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THE DEVELOPMENT OF BIOLOGY MODULE BASED ON STEM-CP TO IMPROVE CRITICAL THINKING AND SELF-REGULATED LEARNING

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ABSTRACT

This research aimed at improving critical thinking and SRL (Self Regulated Learning) ability based on STEM-CP (Science, Technology, Engineering Dan Mathematic- Contextual Problem) by using module. This research employed a research and development (R&D) method, which was used as actual proof in improving a learning media of STEM-CP based modul. There were 12 schools, including state or private schools, and 12 biology teachers as need analysis involved in this study. A needs assessment was conducted by using a questionnaire generated in Google form. The result of the needs assessment showed that teachers 70% of stated so far the learning process has not run optimally, the media that has been used so far have not maximized the learning process of 66,6%, and 83.3% of teachers stated that learning had used modules, but 16.6% stated that the learning process had not used modules. The fact is that in learning the teacher has used the module but it has not maximized the learning process. The STEM-CP module is expected to be able to improve students' critical thinking skills and SRL (Self Regulated Learning).

KEYWORDS

Module of Biology, Science, Technology, Engineering, Mathematic-Contextual Problem

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INTRODUCTION

Education is one of the fields that is strongly influenced by the development of science and technology. Students living in the 21st century are required to be proficient in mastering science, have metacognitive skills, be able to think critically and creatively, and be able to communicate or collaborate effectively (Greenstein, 2012). Based on the results of the 2018 Program for International Student Assessment (PISA) study, Indonesia's PISA ranking in 2018 fell when compared to the 2015 PISA results. This 2018 study assessed 600.000 15-year-old children from 79 countries every three years. The study compared the math, reading, and science performance of each child. Then for the science performance category, Indonesia is ranked 9th from the bottom (71), with an average score of 396 (Tohir, 2019). As stated by Chung (2002) that learning is not only controlled by external aspects, but is also controlled by self-regulated internal aspects (Pravesti, Wiyono, Moenindyah, Triyono, & Atmoko, 2020).

The main priority in learning is educating students about how to learn independently and think critically with the hope of having an effect on student learning outcomes. The character of students in the form of independent learning is something that must be pursued in classroom learning (Sumarmo, 2010). Based on research conducted by Maghfiroh et al., (2016) proved that the SRL (Self Regulated Learning) of high school students in Jember is low (Maghfiroh, Subchan, & Iqbat, 2017). According to Zimmerman et al., (1989) students who have done Self Reguated Learning can make students as masters who are experts in their studies so that they are able to realize the desired learning outcomes (Zimmerman, 1989). This can be the reason why students' Self Regulated Learning (SRL) in Jember is low, because it is evidenced by the observation of Self Regulated Learning (SRL) in Jember High School and student learning outcomes are lacking. In addition to the ability to learn independently, the critical thinking factor is also thought to have an important influence on the achievement of student learning outcomes (Lombu'u, 2019). Critical thinking for students is needed, because during the learning process students develop ideas for thinking about the problems contained in learning.

The low level of students' critical thinking skills can be caused by the learning process that is less effective in developing the interests, talents and potentials that exist in students. Research conducted by Fitriyah (2020) proves that the critical thinking ability of high school students in Jember is in the low category, which is 34.28%, while students with moderate critical thinking skills are 48.58% and the rest (17.14%) are students with high critical thinking skills (Fitriyah, 2020). The success of a learning, in addition to depending on the method used is also very dependent on the learning tools used. A study conducted by (Tjiptiany et., al, 2016) concluded that teaching students who use textbooks has not given optimal results (Tjiptiany, As'ari, & Muksar, 2016). In addition, based on the results of interviews and observations in several high schools in Jember, the same problem was obtained, namely students still had difficulty understanding the material in the textbook and there were no modules developed by the teacher to support the learning process in the classroom.

One of the printed teaching materials that can support student learning activities is a module. Learning with modules allows students who have high speed in learning to complete one or more basic competencies faster than other students (Majid, 2011). Module is a form of teaching material that is packaged completely and systematically which contains a set of learning experiences that are planned and designed to help students master learning objectives (Pratiwi, 2012). The use of the module is considered very effective in creating the nature of independent learning in students.

One of the teaching materials that allow students to have critical thinking skills and SRL (Self Regulated Learning) is through teaching materials based on the STEM approach. Based on the results of Mulyasari & Sholikhah research (2021), STEM-based E-Modules can increase the independence of students during distance learning as measured using a gain score test which shows an increase in independence (Mulyasari, 2021). Although STEM-based learning is able to provide relevant problems as learning stimuli, the problems given are still general, meaning that they are not contextual or do not exist around students' lives (Nuriyah & Prihatin, 2020). Learning that is related to contextual issues becomes easy for students to understand. This is because the contextual problem is a problem in everyday life that functions to stimulate the brain to arrange patterns that are realized into a concept (Maulida, 2020). In addition, the benefits of contextual problems in learning are capable if the STEM approach is equipped with contextual problems (Contextual Problems) that are applied in learning tools into STEM-CP-based modules, then these learning tools can help students understand the material in an integrated manner and apply concepts from the material. it's in life.

The STEM-CP approach is a refinement of the STEM approach, namely STEM which is equipped with contextual problems. Contextual problems in question are real contextual problems that occur in students' daily lives and are displayed to help understanding concepts. Understanding this concept requires an approach that integrates several disciplines into a single unit that is expected to be able to overcome it and enable students to think critically. Based on some of the results of the study above, it is important to develop learning media in the form of STEM-CP-based modules to improve students' critical thinking skills and SRL (Self Regulated Learning).

RESEARCH METHOD

This type of learning media research was in the form of an E-Pocket Book using research and development method. Research and Development (R&D) is a series of processes or steps in order to develop a new product or improve existing products so that they are accountable. The research carried out was the Development of E-Pocket Book Learning Media. Need Assessment data retrieval was carried out in the odd semester of 2020/2021 by using a questionnaire filling technique through Google Forms given to high school Biology teachers. Need Assessment data were used to find out the problems and needs that exist in school. The results of the Need Assessment data were used as the development of the module learning media.

RESULT AND DISCUSSION

1. Need Assessment

The results of the distribution of observation sheets given to 12 high school biology teachers showed the following results:

Table 1. Obtained Need Assessment

Criteria	Percentage
The learning process has not run optimally	70%
The media that has been used so far have not maximized the learning process	66,6%
The learning that has taken place so far has used media, both electronic and non-electronic media	100%
Learning already uses the module	83,3%
The learning process so far has never used a STEM-CP-based module	100%
Agree to Media Deployment	100%

Based on the results of the need assessment distributed to several teachers (12 biology teachers), 70% of the teachers stated that so far the learning process had not run optimally. All teachers stated that the learning that had taken place so far had used media, both electronic and non-electronic media. As many as 66.6% of teachers stated that the media that had been used so far had not maximized the learning process.

As many as 83.3% of teachers stated that learning had used modules, but 16.6% stated that the learning process had not used modules. All teachers stated that the learning process had never used a STEM-CP-based module. Based on the results of the need assessment, teachers do not fully know and use the STEM-CP-based module. The fact is that in learning the teacher has used the module but it has not maximized the learning process. The STEM-CP module is expected to be able to improve students' critical thinking skills and SRL (Self Regulated Learning).

2. Learning Media Development Results

The Biology learning process so far has not run optimally, as many as 70% of teachers stated that so far the learning process had not run optimally even though all teachers stated that the learning that had taken place so far had used media, both electronic and non-electronic media. therefore 100% of teachers agree to apply STEM-CP-based module learning media, and 100% of teachers agree to develop learning media that can improve critical thinking skills and SRL (Self Regulated Learning). The results of the need assessment show that teachers do not fully know how the STEM-CP-based module is. Teachers still do not use STEM-CP-based module media because for everyday learning they still only use power point and video media. According to Pratiwi (2017) a module is a form of teaching material that is packaged completely and systematically which contains a set of learning experiences that are planned and designed to help students master learning objectives.

The module is a teaching material with a unified whole, consisting of a series of activities in learning, which can concretely provide effective learning outcomes in achieving learning objectives that have been clearly and specifically formulated in the module (Mbulu, 2004). The difference between ordinary modules, STEM-based modules and STEM-CP-based modules lies in the description of the material. In ordinary modules, the material contained is not equipped with the integration of Science, Technology, Engineering, Mathematics, or Contextual-Problem. While the STEM-based module is not equipped with Contextual-Problem. The STEM-CP-based module contains Science, Technology, Engineering, Mathematics, and is equipped with Contextual-Problems.

CONCLUSION

The learning media used in some schools looks lacking, therefore the development of STEM-CP-based modules can provide additional media during learning. On the STEM-CP-based module media there are Mastery Checks, Objectives and Material Descriptions: Science in the form of providing articles, videos, pictures, or problem-based animations that students can formulate independently, Technology in the form of applying science in technology to find solution ideas, Engineering in the form of technological designs that will be developed through modification of science, Mathematics in the form of discussing material mathematically, and Contextual-Problem in the form of real problems and close to the lives of students. In addition, there are summaries, practice questions, formative tests, and worksheets which can improve critical thinking skills and SRL high school students.

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