

# Development of POE and SETS Based Science E-Module to Facilitate Creative Thinking Skill and Collaboration Skill

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**Abstract**—Development research conducted aims to develop products in the form of POE and SETS-based science electronic modules to facilitate collaboration skill and creative thinking skill. The model used in this study is the R&D development model that adapts the 4D model. The module eligibility assessment is carried out by media experts and material experts, while the level of module readability through student questionnaires at the time of field testing is limited. Based on expert assessments, it was concluded that the e-module of science based on POE and SETS is suitable for use in learning to facilitate the collaboration skill and creative thinking skill.

**Keywords:** *science e-module, POE, SETS, creative thinking skill, collaboration skill*

## I. INTRODUCTION

Education is the spearhead for the development of national civilization, consciously growing Human Resources (HR) through the learning process [1]. From the learning process we will get an outcome, which is generally called the learning objective. Over time, the learning objectives are also growing. Today's learning is more emphasized on 21st century abilities.

The 21st century is known as the age of knowledge. This era is marked by the rapid advancement of science and technology which is balanced by changes in the paradigm of learning. The 21st century learning paradigm emphasizes the ability of students to think critically, creatively, connect science with real life, master technology and be able to communicate and collaborate well. In line with this paradigm, the Indonesian government carries a 2013 curriculum that was launched as an effort to improve the quality of education.

The effort to improve the quality of education is expected to be a change in the learning process, namely teacher centered to student centered. Through this learning process it is hoped that students will be able to build their own knowledge so that they can develop 21st century abilities in everyday life.

Based on preliminary observations made at several junior high schools in the city of Yogyakarta, the 2013 curriculum has been almost completely implemented. The specialty of the 2013 curriculum is that it allows students to bring smartphones to school. The 2013 curriculum policy on allowing students to bring smartphones to school is another alternative for learning resources. Teachers often ask students to look for additional literature from the internet, to supplement information from printed books.

Like the two sides of the coin, the 2013 curriculum policy on allowing students to carry a smartphone can foster students' technological mastery abilities, but on the other hand this condition makes the lack of cooperation activities between students. Students tend to work alone, and are busy with the technological devices they carry. Not only that, this condition also has an impact on the decreased ability of students to think creatively when faced with a problem. Students will immediately search for answers from the internet without trying to solve with their own abilities.

Therefore, it is necessary to develop a learning resource that utilizes technology, but also still supports a sense of cooperation and creative thinking in students. The sense of cooperation in students can be grown with group work activities, as well as for creative thinking students can be grown with case studies or phenomena that occur in society. The right learning source to answer this need is an electronic module (E-Module) that is integrated with POE and SETS learning models.

SETS or Science, Environment, Technology, and Society is one of many learning models that presents issues and phenomena that occur in society as a source of learning. The issue was raised in order to be discussed in learning. This treatment is able to foster students' creative thinking skills which is reflected in how students associate issues / phenomena that occur with the concept of science learning.

POE is a model that was born from the theory of constructivism. Constructivism frees students in constructing their own knowledge [2]. Learning with this model is carried out by forming small groups to predict, observe and explain together to increase interaction between students, so as to enhance collaboration between them.

It is hoped that the creation of E-Modules of Natural Sciences based on POE and SETS can facilitate the ability of students to collaborate and think creatively, which is useful for daily life

**II. THEORITICAL REVIEW**

**A. E-Module**

The development of technology and information shifts the use of print media in the world of education to electronic media. One of them is the printed module which is now developed into an electronic module or e-module. The e-modules that will be developed in this study are prepared using moodle software. Moodle stands for Modular Object Oriented Dynamic Learning Environment which can be interpreted as a dynamic web-based education package and developed with object-oriented concepts [3].

E-module as a learning media has several characteristics or criteria that distinguish it from other media. However, because e-modules are the development of printed modules, the e-module criteria are not much different from modules in general. The criteria for a module that can distinguish them from other media are having Self Instruction (independent), Self Contained (complete), Stand Alone (not dependent on other sources), Adaptive (according to the development of science and technology) and User Friendly (easy to use).

**B. POE Based Science E-Modul to Facilitate Collaboration Skill**

The ability of collaboration is an ability that should be accustomed to someone. Collaboration according to Maryanah [4] is a joint effort made in groups to achieve one goal. Another understanding of collaboration is one's ability to establish relationships with others to achieve the same goals. Some things that can be observed in student collaboration activities are: 1) accepting group assignments, 2) giving and receiving other people's opinions, 3) completing assignments on time, 4) maintaining group cohesiveness, 5) agreeing on the results of discussions and 6) working on assignments which has become his responsibility [4].

Masawet [5] suggested that there were eight aspects that could be observed in student collaboration activities, namely: 1) exchanging information among members, 2) resolving disputes, 3)

creating a close working atmosphere, 4) giving ideas to make decisions, 5) support group decisions, 6) value input and 7) participate in carrying out the task.

Adjusting to the POE learning model and some of the opinions above, aspects of the collaborative ability that will be observed in this study are:

TABLE I. COLLABORATION SKILL ASPECTS

No	Aspects	Indicators
1	Participation provides ideas / opinions	a. Participate in and respond to questions given by the teacher b. Discuss with peer groups discuss answers c. Trying to find literature to answer questions
2	Participation in solving problems	a. Work permanently in groups that have been formed b. Actively conducting activities as directed c. Complete assignments on time
3	Participation in making reports	a. Present when making a report b. Also participate in finding theories c. Take part in helping write reports
4	Participation in group presentations	a. Also come to the front of the class b. Also participate in speaking out the results of observations c. Take part in responding to questions

**C. SETS Based Science E-Modul to Facilitate Creative Thinking Skill**

SETS is a traditional concept and process approach that is used in science learning by linking topics discussed with the lives of everyday students or the lives of relevant communities. The stages in SETS learning there are five stages, namely invitation, concept formation, concept application, stabilization of concepts, and evaluation / assessment.

SETS-based Science Module is a learning tool or tool with the characteristics of being able to teach yourself, there is a clear and measurable final goal, there is complete material packed in small units, up to date, and contextual, there are examples and illustrations, available exercises and assignments, using communicative straightforward language, there are assessment instruments that allow students to do self-assessment, and include learning according to the syntax of the SETS approach, namely invitation, concept formation, concept application, concept strengthening, and evaluation / assessment.

Creative thinking skill or ability to think creatively is a person's ability to provide several alternative answers when given a question, fluent in expressing his ideas, able to see the mistakes and weaknesses of an object / situation quickly. Creative thinking skills also include skills in providing some kind of

interpretation of an object, can provide several ways of solving a problem, and can classify things according to different divisions or categories. Someone with thinking skills can provide a new solution after listening or reading ideas that existed before. In addition, creative thinking also includes the ability to take detailed steps in solving problems, be able to develop or enrich ideas beforehand, can also test or try details to see the direction to be taken. Four aspects of creative thinking skills are fluency, flexibility, originality and elaboration.

III. METHODS

This research is a development research, because in its implementation it develops learning resources in the form of e-modules based on POE learning models to improve collaboration skills and e-modules based on SETS learning models to improve creative abilities. E-modules were developed made using moodle software.

Data collected in this study include: module quality data, collaborative ability data and creative thinking ability data. Data collection instruments used in this study were: draft modules and their assessment instruments, observation sheets of collaboration abilities and observation sheets of creative thinking abilities.

Module quality is determined based on the results of validation conducted by experts. There are 4 components that are validated, namely in terms of appearance, learning material, presentation and language. Module quality is determined by the combined scores of the four components. The maximum total score is 50. The quality of the module is expressed by the acquisition of values calculated by the following formula:

$$\text{Nilai} = \frac{\text{skor total yang diperoleh}}{60} \times 100 \quad (1)$$

The score criteria are given in the e-module as follows

TABLE II. SCORE CRITERIA

Score	Category of e-modul's quality
score < 50	Not good
50 < score ≤ 70	Quite good
70 < score ≤ 90	Good
90 < score ≤ 100	Very good

(Kemendiknas, 2010)

The collaboration skills of students were analyzed using descriptive statistics with the following formula:

$$P = \frac{n}{N} \times 100\% \quad (2)$$

(Afrizon, 2012).

P = percentage of implementation

n = score

N = total score

$$\text{Presentase tertinggi} = \frac{\text{skor total maksimum}}{\text{skor total maksimum}} \times 100\% = \frac{12}{12} \times 100\% = 100\%$$

$$\text{Presentase terendah} = \frac{\text{skor total minimum}}{\text{skor total maksimum}} \times 100\% = \frac{3}{12} \times 100\% = 25\%$$

$$\text{Interval Kelas} = \frac{\% \text{ tertinggi} - \% \text{ terendah}}{\text{kelas yang dikehendaki}} = \frac{100\% - 25\%}{4} = 18,75\%$$

Assessment of the achievement of students' collaborative abilities is based on achieving indicators. There are 12 indicator items on the observation of collaboration capabilities. The conclusion of achieving student collaboration skills can be stated in qualitative statements as in table 3 below.

TABLE III. ACHIEVEMENT OF COLLABORATION SKILL

Percentage	Criteria
81,25% < x ≤ 100%	entrenched
62,5% < x ≤ 81,25%	Just developed
43,75 % < x ≤ 62,5%	Just seen
25% < x ≤ 43,75%	Not seen

Just like collaboration skills, students' creative thinking abilities are analyzed using descriptive statistics with formula (2) as previously described.

$$\text{Presentase tertinggi} = \frac{\text{skor total maksimum}}{\text{skor total maksimum}} \times 100\% = \frac{12}{12} \times 100\% = 100\%$$

$$\text{Presentase terendah} = \frac{\text{skor total minimum}}{\text{skor total maksimum}} \times 100\% = \frac{3}{12} \times 100\% = 25\%$$

$$\text{Interval Kelas} = \frac{\% \text{ tertinggi} - \% \text{ terendah}}{\text{kelas yang dikehendaki}} = \frac{100\% - 25\%}{4} = 18,75\%$$

For creative abilities, there are four aspects of achievement. The conclusion of achieving students' creative thinking abilities can be stated in qualitative statements as in table 4

TABLE IV. ACHIEVEMENT OF CREATIVE THINKING SKILL

Percentage	Criteria
81,25% < x ≤ 100%	entrenched
62,5% < x ≤ 81,25%	Just developed
43,75 % < x ≤ 62,5%	Just seen
25% < x ≤ 43,75%	Not seen

IV. RESULT AND DISCUSSION

A. Quality of Science E-Module

Validation of e-modules involves 2 experts, namely expert 1 is an expert in the field of instructional media which means the value of display components and the use of software in the e-module, and expert 2 is an expert in the field of learning material. The results of expert evaluations on each component are as follows.

**TABLE V. E-MODULE ASSESSMENT RESULT BY COMPONENT**

Assessment componen	Score Max	Score	Percentage
Display	15	12	80%
Theory	18	16	88%
Presentation	12	10	83%
Language	5	5	100%
Total	50	43	87,75%

The total score obtained is 43 with a maximum score of 50. If this score converted to a scale of 100, the e-module score is 86. Based on established criteria, it can be concluded that the e module is in the good category. There are several strengths and weaknesses found in this prototype, as follows. Advantages:

- The material coverage is quite complete
- Innovative, which is to bring up new things in the approach to presenting a concept.
- Equipped modules with exercises / tests / simulations that are interactive and can provide immediate feedback

Weakness:

- Some navigation is not functioning
- The usage guidelines are incomplete

In the final part of the evaluation instrument, the two experts were asked to provide final recommendations from the assessed media. Both experts stated that. This e-module still needs to be improved again and so that this media is suitable as the main teaching material, it must be improved.

### B. Creative Thinking Skill dan Collaboration Skill

Collaboration capability data is obtained from observation sheets conducted during the learning. There are 12 aspects of collaboration skills, while creative thinking skills are observed every day. From the average score of observations every day and adjusted to the criteria, the observation data on collaboration capabilities is presented in the following table.

**TABLE VI. PERCENTAGE OF COLLABORATION SKILL**

class	Meeting / criteria		
	1 <sup>st</sup> meeting	2 <sup>nd</sup> meeting	3 <sup>rd</sup> meeting
experiment	40%	60%	75%
	Not seen yet	Just seen	developing

**TABLE VII. PERCENTAGE OF CREATIVE THINKING SKILL**

class	Meeting / criteria		
	1 <sup>st</sup> meeting	2 <sup>nd</sup> meeting	3 <sup>rd</sup> meeting
experiment	40%	60%	75%
	Not seen yet	Just seen	developing

### C. Discussion

The development of POE-based e-modules to enhance collaboration skills and SETS-based e-

modules to improve creative thinking skills requires various stages starting from the initial investigation phase, the design phase, the realization / construction phase, the test / evaluation phase and the revision and implementation phases. In the initial investigation, identified two main problems that need to be considered and handled in learning include: the use of e-learning that is not optimal and the low ability of students to collaborate and think creatively in solving a problem. Based on the study, a solution was developed in the form of e-module development based on POE and SETS learning models.

Furthermore, in the design stage / model design, e-module design and also supporting research instruments such as module assessment sheets, collaboration ability observation sheets and creative thinking skills observation sheets. At the realization stage, the research modules and instruments are arranged based on the design that has been created so that a product prototype is produced.

After the prototype e-module is produced, an assessment is carried out by experts in their fields. From the results of the assessment revealed several strengths and weaknesses that exist in this developed e module. Overall the e-modules produced are of good quality. This means that the e-modules produced have met the aspects of eligibility as a source of learning.

In this study, field trials were conducted on junior high school students. The results of field trials show that students' collaboration and creative thinking skills are increasing day by day. In the first trial, classified as low at 40% with criteria not yet visible which means it is not in line with expectations.

Based on observations, this happens because in the learning process many students experience technical obstacles and do not yet know the features available in the e-module portal. The problem solving effort taken is the researcher re-explaining the technical use of e-modules and the use of available features.

After students understand the e-modules provided, they are very enthusiastic about following the learning process. The enthusiasm of students in participating in learning can be seen from the way they work to complete each task given by collaborating with fellow group members. In the beginning, they felt that it was rather difficult to take part in learning, because they had never learned in an online environment. After several meetings, their collaboration skills have increased. This can be seen from the observation that at the second meeting students' collaboration skills were at the criteria starting to be seen with a percentage of 60% and the third meeting with criteria began to develop with a percentage of 75%. This fact confirms Mac Kinnon [6] which states that technology will help develop all types of thinking skills ranging from the most basic to

the high level of thinking skills. This also justifies the results of Puspitasari's [7] research that the POE learning model is able to improve students' cooperative skills.

#### V. CONCLUSIONS AND SUGGESTIONS

Based on the results of research and discussion, it can be concluded as follows: (1) Science E-Module of POE and SETS-based that has been prepared is of good quality and still needs to be refined again. (2) Through the use of science e-modules based on POE and SETS able to improve student's collaboration skills and creative thinking skills.

Some suggestions that can be conveyed in this regard are as follows: (1) The use of e-modules of science in learning requires careful preparation, especially in the preparation of an online learning environment and management

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