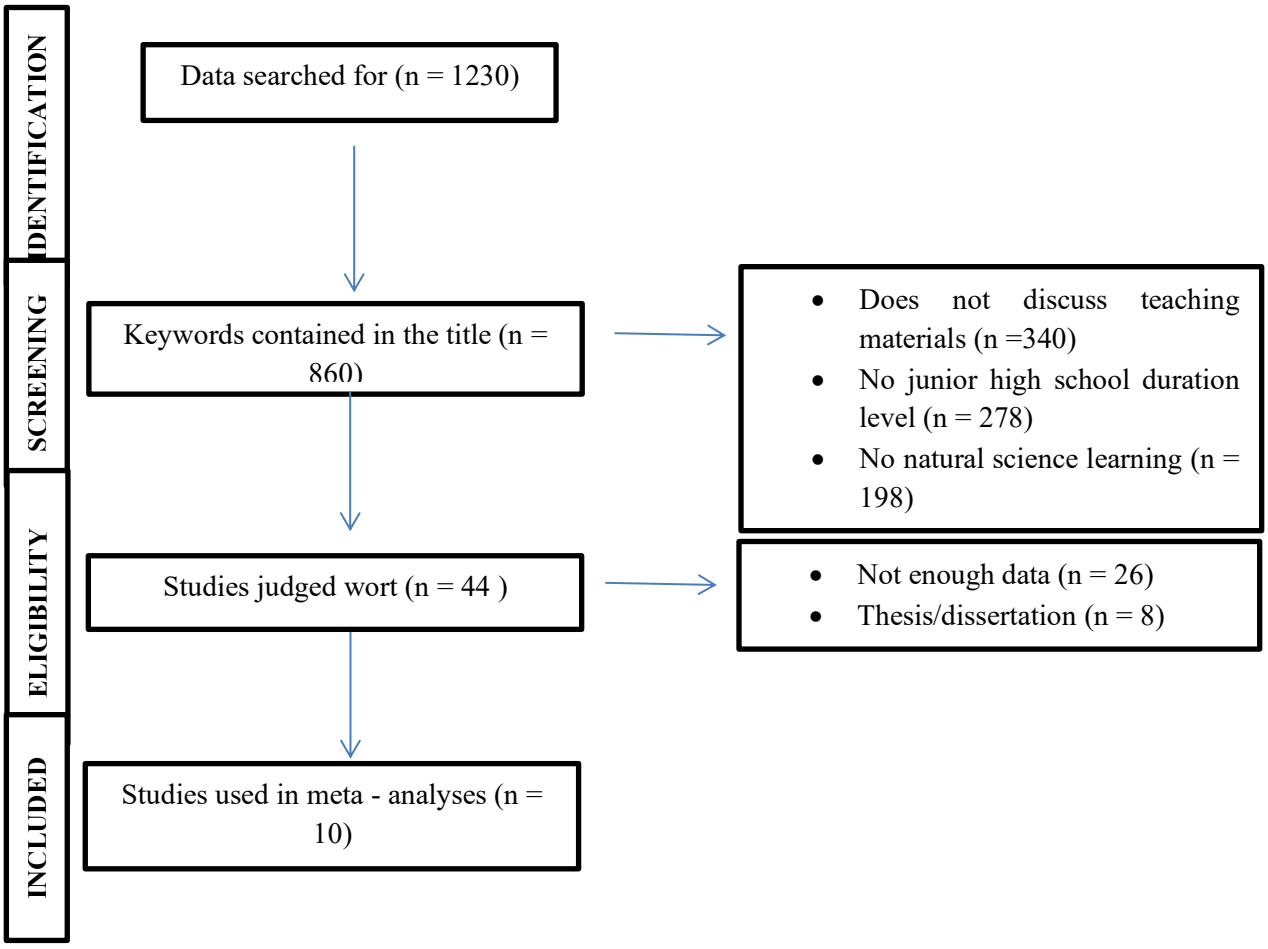

Figure 1. Article Selection

RESULTS AND DISCUSSION

Socio-Scientific Issue approach are that students can stimulate intellectual, moral and ethical development, and foster awareness of the relationship between science and real life (Nurhalimah et al., 2024) . *Socio-Scientific Issues* are controversial and complex because they do not have a definite answer to solve them not only with science but also involving social aspects (Hancock et al., 2019) .

Socio-Scientific Issue) based teaching materials are teaching materials that integrate science materials with relevant and controversial social issues in real life. These teaching materials aim to develop students' critical thinking, problem analysis, and problem-solving skills through an interdisciplinary approach (Monaliza & Miterianifa, 2023) .

After conducting an article search via Google Scholar, 10 clinical articles were found published between 2019-2025, which were analyzed in Table 2 .

Table 2. Characteristics of the Articles Analyzed

No.	Writer	Research methods	Class	Teaching materials
1.	(Laksono & Wibowo, 2022)	ADDIE	IX	Textbook
2.	(Chomsun et al., 2024)	ADDIE	VIII	e-LKPD
3.	(Wahidah & Supeno, 2024)	PLOMP	VII	E-Module
4.	(Rahmayanti & Andayani, 2023)	ADDIE	VII	E-Module
5.	(Ria Naena Febriana et al., 2023)	4D	VII, VIII, IX	E-Module
6.	(Agung et al., 2024)	ADDIE	VIII	E-Module
7.	(ET Wahyuni et al., 2024)	ADDIE	VIII	E-LKPD
8.	(Pinasti et al., 2020)	Borg & Gall	VII	Teaching Module
9.	(Ika et al., 2019)	ADDIE	IX	Textbook
10.	(Setiadi & Putra, 2021)	Borg & Gall	VIII	Module

Based on the analysis results from Table 2. There are 10 articles discussing the development of teaching materials based on *Socio-Scientific Issues* in junior high school science learning. The results of the analysis show that the study uses the Research and Development method, qualitative descriptive and experiments. The percentage of research method use can be seen in Figure 2.

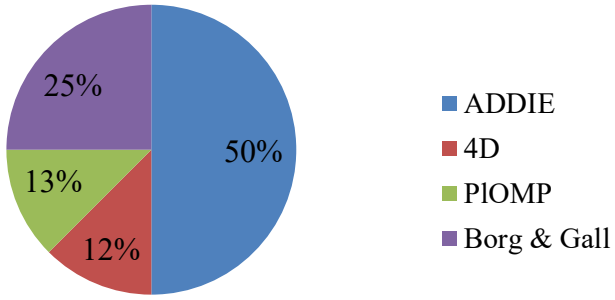

Figure 2. Research Methods

Based on Figure 2, it can be seen that the research method used is the Research and Development (R&D) method. The most widely used development model is ADDIE (50%). The next development model is Borg & Gall (25%). The 4D and PLOMP development models have the same percentage, namely 12.5 % .

According to (Sugihartini & Yudiana, 2018) the ADDIE model is often used because the stages of the ADDIE model describe a systematic approach to instructional development. ADDIE is an acronym for Analyze, Design, Develop, Implement and Evaluate. Furthermore, the Borg and Gall development model is a systematic method used in designing and developing learning media. Developed in 1983 by Meredith D. Gall and Walter R. Borg, this model has become one of the main guides in developing learning media at various levels of education (Nawali et al., 2024) .

Furthermore, the development model used is the 4D model. The 4D model consists of Define, Design, Develop , Dissemination (Rafida et al., 2022) . While Plomp is a Research and development research model consisting of three phases, namely: initial research (plenary research), prototype phase (prototyping phase), assessment phase (assessment phase).

The next thing that can be analyzed from the findings of the article is the class that is targeted by the research. The class percentage can be seen in Figure 3.

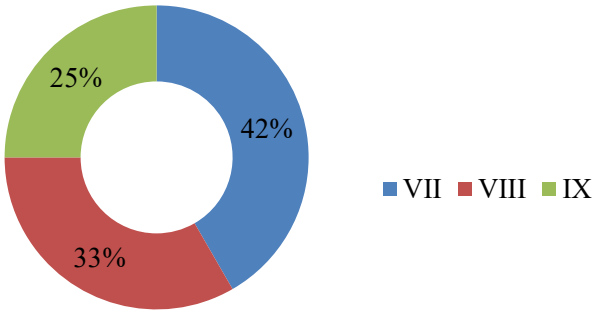

Figure 3. Class Data

Based on Figure 3, it is known that the class that was most researched was class VII with a percentage of 42%. Next, there is class VIII with a percentage of 33% and class IX with a percentage of 25%.

Furthermore, there are several forms of teaching materials based on *Socio-Scientific Issues* in the form of Science E-Modules, Science Textbooks, Science E-LKPD, Science Teaching Modules, and Science Modules. The percentage of teaching materials based on *Socio-Scientific Issues* can be seen in Figure 4.

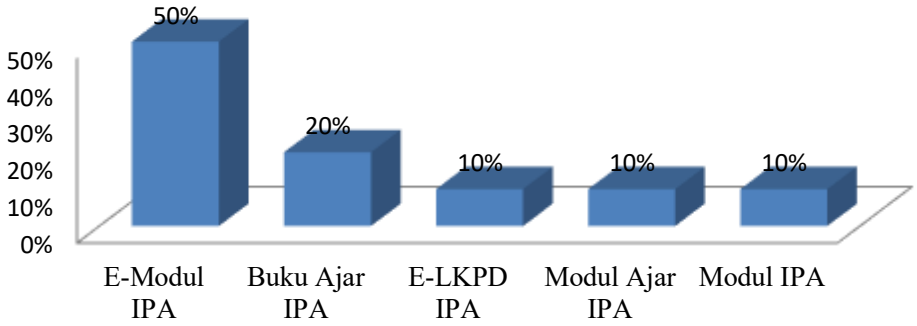

Figure 4. Shape of Teaching Materials based on Socio-Scientific Issues

Based on Figure 4 . it is known that the most widely used form of ethnoscience-based teaching materials is the Science E-Module with a percentage of 50%. Then the Textbook has a percentage of 20%. There are also Science E-LKPD, Science Teaching Modules and Science Modules have the same percentage of 10%.

E-modules are learning modules packaged in digital form. These e-modules allow online learning access, anytime and anywhere, and are usually equipped with various multimedia features such as images, animations, audio, and videos to improve student interaction and understanding (Lastri, 2023) . In addition, e-modules can also be integrated with online learning platforms, making it easier for teachers to monitor student learning progress. With an interactive and flexible design, e-modules are an effective solution in supporting the learning process in the digital era.

Textbooks are one type of teaching material that contains learning materials that are systematically arranged by experts to support the achievement of learning objectives. In Indonesia, the writing of textbooks has followed the systematics set by an official institution, namely the National Education Standards Agency (BSNP). This provision is made to control and supervise the distribution of books that are widely published by various publishers in Indonesia (Halim, 2018) .

E-LKPD is a teaching material in electronic form, containing materials, summaries, and instructions that must be completed (Khasanah & Setiawan, 2022) . LKPD modified into electronic form (E-LKPD) provides the probability for students to be able to learn independently and is able to improve efficient communication between teachers and students (R. Wahyuni et al., 2021) .

The teaching module itself can be said to be an implementation of the Learning Objective Flow (ATP) which is developed from Learning Outcomes (CP) with the Pancasila Student Profile as the target. The teaching module is arranged according to the

phase or stage of student development. The teaching module also considers what will be learned with clear learning objectives. Of course, the basis of its development is also long-term oriented. Teachers also need to know and understand the concept of the teaching module with the intention of making the learning process more interesting and meaningful (Ulfa et al., 2024) .

The following is a trend based on vosviewers analysis shown in Figure 5 .

Based on the visualization results from VOSviewer, it can be seen that the term "socio-scientific issues" is at the center of the network of relationships between the terms analyzed. This term has a direct relationship with two other keywords, namely "e-module" and "science literacy". This shows that socio-scientific issues are the main concept that connects the use of e-modules in learning with the development of scientific literacy. This relationship indicates that the use of e-modules based on socio-scientific issues can be an effective strategy in improving students' scientific literacy. Thus, research that integrates these three aspects has the potential to make a significant contribution to the field of science education, especially in equipping students with critical thinking skills on scientific issues that are relevant to everyday life.

CONCLUSION

Based on the results of the analysis, it can be concluded that the most widely used research method is Research and Development (R&D), with the ADDIE development model being the most dominant (50%), followed by Borg & Gall (25%), and 4D and PLOMP each at 12.5%. The majority of research subjects were conducted on grade VII students (42%), followed by grade VIII (33%) and grade IX (25%). The most widely used form of ethnoscience-based teaching materials is the Science E-Module (50%), then Textbooks (20%), and E-LKPD, Teaching Modules, and Science Modules each at 10%. VOSviewer visualization shows that the term "socio-scientific issues" is the center of the relationship with "e-module" and "science literacy", which shows that the use of socio-scientific issue-based e-modules is effective in improving students' science literacy. Research with the integration of these three aspects has the potential to strengthen science education and students' critical thinking skills.

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