JPPIPA 9(3) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of Science Module on the Topic of Interaction of Living Things and the Environment Using the Scientific Critical Thinking (SCT) Model to Improve Critical Thinking Ability and Self-Efficacy

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Received: November 18, 2022
Revised: March 25, 2023
Accepted: March 28, 2023
Published: March 31, 2023

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DOI: 10.29303/jppipa.v9i3.2458

Abstract: This research is based on the existence of problems in the form of low critical thinking skills and students' self-efficacy in learning. One way that can be done to solve this problem is by utilizing teaching materials in the form of modules that students can use for independent learning. Therefore, this research was conducted to develop science learning modules to improve critical thinking skills and self-efficacy in class VII students of junior high school. This type of research is Educational Design Research (EDR) using the Tessmer development model. The final result of the validation average is 3.67, which is in the very valid category. Therefore, based on the research results, it can be concluded that the science learning module has been declared very valid for increasing students' critical thinking skills and self-efficacy in learning science.

Keywords: Module; Critical Thinking Ability; Self-Efficacy; Validity

Introduction

In the 21st century, the world of education has experienced various significant developments (Oktarina et al., 2021; Suharyat et al., 2022). The National Education System in the 21st century faces complex challenges in preparing quality Human Resources (HR) that can compete in the era of globalization. The development of science and technology causes humans to face many challenges in terms of life, so they demand better quality human resources. According to Wartiningsih et al. (2016), one of the right ways to improve the quality of human resources for the better is through education. Good education reflects a good country because education affects the quality of human resources in that country. Tirtarahardja and Sulo (2005) state that Indonesia needs quality human resources to compete in this global era.

The National Education Association (n.d) has identified 21st-century skills as "The 4Cs", including critical thinking, creativity, communication, and collaboration. According to (Ariyana et al., 2018; Redhana, 2019), in the 21st century, there are at least four skills that students must master: creative thinking, critical thinking, collaboration, and communication. In addition, students also have skills in using media, information, and technology (Pešaković et al., 2014; Vlasta & Jan 2011; Akilli et al., 2017).

The ability to think critically (critical thinking) is one of the higher-order thinking skills that the teacher can develop. Critical thinking ability is one of several types of skills that students must possess to face the times. Critical thinking skills are reflective and reasoned ways of thinking that are focused on making decisions to assist students in interpreting, analyzing, evaluating, solving problems, drawing conclusions, and providing explanations; freedom of thought; thinking based on

How to Cite:
Hasbie, M., Abdullah, A., Rusmansyah, R., Aufa, M.N., Fitri, M. A., Saputra, M. A., & Hairunnisa, H. (2023). Development of Science Module on the Topic of Interaction of Living Things and the Environment Using the Scientific Critical Thinking (SCT) Model to Improve Critical Thinking Ability and Self-Efficacy. *Jurnal Penelitian Pendidikan IPA*, *9*(3), 1348–1351. https://doi.org/10.29303/jppipa.v9i3.2458

skills and responsibilities that lead to criteria assessment and being sensitive to problems (Ennis, 1995; Mundilarto & Ismoyo, 2017; Vong & Kaewuri, 2017; Zulfaneti et al., 2018; Zivkovic, 2016). Critical thinking is also a thinking ability that can give reasons in an organized manner and evaluate those reasons systematically. Developing critical thinking skills is one of the main objectives of learning science and one of the demands of the science curriculum for junior high school students in 2013 to produce a brilliant and quality generation of Indonesians (Suryanti et al., 2018; Zulmaulida et al., 2018). Science learning is a subject that leads students to think critically (Mu'arif & Surjono, 2016).

Critical thinking skills can basically train or increase students' self-efficacy in completing assignments (Hasbie et al., 2018). Self-efficacy can also be defined as a person's belief in his ability to produce an action that can affect his life. Self-efficacy will determine how he thinks, acts, and motivates himself (Bandura, 1997). The study results show how important self-efficacy must be trained and owned by students. Therefore, an innovative science learning model is needed to improve student's critical thinking skills and self-efficacy.

However, in reality, students' critical thinking skills are still classified as moderate and low (Hasbie et al., 2018; Naparin et al., 2020; Ulfah, 2020; Nurhikmayati & Jatisunda, 2019), the low achievement of learning achievement, especially in science subjects, is caused by some factors. The first is related to the way teachers teach. Teachers in schools more often use the teacher center teaching pattern. The second factor, namely self-efficacy or one's belief in one's abilities in learning, is low due to the teacher-focused learning pattern. The third factor is inadequate learning facilities and limited teaching materials to develop students' critical thinking skills.

Based on the problems above, learning innovations are needed by the development of the 21st century, which can later support students to improve students critical thinking skills and self-efficacy. One of the teaching materials that students can use for independent learning is a module (Munadi, 2012). Prastowo (2013) states that a module is a teaching material that is arranged systematically using language that students can easily understand and can learn independently without a facilitator and can be used according to the level of students' understanding of learning ability.

Modules are teaching materials that include learning objectives, usage guidelines, material descriptions, abstracts, evaluations, feedback, and follow-up, designed as independent learning tools (Ummah et al., 2018). Modules are beneficial in the learning process to generate desire and generate motivation for participants (Perdana et al., 2017).

The Scientific Critical Thinking (SCT) model is a learning model that was developed explicitly from the Problem-Based Learning (PBL) model and the Inquiry model to train critical thinking skills and self-efficacy (Rusmansyah et al., 2018). The syntax of the SCT learning model is 1) Student orientation; 2) Scientific Activity; 3) Presentation of Scientific Activity Results; 4) Completion of Critical Thinking Tasks; 5) Evaluation. The SCT learning model refers to John Dewey's problem-solving process flow (Moreno, 2010). This research was conducted to meet the practicality and effectiveness aspects of science learning modules using the SCT learning model to focus on how the SCT model learning was implemented, student activities in SCT model learning activities, and the results of students' critical thinking skills and self-efficacy.

This study aims to develop a science learning module on the interaction of living things with the environment to improve critical thinking skills and self-efficacy in class VII junior high school students. Therefore, the product category developed must meet the valid category (Van den Akker, 2010).

Method

This type of research is educational development research or Educational Design Research (EDR) using the formative evaluation model of Tessmer (1993) with five stages, namely 1) self-evaluation, 2) expert reviews, 3) one-to-one test, 4) small group tests, and 5) field tests.

This study used Banjarmasin 12 Public Middle School to trial the science learning module. Limited tests were carried out in one class, namely class VIIC. The selection of the trial class was determined based on information from the science teacher at SMP Negeri 12 Banjarmasin, who stated that students critical thinking skills and self-efficacy from all courses in class VII still needed to be developed.

Data collection techniques in this study used observation, interviews, and questionnaires. Module validation was carried out by three Validators consisting of 2 lecturers in the Master of Science Education ULM as academics and one science teacher at SMPN 6 Banjarmasin as a practitioner. The assessment results were then categorized based on the validity category table, as shown in Table 1.

Table 1. Criteria for validity

Percentage Intervals	Information
$3.25 < V \leq 4.00$	Very valid
$2.50 < V \leq 3.25$	Valid
$1.75 < V \leq 2.50$	Less valid
$1.00 \leq V \leq 1.75$	Invalid

Note: V = validity value (Akbar, 2013)

Result and Discussion

The results of this study are in the form of science learning modules, which are structured to improve students' critical thinking skills and self-efficacy in learning natural sciences on the interaction of living things with the environment. The development of this science learning module was designed using the Tessmer (1993) development model with five stages, namely 1) self-evaluation, 2) expert reviews, 3) one-to-one test, 4) small group test, and 5) field test. The following is a description of the research results obtained from each of these stages.

Self-evaluation

Researchers collect science materials, develop science modules and evaluate science modules.

Expert review

Providing the results of the prototype development, namely the Science module, to experts, experts evaluating the Science module, and researchers making improvements to the Science module.

One-to-one

The researcher gave the science module developed results that had been validated by experts and had been corrected to three students, the students gave assessments and comments/suggestions for improving the science module developed from the point of view of students, and researchers made improvements to the science module development by and words learners.

Small group

The researcher conducted an initial trial of the validated and revised IPA development module on nine students to assess the practicality and effectiveness of expectations. The researcher observed students carrying out scientific activities/practicum on LKPD in the development module as many as four movements; the researcher then conducted a recapitulation of the results assessing critical thinking, student responses, and self-efficacy towards the developed modules. The researchers made improvements to the developed modules based on student responses.

Field test

The researcher conducted the final stage of trials in large classes to assess actual practicality and effectiveness; the researcher observed students carrying out scientific/practical activities, the researcher then carried out a recapitulation of the assessment of critical thinking results, student responses, and self-efficacy towards the developed module, and the researcher carried out module improvements.

The results of developing science learning modules to improve critical thinking skills and self-efficacy for class VII junior high school students can be seen in Figure 1.

Figure 1: The results of module development based on critical thinking skills

The results of the validity of the Science learning module were obtained from the evaluation results of the validator, and the practicality of the module was obtained from the student's responses to the Science learning module. The validation results stated that developing science learning modules to improve critical thinking skills and self-efficacy for seventh-grade junior high school students was feasible in terms of content, presentation, and language aspects. The results of the module validation can be seen in Table 2, which shows that the average validation results have a very valid category. These results indicate that the module developed is in a very valid category to be used in learning after going through the revision stage following the suggestions and input from the validator.

Tabel 2. Module validation results

Validation	Validators			Average	Category
	I	II	III		
Content	63	53	65	3.71	Vey Valid
Presentation	58	50	60	3.73	Vey Valid
Language	65	52	65	3.73	Vey Valid
The final result				3.67	Vey Valid

Table 2 shows the module product that has been developed as a final result with an average validation of 3.67 with a very valid category. The final results that have been obtained indicate that the module meets very valid criteria to be tested with minor revisions. The results of module validation that have been received can be interpreted that the module's contents are by existing needs, contain new elements, and have excellent grammar, writing format, and layout. This is relevant to Nieveen's statement (1999), which states that the development of a research product must be based on existing needs, have elements of updating (content validity), and use good grammar, format, and layout (construct valid). Furthermore, the module is defined as one of the teaching materials systematically arranged and designed so that students achieve specific learning goals. In this case, understanding objectives are described in learning indicators (Mensan et al., 2020; Sesya et al., 2014; Wiwita et al., 2020). Therefore, table validation results show that the module meets the validity criteria.

Conclusion

Based on the research results, the science learning module to improve critical thinking skills and self-efficacy has validity results in the very valid category. Therefore, the Science module on the interaction of living things with the environment can be used in the learning process to improve critical thinking skills and self-efficacy in class VII junior high school students.

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