The needs analysis on module development based on creative problem solving method to improve students’ problem solving ability

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Abstract. Students’ problem-solving ability is important to be improved in physics learning because it can assist students to solve problems in everyday life. Some problems found in this study were the students do not have good problem-solving skill and students have limited learning resources that can guide students’ self-learning. Therefore, learning resources that make students able to think and act in solving problems need to be developed. Creative problem solving is a learning model that focuses on teaching and problem-solving skill, followed by strengthening of creativity. The purpose of this study is to know the opinions of teachers and students on the physics module based on creative problem solving that will be developed. The research was conducted using 4-D models and was limited to define a phase, namely teachers’ and students’ requirements analysis. Data for this research was obtained from the questionnaire. This research used descriptive analysis method. The results of the questionnaire showed that the average requirement of students were 94.59% and the average requirement of teachers were 100%. Thus, it can be concluded that teachers and students need a module based on creative problem-solving method to improve students’ problem-solving ability.

1. Introduction
The ability of innovation, creativity, and problem-solving skill are needed to meet the challenges of the 21st century. Problem-solving skills highlighted in the student learning process and is seen as a fundamental part of the school’s physics learning [1]. Problem-solving is the application of knowledge or thinking and the ability to achieve certain goals [2]. Physical problem-solving effectively requires students to identify, determine and solve problems using logic, literary and creative thinking [3]. Problem-solving skill helps students in thinking to solve problems based on relevant concepts and theories [4]. A solution of the problems can be gained by using the knowledge, skills, and understanding that the students have [5]. Some problems found so far are that students do not have good problem-solving skill and students have limited learning resources that can guide students’ self-learning. The results of the initial problem-solving ability test of class XI students at State Senior High School 5 of Surakarta showed that in describing the problem obtaining a percentage of 16.54%, the determination of the physics concept obtained a result of 23.63%, the application of the physical concept specifically amounted to 40.18%, the aspect of mathematical procedures by 46.90%, as well as the inability of students to reach logical conclusions which are the final stages in problem-solving. This is due to lack of understanding of concepts [6]. Students are able to solve simple quantitative
problems but they are lack of the ability to solve more complex problems [7]. Students experience difficulties because the strategies used in learning are only to solve problems with mathematical calculations [8]. Learning is vital to developing knowledge and dealing with increasingly complex lives. Learning interaction allows knowledge transfer between teachers and students. The use of appropriate models, methods, and learning strategies certainly make it easier for students to understand the material. Learning resources that can facilitate students’ self-learning are necessary for more effective learning. A conducive learning environment must be created by a teacher so that students are active in seeking knowledge independently. Teaching materials are external factors for students who can improve motivation from within students. The purpose of the preparation of teaching materials, among others: 1) to help students obtain alternative teaching materials in addition to textbooks that are sometimes difficult to understand; 2) provide teaching materials that are in accordance with the curriculum demands and social characteristics of students.

Students’ problem-solving skill needs to be improved in physics learning as it can help students to solve problems in everyday life. Effective problem-solving can be obtained by giving students the opportunity to apply strategies when solving problems [9]. Seeing the importance of problem-solving skills in physics learning, it is necessary to develop learning resources that make students able to think and act in solving problems. One solution that researchers design is learning by using a physics module based on creative problem-solving.

A module is one form of teaching materials that can be used in learning. A module is a teaching material that contains concepts, facts, procedures, principles, and assessment tool that serves as an independent learning media in units of learning materials. The role of the module for teachers includes saving time, changing the role of the teacher in the facilitator, and improving the interactive learning process. Creative Problem Solving (CPS) is a learning model that focuses on teaching and problem-solving skill that is followed by reinforcement of creativity [10]. Physics learning with a creative problem-solving model by using a module is very appropriate to train students in finding the concept of physics. In the CPS-based learning, the educator acts as a facilitator and motivator. Therefore, the learners are given wide opportunities to practice self-study during the learning process. Students who are able to solve problems properly will get satisfying learning outcomes [11].

The analysis of teachers and students’ needs is essential in developing CPS-based modules. The product to be developed is not only in the form of objects but focuses on an idea or scientific thought [12]. Needs analysis is an important step in terms of developing a curriculum and syllabus for different courses [13]. Needs analysis is an important step to know about the purpose, study habits, and expectations of students on the process of physics learning. Teachers must respond to students’ needs by creating different teaching materials and learning tools so that learning is more meaningful [14]. The purpose of this study is to know the opinions of teachers and students on the physics module based on creative problem-solving that will be developed.

2. Experimental Methods

This study used a 4-D development model [15]. This development model consisted of 4 stages, namely: defining, designing, developing, and disseminating. This research was done until the defining stage in the form of requirement analysis on teachers and students. Data collection used a questionnaire of teacher and student needs analysis with a total of 20 items for teachers and 15 items for students. The subjects of this study were 111 students of grade XI in State Senior High School 5 of Surakarta and 5 physics teachers who teach class XI. This research used descriptive qualitative method for the data analysis which includes data reduction, data presentation, and conclusion.

3. Results and Discussion

The results of the questionnaire about students and teachers’ needs analysis can be seen in Table 1.
Table 1. The results of the needs analysis on students and teachers

| No | Question                                      | Student Answers                                                                 | Teacher Answers                                                                 |
|----|-----------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 1  | Availability of teaching materials and learning media | 67.57% students use books, physics formula book, and study guidebook              | The teaching materials used by teachers were a book, fluid static modules based on inquiry method, computer application, and props |
|    |                                               | 96.4% of students use the internet, and 89% students use fluid static modules     |                                                                                |
| 2  | Limitations of teaching materials             | 67.57% students opinion the lack of teaching materials was standard book language and the explanation of the book is incomplete | The limitations of teaching materials were caused by limited contextual questions, there are some wrong prints on the book, exposure of material that is difficult for students to understand, the discussion details focused on the physics formula and the order of the material does not fit the curriculum |
| 3  | Implementation of learning activities         | 57.66% of students said learning activities were carried out in the laboratory    | Teaching methods used by teachers were guided inquiry, experiments, discussion, demonstration, lectures, problem-solving, problem-based learning, and project-based learning |
| 4  | Limitations of the learning process           | 84.68% students need self-supporting materials because of the limited time to study physics in school | Teachers also had difficulty to cultivate the creativity of learners in solving the problems, limited time of learning activities, and a shortage of independence in learning |
| 5  | Students’ Problem Solving Skill               | 87.39% students have difficulty solving a physics problem                        | Students have difficulty in understanding abstract concepts and students do not yet have good problem-solving skill |
| 6  | Response to the development of physics module based on creative problem solving | 94.59% agreed                                                                  | 100% agreed because the module can make it easier for teachers to teach.        |

From table 1, it can be seen that the teaching materials used by the students were books, physics formula book and study guidebook (67.57), (96.4%) of students used the internet to search for materials and (89%) of students used modules that were limited to the fluid material. According to teachers who taught physics in grade XI, the teaching materials used by teachers were books, modules (inquiry-based static fluid material), computer applications and props. According to the students, the lack of teaching materials was the standard book language and the explanation of the book was not
complete, whereas according to the teacher, the limitations of teaching materials were caused by limited contextual problems, wrong prints, the exposure of material that was difficult to be understood by the students, the discussion details focused on the physics formula, and the order of the material does not fit the curriculum.

Teaching methods used by teachers based on students' opinions were lab work (57.66%), while the models used by the teacher were guided inquiry, experiment, demonstration, discussion, lecture, problem-solving, problem-based learning, and project-based learning. The models and methods used were in accordance with the K13 curriculum. Limitations of the learning process that teachers and students perceived were limited time to study in school (84.68%). This situation caused the students to need self-contained learning materials that were practical and could be used at any time. Teachers also had difficulty in fostering the creativity of learners to solve problems and a shortage of student independence in learning. After viewing the problem-solving abilities, teachers stated that students did not yet have good problem-solving skill. This was because students were difficult to understand the abstract concept, thus, (87.39%) students had difficulty in solving the physics problem. This was in accordance with the results of previous research which stated that the difficulty of problem-solving was caused by a weak understanding of the principles and rules of physics, a lack of understanding of the problem, and not enough motivation from students [16]. Students could not solve problems due to lack of practicum in the laboratory, feeling confused in writing unit conversions, and limited physical books that were used as references [17].

On the question about their opinion if a physics module based on creative problem-solving method was developed to improve problem-solving skill, (94.59%) of students agreed and (100%) of teachers agreed, because the module could facilitate teachers in teaching. The implementation of creative problem-solving learning model could increase students’ activity, especially in expressing an idea. In addition, it can increase students’ activity in discussing strategies to solve problems [18]. The results of the discussion above showed that teachers and students needed independent teaching materials that made the students able to think and act in solving problems. Therefore, there was a need to develop a physics module based on creative problem solving to improve students’ problem-solving skill.

4. Conclusion
Based on the results of the study it can be concluded that students' problem-solving abilities are in a low category and need to be improved. Student difficulties in solving problems are caused by limited learning time at school, limited independent teaching materials, and lack of creativity. Teachers and students use books in the learning process. The books used have limitations including standard book language, limited contextual questions, and sequences of material that are not in accordance with the curriculum. Teachers and students in State Senior High School 5 of Surakarta need independent teaching materials in units of learning materials that make students active in thinking and acting in solving problems. Therefore, modules based on the creative problem-solving method need to be developed to improve students' problem-solving abilities.

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