The Development of Learning Module Environmentally Friendly Technologies Based Creative the Problem Solving

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Abstract. The use of modules in science learning has a positive impact on science process skills. The purpose of this study is to develop eco-friendly technology learning modules based on Creative Problem Solving (CPS). This module consists of 3 parts, namely introduction, learning, and evaluation. In the learning section the steps of the CPS are explained on the contents of the material. The process skills of each meeting are made by an environmentally friendly technology product. The resulting product helps in solving environmental problems in everyday life. The results of the validation assessment get a valid category from all aspects of the assessment. The highest score is in the aspect of presentation and graphic components with values of 3.71 and 3.74. So this module can be used as an alternative solution to learning environmentally friendly technology.

1. Introduction
You Gov-Cambridge Globalism Project 2019 research and analysis institute states 18 percent of Indonesians do not believe that humans are the cause of global warming. Indonesia is ranked first as a country with a number of people who do not believe in climate change. Environmental quality index in Indonesia from 2011-2014 has decreased every year by 1.2. In 2015-2017 it increased an average of 0.7 per year. This increase is still fluctuating, due to the air quality index and land cover quality index is still experiencing a decline [1]. The environmental quality index is calculated based on the air quality index, water quality index and land cover quality index.

2016 in Indonesia Environmental Performance Index ranks 107th followed by 180 countries issued by the Yale Center for the International Earth Science Information Network (CIESIN). National development that requires a balance between humans, the economy, and environmental management has many challenges [2]. The progress of the state is very influential on the progress of its technology. Skills will produce new technology. In science education, student skills are important in the science learning process [3]. Rifqa, et al [4] Technology in learning is also useful for explaining an abstract topic in learning. Glenda Crossling, et al [5] said that creativity and innovation are important to be taught in education. The results of Triyono's research, et al [6] in 2016 in 3 Yogyakarta State Junior High Schools learning science based on Creative Problem Solving (CPS) showed a positive effect on increasing students' environmental care. The use of modules in science learning by Sugiyanto, et al [7] by 81.17% strongly agrees that the module makes it easy for students to learn.

In this study, an environmentally friendly technology learning module will present material that has CPS-based learning steps. Modules contain material, worksheets, and evaluations. This module is expected to facilitate the process of learning science about environmentally friendly technology.
2. Methodology
Research was conducted using the Research and Development (R&D) method. The research phase is divided into two, namely the design and validation of experimental devices. The design phase includes (1) a preliminary study, to find a problem, a literature study is carried out by searching related journals and conducting a short survey to look for facts of learning problems in the school environment, especially on environmentally friendly technology materials. (2) Making learning modules, making is done by following the facts that have been obtained in the previous stage.

The next stage is validation which is divided into two, (1) Validation of learning modules, module testing is carried out to determine the compatibility of modules with learning assessed by the validator, by filling out a questionnaire. If there are still shortcomings, then improvements will be made to the assessment indicators. Validation is carried out until a valid module is obtained. (2) Product revision, a revision is carried out to follow up on the results of the previous validation which still has some deficiencies then an improvement is made to match the research objectives.

Validation is done to find out whether the learning module is valid or invalid. Validation is carried out by several experts called validators. The validator assesses the module in terms of content eligibility, presentation components, linguistics, and graphics. All aspects have been covered in fifty-four questions with four scales. The highest value is 4 which means strongly agree, 3 means agree, 2 means disagree, and 1 means strongly disagree.

3. Result and Discussion
The module was developed based on the 2013 Indonesian Curriculum in 2018. The parts of the module are divided into three namely introduction, learning activities, and evaluation. The learning module for environmentally friendly technology is divided into four sub-chapters, 1) Determination and principles of environmentally friendly technology, 2) Application of environmentally friendly technology, 3) Energy-saving behaviour in daily life, and 4) Environmentally unfriendly technology. Every meeting in this learning module always produces a simple technology product that is environmentally friendly.

The first meeting the problem of the lack of availability of clean water, especially urban areas was raised as a problem and problem solving, namely the manufacture of simple water filtration products. Filtering equipment is made simple with used bottles and filled with gravel, fine sand, stones, fibers, old cloth, and river stones. The ingredients are arranged in a bottle as a filter for dirty water to get clearer water than before. Students are tasked with discovering how the composition and arrangement of these materials produce the clearest water. At the second meeting the product produced was a solar stove by solving the problem of depletion of clean water. Next a third meeting of problems was resolved regarding the scarcity of fuel as a resource. Environmentally friendly technology products produced in the form of windmills. And the last meeting of the issues discussed was a lack of awareness in terms of energy savings. Then made a poster as a product.

There are four aspects of the assessment that are assessed by the validator, namely, the appropriateness of the content, presentation component, linguistics, and graphic. In total there are 54 questions to be scored by the validator which covers aspects of the assessment of this module. Table 1 shows the scores given by the validator.

| No  | Assessment Aspects      | Score | Category |
|-----|-------------------------|-------|----------|
| 1   | Content Feasibility     | 3.48  | Valid    |
| 2   | Presentation Component  | 3.71  | Valid    |
| 3   | Linguistic              | 3.63  | Valid    |
| 4   | Grafting                | 3.74  | Valid    |
|     | Average                 | 3.62  | Valid    |
From Table 1 it can be seen that all aspects of the assessment in the category are valid. The highest score is in the aspect of presentation and graphic components. This aspect has the highest value because of the attractive display module. The following module cover can be seen in Figure 1.

![Module Cover](image)

**Figure 1.** Cover of an environmentally friendly technology module

4. Conclusion

The CPS-based environmentally friendly learning module developed is valid. Learning modules can be used in schools in learning activities as an alternative solution to learning environmentally friendly technology by solving problems creatively.

References

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