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Science, Environment, Technology, and Society - Based Module to Improve Critical Thinking in Class IV Elementary School Learning

Uhori Adriyono[1*], Fatkhur Rohman[2], Pargito[3]

[1,2,3] Universitas Lampung, Bandar Lampung, Indonesia

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ABSTRAK

Rendahnya kemampuan siswa Indonesia berkaitan dengan proses pembelajaran (khususnya pembelajaran IPA) yang belum sepenuhnya memberikan kesempatan kepada siswa untuk mengembangkan kemampuan penalaran kritis. Penelitian ini bertujuan untuk membuat modul berbasis SETS untuk meningkatkan berpikir kritis siswa. Penelitian ini merupakan jenis penelitian Research and Development (R&D), pengembangannya dilakukan mengacu pada teori Borg & Gall. Populasi penelitian ini adalah siswa kelas IV Sekolah Dasar. Subyek dalam penelitian ini ditentukan dengan menggunakan teknik purposive sampling diperoleh sebanyak 24 siswa. Alat pengumpulan data menggunakan instrumen tes yang valid dan reliabel. Teknik analisis yang digunakan adalah analisis kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa modul berada pada kategori sangat valid dan praktis. Ahli materi memperoleh nilai sebesar 0,92, ahli media sebesar 0,87, dan ahli bahasa 0,93 serta ahli pedagogi 0,93, secara keseluruhan berada pada kategori valid. Hasil penilaian respon pengguna dari siswa sebesar 96,4 dan kepraktisan guru sebesar 93,61 termasuk kategori sangat praktis). Data menggunakan N-Gain dengan hasil perhitungan sebesar 0,52. Kesimpulannya menunjukkan bahwa modul berbasis SETS yang dikembangkan efektif untuk meningkatkan berpikir kritis siswa sekolah dasar.

ABSTRACT

The low ability of Indonesian students is related to the learning process (especially science learning) which does not fully provide opportunities for students to develop critical reasoning abilities. This research aims to create a SETS-based module to improve students' critical thinking. This research is a type of Research and Development (R&D) research, the development was carried out referring to Borg & Gall's theory. The population of this study was fourth grade elementary school students. The subjects in this research were determined using a purposive sampling technique and obtained 24 students. Data collection tools use valid and reliable test instruments. The analysis technique used is quantitative and qualitative analysis. The research results show that the module is in the very valid and practical category. Material experts received a score of 0.92, media experts 0.87, language experts 0.93 and pedagogy experts 0.93, overall, in the valid category. The results of the user response assessment from students were 96.4 and teacher practicality was 93.61, including the very practical category). Data uses N-Gain with a calculation result of 0.52. The conclusion shows that the SETS-based module developed is effective in improving elementary school students' critical thinking.

1. INTRODUCTION

The change in the 2013 Curriculum to the Merdeka Curriculum at the elementary school level is the government's effort to improve the quality of education, due to the low literacy of students at the elementary school level (Anridzo et al., 2022; Muslim, 2023). The independent curriculum gives teachers the freedom to choose various teaching tools so that learning can be tailored to the needs and interests of students (Armadani et al., 2023; Iis et al., 2022). One of the freedoms that teachers have is related to developing learning tools of accordance with the content of the independent curriculum at the elementary school level. One of the contents in the independent elementary school curriculum is IPAS. Science is a

*Corresponding author
E-mail addresses: uhoridriyono@gmail.com (Uhori Adriyono)

new subject in the Merdeka curriculum which is a combination of Natural and Social Sciences. The fusion of science and social studies in the current curriculum indicates that they can be taught simultaneously. Science lessons are science that studies living things and non-living things in the universe and their interactions (Antara et al., 2022; Devi & Bayu, 2020). Science studies examine human life as individuals and as social creatures who interact with students in the environment. In the Independent Curriculum pocket book, it is stated that the combination of science and social studies lessons is expected to trigger children to be able to manage the natural and social environment in one unit (Indah Junia & Sujana, 2023; Syifaunnida & Kamaludin, 2022). Science learning stimulates students to develop abilities and skills. The thinking skills that students must master in education in the 21st century are creativity, critical thinking, problem solving, and decision - making. Critical thinking includes high-order thinking skills which is one of the components of 21st - century literacy (Hastuti et al., 2020; Rapanta et al., 2021; Rusdiana & Wulandari, 2022a). Critical thinking is an important thing that must be possessed in building students' knowledge to ask questions, express opinions, and refute the information obtained, critical thinking skills will stimulate students' cognitive reasoning in acquiring knowledge (Anwar et al., 2020; Ichsan et al., 2021; Widana et al., 2020). Without adequate abilities in terms of reasoning (deductive, inductive, and reflective), a person cannot carry out critical thinking processes correctly (Suci et al., 2019; Utami & Dafit, 2021). In reality, students' critical thinking skills are still low. The low ability of Indonesian students is related to the learning process (especially science learning), which does not fully provide opportunities for students to develop critical reasoning skills (Antara et al., 2022; Maslakhatunni'mah et al., 2019). Teachers still have weaknesses in implementing learning that is in accordance with the nature of science learning (Dwiqi et al., 2020; Rusdiana & Wulandari, 2022b; Wiradarma et al., 2021). Based on the results of the observations, it was found that several students did not dare to ask questions and were afraid to express their opinions, especially when composing sentences based on logical things. In learning so far, not many learning media have been used so that all learning resources are with the teacher and the impression of independence has not been ingrained in the students. The distribution of needs analysis questionnaires to students with curiosity so that learning focuses on the teacher (teacher center) is characterized by the dominance of educators' activities in learning activities. Improving the learning process is carried out by creating a student-centered learning atmosphere so that students are more motivated and active in learning activities. The teacher is no longer the center of learning but a guiding facilitator for improving critical thinking skills in science and science learning. The results of interviews with teachers show that learning activities in the independent curriculum have undergone new changes, namely the fusion of natural and social science subjects. Teachers need teaching materials such as modules that can be used as a systematic learning reference and can be used by students independently so that they can improve students' skills more effectively.

The solution to this problem is to use learning tools. A learning device is a component that must be studied, observed, studied, and used as teaching material for students to learn (Anisah & Lastuti, 2018; Aryawan et al., 2018). Some of the teaching materials are modules. A module is one of the learning tools that is designed with guidelines arranged in a systematic and interesting manner. The aim of the learning module is that students are expected to be able to master material competencies and help students learn in a directed manner (Apriani et al., 2021; Widiastuti, 2021; Yerimadesi et al., 2017). Students' critical thinking skills can be trained by applying approaches to learning, one of which is the Science, Environment, Technology, and Society (SETS) model. The Science, Environment, Technology, and Society (SETS) learning model is an extension of science, environment, technology, and society. The basis for using this approach is that students will have the ability to view things in an integrated way by paying attention to the four elements so that they can obtain a deeper understanding, not just knowledge (PR Dewi & Arnyana, 2020; Sarjono, 2020). The SETS learning model develops the concepts of green chemistry and caring for the environment. The accompanying effect is increasing critical thinking and high-level thinking skills. Previous research findings stated that learning with the SETS model can increase students' understanding of higher-level thinking. Students' critical thinking skills can be trained by applying approaches to learning, one of which is the Science, Environment, Technology, and Society (SETS) model (PR Dewi & Arnyana, 2020; Sarjono, 2020). There is an influence of the SETS learning model on students' motivation and learning outcomes in biology on the concepts of environmental change and conservation (PR Dewi & Arnyana, 2020; SHJ Putra, 2021). Much research has been carried out regarding the SETS learning model, but to use science (S-first) in the form of technology (T) to meet the needs of society (S-second) requires thinking about the various implications for the environment (E) both physically and mentally. SETS covers topics and concepts related to science, the environment, technology, and things that can damage the environment and society itself. This research aims to create a Science, Environment, Technology, and Society (SETS)-based module to improve critical thinking in fourth grade elementary

school learning. It is hoped that the existence of the module can help students in the learning process, so that it can improve students' critical thinking skills.

2. METHOD

The type of research used is research and development (R&D). Development research is a process used to develop and validate educational products (Kimianti & Prasetyo, 2019; Kirana, 2020). The Science, Environment, Technology, and Society SETS-based module aims to create innovation in the development of SETS-based modules. The research procedures carried out by researchers in development were adapted from the development steps developed by Borg & Gall. Implementation of research from step one to step six, namely, gathering initial information, product planning, product development, limited testing, revision, and main testing. The preliminary study and trial of the module equipment were carried out at SDN 1 Jati Indah, Tanjung Bintang District. The process of developing learning tools is carried out on the Lampung University campus. The research subjects were modules based on Science, Environment, Technology, and Society and critical thinking skills, while the product trial subjects were fourth grade elementary school students. Data collection techniques in research are used to obtain data information that can be taken into consideration in generalizing research results. The needs analysis data collection technique was carried out by interviewing elementary school teachers and providing a questionnaire on the needs of students in class IV, with a total of 40 students. Product validity data collection techniques from experts, in the form of validation test questionnaires, are used to obtain valid values for product prototypes. The validation sheet uses a Likert scale consisting of numbers 1 (not suitable) to 5 (very suitable). Evaluation of learning outcomes and effectiveness data is measured using test instruments in the form of pretest and post-test questions, which will be given to students before and after the learning process takes place. The test instrument is a post-test and pretest of 15 multiple-choice questions calculated using the T test using SPSS with appropriate software and Windows. This T test is a test of the difference between two paired samples; these paired samples are the same object but have experienced different treatment. This model is used to analyze before and after research models. The T test will later obtain quantitative data. A paired sample test is one of the testing methods used to assess the effectiveness of treatment, characterized by differences in the average before and after the treatment is given.

3. RESULT AND DISCUSSION

Result

The type of research used is research and development (R&D). The first step in developing a Science, Environment, Technology, and Society (SETS)-based module is collecting information and analyzing the needs of educators and students. The stage carried out is a field survey. This activity aims to identify and determine the basic problems faced by educators and students in the science and science learning process. Based on needs analysis, namely by interviewing teachers at schools and distributing needs questionnaires to fourth grade elementary school students, A literature review carries out literature studies related to research. The results of the literature study are in the form of relevant research journals and literature reviews, such as IPAS textbooks that support research. The planning stage includes defining the skills that must be learned, formulating objectives, determining the learning sequence, collecting materials. This research and development planning includes aspects of the content of what materials will be taught. The design process in developing this module includes making clear objectives, developing learning content and creating an initial interface or cover for the product to be created. Product development stage according to student needs. The first step in development is to design the product design. The design of Science, Environment, Technology, and Society (SETS)-based modules for learning Natural and Social Sciences is based on the results of analysis of student needs, problems and analysis obtained at the analysis stage. The prototype module based on Science, Environment, Technology and Society (SETS) will adopt a model with 4 SETS stages, namely invitation (preliminary), exploration, solution, application and 5) evaluation. Initial product development, an introduction containing assumptions, theoretical basis for development, and usage mechanisms, until an initial product is formed and then validated. A recapitulation of expert validation percentages is presented in **Table 1**.

Based on Table 1 shows the results of expert validation showing that validation of the Science, Environment, Technology, and Society (SETS) - based module is in the very valid category. So that the Science, Environment, Technology, and Society (SETS) - based module is valid for use in the learning process. The initial trial was carried out to determine the response of teachers and children to the SETS-based module to improve critical thinking developed in the learning process. This trial was carried out on

six teachers and 10 students using a questionnaire of teacher and student responses to the module being developed. The practicality test is used to determine the level of suitability of the product that has been developed before it is used in learning. The results of the teacher and student practitioner tests are presented in Table **2**.

Table 1. The Product expert validation results

Expert Validation	Value Range Results	Information
Materials Expert	0.92	Very Valid
Media Expert	0.87	Very Valid
Linguist	0.90	Very Valid
Pedagogist	0.93	Very Valid

Table 2. The Teacher and Student Practitioner Test Results for Science, Environment, Technology, and Society (SETS)-based modules

Practicality	Percentage Yield	Classification
Learners	96	Very Practical
Teacher	94	Very Practical

Practitioner test results show that the percentage of students is 96% and the percentage of teachers is 94%; overall, it is in the very practical classification. This shows that the Science, Environment, Technology, and Society (SETS)-based module is suitable for use in science learning. According to the results of the feasibility test, if parts are still found that are not appropriate, then revisions need to be made according to the validator's input. Media experts, material experts, language experts, and pedagogical experts are the ones who determine whether revisions still need to be carried out or whether they are suitable for use in learning. Products that were feasible were then tested on a wider range of users, totaling 24 students. Users in this context are students who are users of the product being developed. In the wider field test, testing was carried out in 2 parallel classes at 1 school. The results of the effectiveness test are presented in Table 3.

Table 3. The Statistical Test Results for Pre-Test, Post-Test and N-Gain Data

Data	Class	Normality test	Homogeneity Test	Independent Sample t-Test	Note.
Pre-test	E	Sig.0.199> 0.05	Sig. 0.144 > 0.05	Sig.0.00 < 0.05	There is a difference
	K	Sig.0.058> 0.05			
Post-test	E	Sig.0.171> 0.05			
	K	Sig.0.124> 0.05			

Based on Table **3**, the results of statistical tests on pre-test, post-test, and N-Gain data show that the SETS-based module improves the critical thinking skills of elementary school students (Sig. 0.00<0.05), which means there is a difference in the average learning outcomes of students between the experimental class and the control class. The results of the independent sample t-test using the N-gain score stated that the SETS-based module was effective in improving students' critical thinking skills during learning (Sig. 0.00<0.05), with an n-gain for the experimental class of 0.52, including the medium category. The t-test results are presented in Table 4**.** Based on Table 4, **it** shows the sig value. Levene's Test for equality of variance is 0.497 < 0.05, so it can be interpreted that the data variance between groups is heterogeneous. With the resulting Sig value. (2-tailed) of 0.000 < 0.05, it can be concluded that there is a significant difference between the average student learning outcomes with SETS-based modules and conventional learning.

Table 4. The T test results

Statistics		*Levene's Test for Equality of Variances*		*t-test for Equality of Means*						
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*	*95% Confidence Interval of the Difference*	
									Lower	*Upper*
Learning outcomes	***Equal variances assumed***	0.468	0.497	9,620	46	0.000	21.667	2.252	17.133	26.200
	Equal variances not assumed			9.620	44.104	0.000	21.667	2.252	17.128	26.206

Discussion

SETS-based modules are feasible and valid for use in the learning process for class IVA students at SDN 1 Jati Indah to improve students' critical thinking skills. This is seen in the media, material, and design aspects that are suitable and valid to use. A SETS-based module was developed in accordance with the curriculum and learning materials applicable in schools. Conformity of material with the curriculum is very important to reduce the occurrence of deviations in the delivery of material and make it easier for students to receive material packaged in learning media appropriately and accurately (Asrial et al., 2020b, 2020a; Sukarman et al., 2021). Apart from that, the material presented in the media has been presented systematically. Systematic material can make it easier for students to construct their understanding of the material being studied (PYA Dewi & Primayana, 2019; Hamid et al., 2021). Apart from that, the presentation of the material, choice of typeface, layout, and colour composition in this module are in accordance with the rules of module development. A media that is suitable for application in learning should follow the basic rules and principles of media development, which include dimensions of material presentation, choice of typeface, layout, colour composition, and others (Laili et al., 2019; Sintawati & Margunayasa, 2021).

SETS-based modules are effectively used in the learning process for class IVA students at SDN 1 Jati Indah to improve students' critical thinking skills. SETS-based modules allow students to be more active so that the learning process becomes more meaningful and can indirectly increase students' understanding. Learning using SETS is also able to improve problem-solving abilities related to students' critical thinking abilities (Hidayati & Prayitno, 2022; Ivanović et al., 2013). The use of learning media oriented towards higher-level thinking abilities will provide opportunities for students to practice solving problems using higher-level thinking abilities (IMYT Putra, 2021; Suci et al., 2019; Yusuf, 2018). The use of modules can also provide opportunities for students to play an active role in the learning process and can increase their insight and knowledge (Fonda & Sumargiyani, 2018; Nopiani et al., 2021).

The SETS-based module form makes it easy to access the module anywhere and anytime. Apart from that, the use of modules can create a new atmosphere for students, which can increase their' interest and motivation to learn. This finding is reinforced by previous research findings stating that SETS integrated learning media is able to make students improve their process and activity skills and provide good responses to learning (PR Dewi & Arnyana, 2020; Pralisaputri, Kurnia Ratnadewi Soegiyanto & Muryani, 2016).The use of SETS-based learning media can also produce effective learning, as seen by increasing students' critical thinking abilities. SETS (Science, Environment, Technology, and Society)-based chemistry e-module for students (Hayati et al., 2019; Safitri & Sari, 2022). Based on previous discussions and findings, it shows that SETS-based modules are effective in improving students' critical thinking skills. Limitations in this research lie in the scope of material, level, and learning content developed in the module. The material developed in the module product in this research is only limited to science learning content for elementary schools. The implications of this research can improve students' critical thinking skills through SETS-based modules, so that learning outcomes can also improve.

4. CONCLUSION

The SETS-based module product developed is valid in content and construction. SETS-based modules are effectively used in the learning process for class IVA students at SDN 1 Jati Indah to improve students' critical thinking skills. This is proven by the results of the critical thinking test, which obtained a medium rating. The use of SETS-based learning media can also produce effective learning, as seen by increasing students' critical thinking abilities. It is recommended that teachers use learning modules to support the learning process.

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