American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-10, Issue-01, pp-189-191
www.ajer.org
Research Paper Open Access

Description of the Need for Mathematics Teaching Materials with a STEM Approach to Develop Students' Creative Thinking Ability

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***ABSTRACT**: Creative thinking is one of the skills that students must have in 21st century learning in the era of the industrial revolution 4.0. Learning resources that have not facilitated students to develop creative thinking skills have an impact on the achievement of learning objectives. This study aims to describe the need for STEM-based teaching materials that can develop creative thinking skills for students of mathematics education at Bung Hatta University. This research is a qualitative descriptive study. The research subjects were students of the Bung Hatta University mathematics education study program. The data collection instrument used observation guidelines and interview guidelines. Observations on students to determine students' creative thinking skills and to determine the use of learning resources in learning. Interviews with lecturers to collect data about student needs for teaching materials and to find out the creative thinking abilities of students of the Bung Hatta University mathematics education study program. A literature study was conducted to determine the impact of using STEM on creative thinking skills. The research results provide some information. First, students' creative thinking skills need to be improved. Second, the teaching materials used in the learning process have not helped students to develop creative thinking skills. Third, the STEM approach can train students to hone their creative thinking skills. Fourth, lecturers need teaching materials that can develop students' creative thinking skills. Research can be extended to the development of STEM-based teaching materials to improve students' creative thinking skills.*
***KEYWORD**: Creative Thinking, Teaching Materials, STEM*

Date of Submission: 04-01-2021 Date of acceptance: 19-01-2021

I. INTRODUCTION

Mathematics plays an important role in the world of education because it becomes the basis and development of other sciences [1][2]. However, learning mathematics is still considered difficult by some students [3][4][5]. In general, in learning lessons that are considered difficult, students tend to show low interest in learning and achievement motivation [6]. Given the importance of mathematics, it is hoped that the role of a teacher can determine a learning approach that can change the mindset and views of students towards mathematics [7]. One learning approach that is in accordance with the revolutionary curriculum 4.0 is the STEM (Science, Technology, Engineering, and Mathematics) approach. The STEM approach is a learning approach that combines two or more fields of science contained in STEM, namely science, technology, engineering / engineering, and mathematics [8]. Through the STEM approach, students are expected to have learning and innovation skills that include critical, creative, innovative thinking, and are able to communicate and collaborate [9].

The purpose of STEM in the world of education is in line with the demands of 21st century education, namely that students have scientific and technological literacy as seen from reading, writing, observing, and doing science, and being able to develop the competencies they have to apply in dealing with problems in everyday life. related to the field of STEM science (Bybee, 2013; National STEM Education Center, 2014) [10]

STEM shows students how concepts, principles, engineering science, technology, engineering and mathematics (STEM) are used in an integrated manner to develop products, processes and systems that are beneficial to human life [11] and enable students to be able to compete in the 19th century 21 [12]

Creative thinking is one of the skills that students must possess in the 21st century learning and revolutionary curriculum 4.0 [13] [14]. The ability to think creatively is a way of thinking to see a situation or problem from a different side and open to various ideas and ideas to solve problems [15][16]. Creative thinking

in mathematics is a skill related to fluency, flexibility, originality and elaboration [17]. Therefore, creative thinking is a process of thinking using new ways that are related to fluency, flexibility, originality and elaboration and open to various ideas and ideas to generate possibilities in solving a problem.

II. RESEARCH METHODS

This research is a qualitative descriptive study. This research is a preliminary study conducted to collect information both literature review and observation, identify problems that occur in learning and then summarize them [18]. The first stage of this research is conducting preliminary, observation, data analysis and literature study. The research data collection technique is in the form of observation guidelines, interview guidelines and literature studies. Observation guidelines are used to retrieve data about student needs for learning media. Interview guidelines are used to determine the use of instructional media outside the classroom. A literature study was conducted to determine the impact of using STEM on critical and creative thinking skills. The subjects of this study were students of the 3rd semester of the Bung Hatta University mathematics education program. The data analysis used descriptive qualitative data including data reduction and conclusion drawing.

Analysis stage

The analysis stage is the stage of analyzing the need for product development and analyzing the feasibility and terms of development. The stages of the analysis carried out include three things, namely:

a. Needs Analysis

Needs analysis is carried out by first analyzing the state of the teaching material as the main information in learning and the availability of learning resources that support the implementation of learning. At this stage, the material that needs to be developed will be determined to assist students in learning.

b. Curriculum analysis

The curriculum analysis is carried out by improving the characteristics of the curriculum that is being used. This is done so that the development is carried out in accordance with the demands of the applicable curriculum. Then the researcher examines the Basic Competence to formulate indicators of learning achievement.

c. Character Analysis of Students

This analysis was carried out to see the attitudes of students towards learning mathematics. This is done so that the development carried out is in accordance with the character of the students.

III. RESEARCH RESULTS

The activities carried out in the analysis stage are needs analysis, curriculum analysis, and character analysis of students

The results of the research at the Analysis stage are:

1. Needs Analysis

Needs analysis aims to raise and determine basic problems in mathematics research, so it is necessary to develop STEM-based mathematics teaching materials. Based on the results of observations and experiences from researchers as lecturers, it was revealed that students were less motivated to learn because the way the lecturers presented the material presented was less attractive to students. In delivering the material, the lecturer only explains the material, then gives examples of questions and exercises.

The low level of student attention in following the mathematics learning process and the difficulty of students in understanding the learning material are obstacles faced by lecturers in achieving learning objectives. Therefore, it is necessary to develop a teaching material in accordance with student characteristics. Learning sources that have been used by students to study are books in the library and also downloaded from the internet. Most of the students do not have these learning resources, and they just wait and just accept what the lecturers say in class. Therefore, teaching materials that are made by lecturers are urgently needed as an effort to motivate students to learn.

2. Curriculum Analysis

The curriculum used at Bung Hatta University is the Industrial Revolution 4.0 curriculum. The higher education curriculum is a set of plans and arrangements regarding the objectives, content, and teaching materials as well as the methods used as guidelines for implementing learning activities to achieve higher education goals. The curriculum is used as a guide in the preparation of this teaching material. This designed teaching material uses STEM as a reference for preparation, in which this teaching material will show the relationship between mathematics and other fields of science, which can stimulate critical thinking from students. Which is the ability to think critically is the goal of the industrial revolution 4.0 curriculum, namely students have HOTS (Higher Order Thinking Skills) abilities.

3. Character Analysis of Students

The learning resources used by the lecturer greatly determine the success of their students in achieving learning goals. One of them is teaching materials that the lecturers make themselves by taking into account the characteristics of these students. Thus, students will feel comfortable with the learning atmosphere, with the materials used in the learning process. Because every student has different abilities. Not all students are able to understand textbooks in the library or study materials that are downloaded on the internet. which learning resources are generally accepted for all students. Meanwhile, teaching materials that are made by the lecturer can consider and adjust to the abilities possessed by students. Because it is very important that teaching materials designed by the lecturer are used in learning. And lecturers can also design and direct the teaching materials according to the demands of the curriculum used, and produce students with high level abilities (HOTS).

IV. CONCLUSION

Based on the results of the needs analysis, it was found that the teaching materials used by students for learning had not been able to make students think critically and creatively. Therefore, students really need teaching materials that are in accordance with student character and support the applied curriculum, and are able to make students think critically and creatively. STEM-based teaching materials are an alternative for lecturers in designing teaching materials according to student needs.

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Yusri Wahyuni. "Description of the Need for Mathematics Teaching Materials with a STEM Approach to Develop Students' Creative Thinking Ability."*American Journal of Engineering Research (AJER)*, vol. 10(1), 2021, pp. 189-191.