

## THE PROSPECTIVE OF STEM EDUCATION : PERCEPTION OF FLIPPED CLASSROOM LEARNING STRATEGY USING SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS (STEM) INTEGRATED E-MODUL IN IMPROVING SYSTEMS THINKING SKILLS

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### Article Info

#### Article history:

Received: Month XX, 20XX

Accepted: Month XX, 20XX

Published: Month XX, 20XX

(Times New Roman 11)

#### Keywords:

STEM Education

System Thinking Skills

Flipped Classroom Strategy

Electronic Modul

### ABSTRACT

This study aims to describe the teacher's perception of Perception Flipped Classroom Learning Strategy Using Integrated STEM E-Modules In Improve Systems Thinking Skills. The research was conducted in Lampung Province, Indonesia. involving 50 junior high school science teachers. The method used in this research is mixed methods with Sequential Explanatory Design. Data is retrieved using Questionnaire. Data were analyzed using descriptive analysis. The survey results show that teachers have a positive perception of the STEM approach. The results of the analysis of the STEM Approach most teachers have not used the STEM approach to provide understanding about science. Teachers have not implemented STEM integrated teaching materials.

## PROSPEK PENDIDIKAN STEM : PERSEPSI STRATEGI PEMBELAJARAN FLIPPED CLASSROOM MENGGUNAKAN E-MODUL TERINTEGRASI STEM DALAM MENINGKATKAN KEMAMPUAN BERPIKIR SISTEM

### ABSTRAK

#### Kata Kunci:

Pendidikan STEM

Kemampuan Berpikir Sistem

Strategi Flipped Classroom

Modul Elektronik

Penelitian ini bertujuan untuk mendeskripsikan persepsi guru tentang Persepsi Strategi Pembelajaran *Flipped Classroom* Menggunakan *E-Modul* Terintegrasi STEM Dalam Meningkatkan Keterampilan Berpikir Sistem. Penelitian dilakukan di Provinsi Lampung, Indonesia. melibatkan 50 guru IPA SMP. Metode yang digunakan dalam penelitian ini adalah metode campuran dengan Sequential Explanatory Design. Data diambil menggunakan Kuesioner. Data dianalisis menggunakan analisis deskriptif. Hasil survei menunjukkan bahwa guru memiliki persepsi positif terhadap pendekatan STEM. Hasil analisis Pendekatan STEM sebagian besar guru belum memanfaatkan pendekatan STEM untuk memberikan pemahaman tentang sains. Guru belum menerapkan bahan ajar terintegrasi STEM.

## 1. INTRODUCTION

Along with the development of social and ecological systems around the world (globalization), it has an impact on increasing the needs of the present generation but also must be able to ensure that future generations enjoy quality sustainable resources. Students as the current generation are required to have sufficient knowledge and skills to decide to act in a way that supports sustainable development, namely thinking about sustainable communities, one of which is improving systems thinking skills.

Learning science, systems thinking emerged as a reaction to the difficulties of science in dealing with various problems in complex systems. For biological researchers, systems thinking is the basic conceptual framework that underlies everyday work and dynamic living systems. The complexity of systems thinking does not only appear in science, but also in human life as the ability to manage that complexity, which is a way out to direct changes in the world for the better. Science education emphasizes environmental and environmental issues in the science curriculum. Thus, each student seeks to develop environmentally responsible behavior as an introduction to scientific understanding of the physical environment such as recycling or cleaning the school yard.

Better familiarization with environmental issues alone is not enough for students to develop decision-making abilities in good systems thinking about environmental issues. Science education, revealed that junior high school students may have little experience of thinking and even about simple emergent systems. Thus, he argues that teachers need to consider the types of activities such as facilitating students' systems thinking that arise in real-world contexts. In addition, teachers demonstrate environmental care behavior by learning specific and holistic knowledge that guides learning about the environment. Teachers prepare students for the future by involving them in the process of constructing concepts in their minds. Therefore, the main goal of school science education should be to equip students with the systems thinking skills needed in translating environmental problems, such as environmental pollution into a more coherent way. The results of the preliminary study observation analysis of the E-Module needs questionnaire conducted on 50 science teachers in Lampung Province showed that 58% of teachers had not implemented learning oriented towards improving systems thinking skills, because 24 out of 50 teachers did not know how to think continuously and had not received strategies, approaches and appropriate teaching materials to be applied. The ability to think systems in science learning is done by associating a concept with another concept, but the learning that is carried out only focuses on one printed book concept and is not associated with other concepts. Less effective teaching materials make teachers deliver learning using methods that tend to be conventional. This is supported by the results of the questionnaire analysis of teacher needs as many as 66% of teachers have not used STEM integrated teaching materials and the modules used by teachers do not use learning strategies and there is no science integration.

STEM education engages science, technology, engineering, and mathematics as well as other fields of study through project-based learning experiences that require the application of knowledge to solve authentic real-world problems in a collaborative environment for the needs of learners. Through STEM learning, students learn about scientific and technological literacy that arises from reading, writing, observing, and doing science in the environment. This study aims to describe the teacher's perception of the role of STEM in E-Module teaching materials on students' systems thinking skills.

## 2. METHOD

This type of research is mixed methods research. The mixed methods strategy used by Sequential Explanatory Design combines qualitative and quantitative data collection and data analysis. The research was conducted in SMP/MTs throughout Lampung Indonesia. The research subjects were 50 science teachers. Collecting data using a questionnaire created through google form and distributed online to find out the teacher's perception of STEM with the teaching materials used during the learning process. The questionnaire made has three aspects including aspects of systems thinking skills, STEM integrated teaching materials and flipped classroom learning strategies. The results of the questionnaire were analyzed using the percentage of responses from each item submitted. The schematic research design can be seen in the following figure :

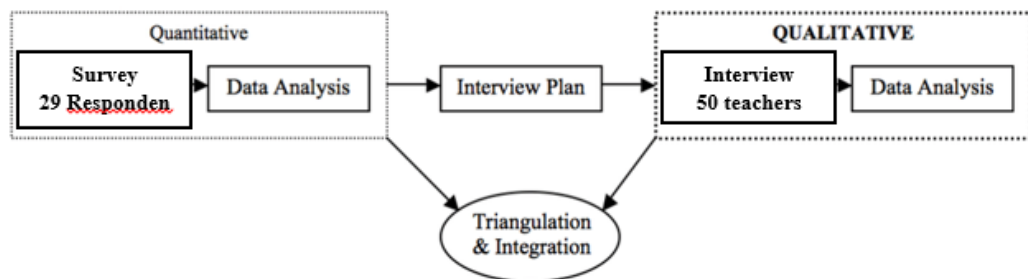


Figure 1. The schematic research design

## 3. RESULTS AND DISCUSSION

The results and discussion of the data obtained in the form of a questionnaire. The results of the teacher's perception of the flipped classroom learning strategy using the integrated STEM E-Module in Improving Systems Thinking Skills are in Table 1.

Table 1. Results of Interpretation of Teacher's Perception Questionnaire

No	Question	Percentage (%)	
		Yes	No
1	Teachers' understanding of sustainable community thinking	34	66
2	Teacher's understanding of systems thinking skills	56	44,2
3	The teacher's way of applying systems thinking skills during learning	42	58
4	Use of teaching materials that improve systems thinking skills	94	6
5	Teaching materials used by teachers during classroom learning	42	58
6	How teachers obtain teaching materials	34	44
7	The need for teaching materials that can be accessed with mobile learning	98	2
8	The need for teaching materials with the STEM Integrated <i>Flipped Classroom</i> strategy	93	7
9	Teacher's understanding of <i>Flipped Classroom</i> strategy	46	54
10	<i>Flipped Classroom</i> strategy implementation	24	76
11	Giving Assignments Before Starting Classroom Learning	96	4

The results showed that as many as 34% of teachers did not know about sustainable community thinking so that in implementing learning oriented towards improving systems thinking skills there were difficulties because only 56 % of teachers already knew the

indicators of system thinking. The ability to think systems in science learning is done by associating a concept with another concept, but the learning that is carried out only focuses on one concept and is not associated with other concepts. Less effective teaching materials make teachers deliver learning using methods that tend to be conventional. This is supported by the results of the study, namely as many as 66% of teachers have not used STEM integrated teaching materials and 52% of teachers have used teaching materials such as printed modules, as many as 42% of teachers obtained modules by downloading from the internet and only 16% of teachers obtained modules by means of make your own. The modules used by teachers do not use learning strategies and there is no integration of science so that as many as 94% of teachers need teaching materials that can improve systems thinking skills. In the current era of digital technology, *E-Learning* is experiencing rapid development. *E-Learning* leads to learning through electronic resources, and supports distance interactive learning. The available information can be accessed using a web system without having to be bound by space and time, therefore as many as 98% of teachers need electronic-based teaching materials that can be accessed online. A teacher can prepare students for a better learning process and improve learning performance, encourage students to actively participate in sharing knowledge through the flipped classroom strategy, but as many as 46% of teachers do not understand the flipped classroom strategy, and 24% of teachers have not implemented the flipped strategy. The results of the teacher's questions and responses are in Table 2.

**Table 2.** Teacher's Questions and Responses

No	Question	Teacher's Response
1	What are the thinking skills of a sustainable community?	<ul style="list-style-type: none"> <li>• To a better direction for society in the future</li> <li>• Critical thinking</li> <li>• mindset related to custom and science and technology</li> <li>• Efforts to develop community empowerment through the development of human resources, technology, environmental conservation, legal awareness and others that can</li> </ul>
2	What is systems thinking ability?	<ul style="list-style-type: none"> <li>• Systems thinking is a person's ability to think in a structured and global way</li> <li>• Ability to look at the problem as a whole</li> <li>• Understanding things in a different way (not just from one side only)</li> </ul>
3	How do you improve systems thinking skills in science learning?	<ul style="list-style-type: none"> <li>• Not yet, because I don't really understand how to apply systems thinking</li> <li>• Haven't found the right approach</li> <li>• Discovery learning models, scientific approaches, and methods of discussion, question and answer and recitation.</li> </ul>
4	What teaching materials have you used so far?	<ul style="list-style-type: none"> <li>• LKPD</li> <li>• Module</li> </ul>

		<ul style="list-style-type: none"> <li>• Props and information resources</li> </ul>
5	How did you get the module in science learning?	<ul style="list-style-type: none"> <li>• Downloading from internet</li> <li>• Teacher's book</li> <li>• Buy at publisher</li> </ul>
6	Can the module that you have used so far improve students' system thinking skills?	<ul style="list-style-type: none"> <li>• Lack of understanding of making modules that can improve students' systems thinking skills</li> <li>• More to improve mastery of concepts</li> </ul>
7	According to you, do you need a module that integrates STEM and constructs the way students think to work in groups through <i>Flipped Classroom</i> ?	<ul style="list-style-type: none"> <li>• I think it is necessary, because as part of the variation in teaching so that students are not too bored to take part in learning</li> <li>• So that students in particular and educators are ready to face the challenges of 21st century learning</li> </ul>

Based on the explanation above, it is believed that the use of technology in learning is in the form of an electronic module with an integrated STEM -based *flipped classroom* strategy on science material that is close to the context in everyday life, namely environmental pollution. One way to implement *E-learning* learning strategies and models is by developing electronic module teaching materials. Learning in the form of electronic modules or ( *E-Modules* ) is teaching materials designed in a structured manner based on the curriculum and arranged in a certain time unit, which packaged using electronic devices such as computers or androids, which makes the learning process more effective, practical and can increase knowledge to additional skills for teachers and students.

The following is the STEM integration design in teaching materials according to the results of observations and interviews :

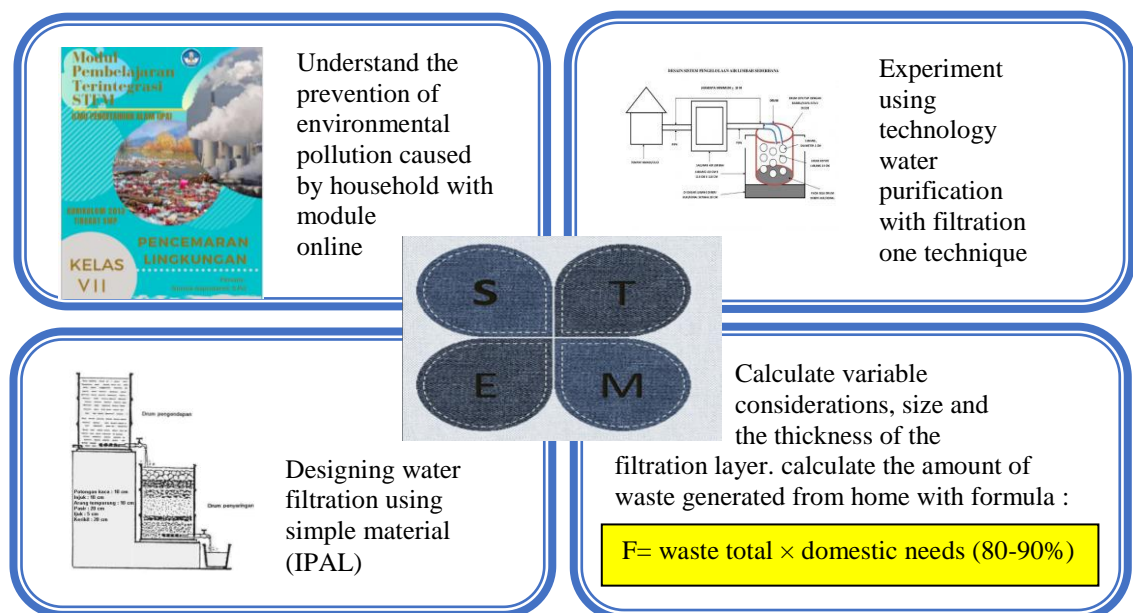


Figure 2. STEM Integration Design in Teaching Materials

STEM integration teaching material, Through the tool information in a simple IPAL video, students can conclude the use of household by correct. students can arrange experimental procedures for household IPAL (Waste water treatment installation) systematically. students can describe the design of a simple IPAL for household waste stairs according to literature, measuring in the manufacture of simple IPAL tools for waste household properly. making simple IPAL products for household waste according to the correct procedure.

Thus, this approach involves fully automated e-learning and team collaborative learning by implementing the Flipped Classroom strategy. This is also in accordance with multimedia learning, it is expected that students can have control over the speed of their own learning according to their respective abilities. In addition, multimedia learning makes students more independent in understanding the subject matter. Multimedia cognitive theory explains that students have two channels of information processing, namely visual and verbal. This means that every human being has a separate communication channel freely so that different information must be presented in appropriate media to maximize the learning process. Therefore, teaching materials in the form of *E-Modules* will make it easier for students to understand learning materials, this is in line with previous research, namely the Development of *E-Modules for Natural Science Subjects for the Interaction of Living Things with their Environment*. Teachers make learning materials as homework for students. During the learning process in the classroom, students must pay attention to the teacher. Learning significantly related to the concept of *E-Learning* can be through modules science based projects, combined with the approach of STEM. So that students have the opportunity to learn Science, Mathematics, and Engineering by overcoming problems that have applications in the real world.

Learning in the exact fields of Science, Technology, Engineering and Mathematics can occur through STEM, namely learning between sciences to learn academic concepts that are combined with the real world as the application of these fields. In STEM learning, students are required to solve problems, make updates, find/design new things, understand themselves, do logical thinking and master. STEM in learning is expected to produce meaningful learning for students through the integration of knowledge, concepts and skills systematically

#### 4. CONCLUSION

The survey results show that teachers have a positive perception of improving students' abilities which are implemented through STEM integrated *E-Modules*. The results of the analysis of the STEM approach, most teachers have not used the STEM approach to provide an understanding of science. The STEM approach not only provides an understanding of students' science but also mathematical skills and conceptual understanding in science so that STEM learning with the *Flipped Classroom* strategy can support 2013 curriculum learning. Science learning with the STEM approach has the potential for the development of learning oriented to the provision of systems thinking skills, thus able to involve students actively in the learning process.

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