Role of learning module in STEM approach to achieve competence of physics learning

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Abstract. STEM (Science, Technology, Engineering, and Mathematics) the problem of education has received much attention in recent years. With STEM education, individuals can compete globally to deal with more complex changes or advancements. Learning with STEM approach is actually able to train students to be able to communicate, collaborate, critical thinking and problem solving, as well as creativity and innovation so that learners will be able to face global challenges. In this paper, we report on the study of literature studies by finding reference to theories relevant to the cases or problems found. This review is based on a number of empirical and conceptual journal articles on STEM published recently. The results of this review will be used as the theoretical reference to serving as the basic foundation and the main tool for the development of learning modules in accordance with the STEM approach in physics learning.

1. Introduction

Science and technology developed so rapidly in the 21st Century, causing the education process must prepare graduates able to compete in the field of technology. Human resources must have a high quality and have the ability to compare, innovative, competitive, and collaboratively so as to be able to face the challenges of the times.

Education is the most important thing in human life. This means that every human being deserves and hopes to always thrive in education. Education can help students have competence: attitude, knowledge, skills, and students are required to have the skills of thinking and problem-solving skills.

Physics is part of the natural sciences, so physics must also be based on scientific findings and going around. So, in the learning of physics must be instilled about the basic concept and development of skills. STEM is an established approach based on a combination of several disciplines, namely Science, Technology, Engineering, and Mathematics. Collaboration in the learning process, STEM can help students to collect and analyze and solve problems that occur and be able to understand the relationship between a problem and other problems [1,2,3]. Models with the STEM approach can form a human resource that is capable of reasoning and critical thinking, logical, and systematic, so that they will be able to face global challenges [4,5]. STEM is usually followed by active and problem-based learning. Problem-based Learning STEM can achieve problem-solving skills and assist students in acquiring enjoyable learning experiences [6,7].
Learning by using the STEM approach is very important, because it provides training to learners to be able to integrate each aspect at once. The learning process that involves the four aspects will shape the knowledge of the subject being studied more comprehensively. In physics learning, STEM helps learners to use technology and assemble an experiment that can prove a law or concept of science. This conclusion is supported by mathematically managed data [8].

At present, the teaching materials used in the 2013 curriculum are student package books compiled by the government but have not yet embraced the STEM approach [9,10]. According to observations made by Hapiziah [4], through textbooks as teaching materials used in Senior high school, obtained that 65.62% stated that the teaching materials used quite difficult for students to understand the concept of the question in the book 79.69%. Research about modules with the STEM approach in PBL is still rare. PBL integrated STEM can enhance students’ learning interest, learning becomes more meaningful, helping student’s problem solving in real life [11,12,13]. The module using the STEM approach is currently an alternative to science learning that can build a capable generation facing a challenging 21st century [14,15,16].

This paper will outline the physics module using the STEM approach to improve students' learning competencies.

2. Methods
Descriptive method of analysis of the theoretical references relevant to the case or problem found. This review journal is based on a number of articles empirical and conceptual on STEM. The results of this review will be used as a theoretical reference as the basic foundation and the main tool for the development of learning modules in accordance with the STEM approach in physics learning.

3. Results and Discussion
The term STEM was first used by the NSF in 1990 become an acronym of STEM [17]. The basic definition of each word is:

- Science: is a part of science that studies nature esta, facts, phenomena and order that is in it.
- Technology: made as innovation, change, modification of the natural environment gives satisfaction to human needs and desires. Technology aims to make modifications to the world to meet human needs
- Engineering: consists of determining the problem (ask), imagine (imagine), design (plan), create (create), and develop (improve). Engineering is a profession where scientific and mathematical knowledge is obtained through study, experimentation, and practice or applied to operate or design a procedure to solve a problem to meet the needs of human life
- Mathematics: a branch of a discipline that studies patterns or relation

STEM consists of four disciplines each have a field of study which are intertwined in it.

| Table 1. Related STEM Lessons [18] |
|-----------------------------------|
| **STEM** | **Related STEM Lessons** |
| Science | Natural Sciences is Biology, Chemistry, Physics, Earth Science |
| Technology | Computers / Information Systems, Communication Systems, Web Development |
| Engineering | Computer Engineering; Electrical Engineering; Chemical Engineering, Mechanical Engineering, Civil Engineering, Physics engineering |
| Mathematics | Statistics-Calculus |

STEM has been implemented in a number of developed countries such as USA, Japan, Finland, Australia and Singapore. STEM is an initiative of the National Science Foundation. The goal of
applying STEM in the USA is to make these four fields (science, technology, engineering, and mathematics) a major career choice for learners [19,20].

STEM is needed in learning. STEM literacy refers to: a). Knowledge, attitudes, and skills of an individual to overcome the problems in real life, explains a natural and design world, and describes the conclusions of different facts on the subject of STEM [21,22]. b). An individual's understanding of the characteristics of the STEM discipline as a form of knowledge, and inquiry. c). An individual's sensitivity about how STEM shapes material, intellectual and environmental cultures. d). The desire of an individual to be tied to the STEM issue and tied to the ideas of STEM as a constructive, caring and reflective citizen [23,24].

STEM learning is possible in collaboration with problem-based learning. Thus, all learning achievements accommodated by the Physics subject can be realized through the implementation of PBL-STEM [25,26]. The achievement of learning is cut with the literacy of the environment and creativity. Thus, can be said that the design PBL-STEM-based learning is strongly believed to enhance these two abilities [27,28,29].

From the results of previous research STEM has been widely applied in learning. This situation is shown by the results of research that revealed that the application of STEM can improve academic and non-academic achievement of learners [30,31,32]. Therefore, the application of STEM which initially only aims to increase students' interest in the field of STEM becomes wider [33,34,35]. This situation arises because after applied in learning, STEM able to increase the mastery of knowledge [36,37,38], apply knowledge to solve problems, and encourage learners to create something new. Application of the module using STEM approach to high school students can have a positive effect [39,40,41], as follows: (a) support the development of students thinking and awareness skills [42,43] (b) assist in the development of critical thinking skills (c) increase students' interest in science and mathematics, and interest in matters relating to STEM [44,45] (d) develop the nature of curiosity, and the ability to problems solve and (e) provide students with extensive experience of the world around them.[46,47,48].

Based on the results of previous research has been found that modules using the STEM approach can improve attitude competence, knowledge competence, and skill competence of students and increase students' interest in science and math, as well as support student success later in the field of work related to STEM [49,50].

4. Conclusions
The physics learning using modules with the STEM approach effectively improves students' learning competencies includes knowledge, attitudes, and skills. These results indicate that STEM approach is very important to be used physics learning in high senior school.

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