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Perception of Physics Teachers and Students about E-Modules Using Stem-Integrated Flipped Classroom Approach to Improve Critical Thinking Skills

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Abstract: The purpose of this study was to describe the perceptions of teachers and students related to the use of e-modules using the integrated STEM flipped classroom approach. The approach used was a STEM-integrated flipped classroom . Data collection methods using a questionnaire were analyzed with descriptive analysis with the 15 professional and unprofessional teachers and 30 students in Lampung province as respondents. The results of teachers 'perceptions about e-modules amounted to 66.7% if presented as belonging to the required category, while the results of students' perceptions using e-modules amounted to 63.3% and classified as needed. The practice was also needed in making e-modules with the results of 73.3% of teachers answering practical answers and 56.7% of students answering practical questions. It can be inferred that students need new teaching materials to support practical and easy to use learning t any time limit.

Keywords: e-Module, Flipped Classroom, Critical Thinking Skills.

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INTRODUCTION

One of the challenges of education today is building 21st century skills, including information & communication technology literacy skills, critical thinking skills, problem solving skills, effective communication skills and collaborate skills so students are able to develop all types of thinking skills ranging from the most basic to critical thinking (Suarsana, 2013). The 2013 curriculum uses a scientific approach as a new approach that must be used by teachers in delivering teaching material that is presented through the process of observing, asking, trying, associating, and communicating (Suryani, 2016). The use of a scientific approach can facilitate students in learning if the approach is associated with teaching media such as modules, it requires a special approach to adjust to the model and material to be used (Fairuz, 2016) this refers to learning physics which is considered difficult because there are many formulas and difficult to understand.

In fact, the ideal conditions of learning physics in schools cannot be fully implemented but physics learning is often dominated by conventional teaching methods such as lectures and discussions (Williams, 2003). Physics learning should be made as attractive as possible so that students are interested because physics material is always associated with everyday life (Joyce, 2011). Along with advances in technology and the increasing use of electronics, and the increasingly high use of mobile phones, there is a need for new and practical teaching materials such as electronic teaching materials, thus increasing student attractiveness in learning. Apperception of teachers who use e-modules based on needs analysis reached 66.7% which means e-modules are needed because it is easy and practical to use. Dependence of students in using mobile phones makes students less interested in printed books so that electronic teaching materials are needed to improve student learning outcomes this can be seen based on the perception of the use of e-modules which reached 65.3%. Teaching materials commonly used in schools such as printed modules are considered to be impractical, so electronic modules or e-modules are needed (Tania, 2013). As the results of student responses by 56.7% that electronic modules are more practical than printed modules. Because printed modules are still considered to be impractical, heavier, and large in size, researchers are interested in developing electronic-based modules or commonly called e-modules. The advantages of e-modules compared to printed modules are that they are interactive, they can load images, audio, video and animation as well as formative tests/quizzes and can be accessed using mobile phones (Fausih, 2016). Learning with e-modules is more flexible because it can be used at home or outside the home, so students are better prepared to learn, students should learn the material at home first, which means homework that is usually done at home (flipped classroom) but now homework is done at class (Wulandari, 2014). Learning with flipped classroom involves the active participation of students individually to explore the material outside the classroom with unlimited time before class begins, it can help students to be more active, and more independent in the learning process and time in class is used to solve problems found by students in learning at home with the help of the concept teacher. The use of e-modules will be more useful if there are experiments in making simple tools about STEM (Science Technology Engineering and Mathematics) on physical optics. Learning with STEM can improve student memory and make students more critical in understanding

concepts (Dawyer, 2014), the types of questions asked or assignments given by teachers are very influential on the development of thinking skills, because these questions or assignments are not just to focus students on activities, but also to explore their learning potential, and to trigger students to think analytically, evaluatively, and creatively can train students in critical thinking. As according to (Afriana, 2016) that in STEM learning, students have the opportunity to study Science, Mathematics, and Engineering so that a problem-based project (Pjbl) is needed so that students are able to solve problems and can improve critical thinking skills. The purpose of this research was to create an electronic module/e-module that is practical and effective and easy to use without any time limit.

METHOD

The method in this research was apperception of the use of e-modules with STEM integrated flipped classroom approach with the number of respondents sampled in this study were 15 physics teachers who were professional or unprofessional and 30 students from various schools throughout Lampung province, where teachers and students were given with various questions regarding apperception of the use of e-modules with STEM integrated flipped classroom.The instrument used in the form of a module apperception questionnaire with a Likert scale assessment type which has criteria, 4 which means it is very necessary, 3 which means it is necessary, 2 which means it is fairly necessary, 1 which means it is not necessary. Response data obtained were then analyzed using descriptive analysis and presented in the form of percent (%).

RESULT AND DISCUSSION

Apperception of teachers on e-modules with STEM integrated flipped classroom to improve critical thinking skills requires teaching materials in the form of electronic modules/e-modules that contain videos of physical phenomena, animations related to learning content, interesting images, practice questions, short material, learning instructions, summary of the material, and practical simulations. Technological advances have the potential to require teaching materials that are easy to use and carry anywhere without time limit.

Following are the results of the analysis of the need for e-modules with STEM integrated flipped classroom. The data can be seen in table 1.

Table 1. The Results of The Analysis

Statement		Percentage
Apperception of e-module usage	Necessary	66.7%
The practicality of e-module than printed module	Practical	73.3%
E-module design	Videos of physical phenomena	73.3%
	Interesting images	66.7%
	Graph	46.7 %
	Practice questions	86.7 %
	Short material	73.3 %
	Competency test	53.3 %
	learning instruction	66.7%
	Easy to understand language	73.3%
	Practical Simulation	73.3%
Easiness of e-module	Used independently	73.3%
Perception of teacher on Flipped classroom	Have heard	53.3%
Influence of*Flipped classroom*on learning outcome	Influence	46.7%
The ease of using flipped classroom without time limit	Very easy	40%
Perception of teacher on STEM	Have used	53.3%
The effectiveness of questions related to STEM can improve critical thinking skills	Very effective	46.7%

Response of students on e-modules with STEM integrated flipped classroom to improve critical thinking skills requires teaching materials in the form of electronic modules/e-modules that contain videos of physical phenomena, animations related to learning content, interesting images, practice questions, short material, learning instructions, summary of the material, practical simulations, easy to use without any time limit, accompanied by questions to improve critical thinking skills. The results of student responses can be seen in table 2

Table 2. Results of Student Responses

Statement		Percentage
Apperception of e-module usage	Necessary	65.3%
The practicality of e-module than printed module	Practical	56.7%
E-module design	Videos of physical phenomena	63.3%
	Interesting images	40 %
	Graph	16 %
	Practice questions	40 %
	Short material	33.3 %
	Competency test	23.3 %
	learning instruction	43.7%
	Easy to understand language	36.3%
	Practical Simulation	46.3%
Physics learning with STEM	Necessary	37.3%
Influence of*Flipped classroom*on learning outcome	Influence	46.7%
The ease of using flipped classroom without time limit	Very easy	40%
Practicality of e-module	Handphone and Laptop	50%

The use of information technology to support learning raises motivation for both teachers and students. Based on the results of perceptions of teachers and students that e-modules are considered easy to use and practical. Previously many printed modules used which had many shortcomings so teachers needed e-modules to support learning. The practicality of e-modules for teachers becomes a consideration for changing printed teaching materials into electronics, based on the results of the responses obtained by 73.3%, while responses of students reached 56.7%. The use of information technology can increase the efficiency and effectiveness of the assessment process and learning outcomes. The use of electronics can support the traditional assessment process carried out traditionally by making some modifications to teaching materials (Buzzetto-More, 2006) the advantage compared to printed modules is that it is interactive, easy, can display images, audio, video and animation and is equipped with formative tests/quizzes which allows students to respond quickly (Dimhad, 2014).

The design required by teachers and students on e-module teaching materials includes video content that presents short videos of physical material about optics which are considered to be one of the most difficult material, the responses of teacher of 73.3% and the responses of student of 63.3% which means in the good category, then contains animations, which makes learning more colorful and interesting, the responses of teacher of 66.7% while the responses of student of 40%, equipped with graph of 46.7%, contains practice questions to aim at student understanding, the questions presented can trigger critical thinking skills. The responses of teacher of 86.7%, and he

responses of student of 40%, which means in the category of necessary. In the analysis on the short material, the material listed must be easy to understand, systematic and has clear objectives, the the responses of teacher of 73.3% and the responses of student of 33.3%. The required e-module must have competency test, the responses of teacher od 53.3%, equipped with learning instructions of 66.7%, has a language that is easily understood by students of 73.3% and has a practical simulation of 73.3%. The e-module indicator is in accordance with the response results of students who want the e-module to be easy to use on their own without a time limit, students simply need to access the link given by the teacher, then students open the link. The ease of e-modules is reinforced by statement (Suarsana, 2013). The ease of e-modules that are more flexible to use at home or outside the home, students learn the material at home in advance means that homework that is normally done at home (flipped classroom) but now it is done in class (Wulandari, 2014). In recent years, Flipped Classroom has become one of the emerging technologies in education and can become a standard of teaching and learning practices to encourage students to actively learn so that students easily access them without time constraints. Teacher's perception of the use of flipped classroom as much as 56.3% who answered that they have heard and used it in learning and the results are very good for improving learning outcomes. Learning by using flipped classroom involves the active participation of students individually to explore the material outside the classroom with unlimited time before class begins, can help students to be more active, and more independent in the learning process and time in class is used to solve problems found by students in learning at home with the help of the teacher. Teacher's perception of STEM learning that they have used STEM with a percentage of 53%, which means some teachers and students have used STEM to improve critical thinking skills.

The teacher also believes that the e-learning module integrated with STEM will be more innovative and practical to be used by students as according to (Afriana, 2016) that in STEM learning, students have the opportunity to study Science, Mathematics, and Engineering so that a problem-based project is needed (Pjbl) so that students are able to solve problems and can improve critical thinking skills, one of the efforts made to develop critical thinking skills as demands of the global era is to accustom students to solving problems not only at the end of learning but at the beginning of learning by solving problems about physics, but it is an obstacle for students who don't have a personal laptop of 90% and who have a Andriond handphone of 90%. This makes the e-module more practical because it can be accessed using a mobile phone and laptop. The use of an android mobile phone is more in demand because it is a communication tool that is always used every day.

CONCLUSION

Based on the apperception analysis of the use of e-modules with the STEM-integrated flipped classroom approach with the results 66.7% of teachers need e-modules, and 63.3% of students answered that e-modules were needed because they were interactive and easy to use so that e-modules were needed as practical and easy teaching material used without a time limit. The e-modules needed by students must be equipped with physics phenomena video content including animations, contain interesting images, contain practice questions, contain short material, and equipped with

learning instructions and equipped with summary material, contain practical simulations. Teachers' perceptions about flipped classroom with 53.3% results had never heard, which means that flipped classroomwas used by some teachers, while the indicators of the influence of flipped classroomwere considered to be students and teachers influence learning outcomes by 56.3%. There were 53.3% teachers answered that they used it which means STEM is familiar to the teacher and can increase the critical thinking skills

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