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Analysis of Students' Creative Problem-Solving Ability in Static Fluids: Pilot study

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Abstract: This study aims to describe the ability of creative problem solving in static fluid materials. The method used in this study is a descriptive method which was carried out at SMAN 4 Luwu, North Sulawesi. The research sample was 36 students. The research data were collected through the provision of creative problem solving tests on static fluid materials given after the learning process was carried out. The data that has been collected is then analyzed using the calculation of the average pretest and posttest and Rasch Analysis. The results of data analysis show that reviewing four indicators, namely fact finding, problem finding, idea finding, solution finding and the highest score is on the fact finding indicator with an average of 67.57 for classes that use creative problem solving. In implementing the creative problem solving learning model, it is necessary to pay attention to the time management allocated so that each implementation can be carried out properly. The creative problem solving learning model can be tested on other materials according to school conditions.

Keywords: reative problem solving, static fluids, Rasch analysis.

Abstrak: *Penelitian ini bertujuan mendeskripsikan kemampuan creative problem solving pada materi fluida statis. Metode yang digunakan dalam penelitian ini adalah metode deskriptif yang dilakukan di SMAN 4 Luwu Sulawesi Utara. Sampel penelitian sebanyak 36 siswa. Data-data penelitian dikumpulkan melalui pemberian tes creative problem solving pada materi fluida statis yang diberikan setelah proses pembelajaran dilakukan. Data yang sudah dikumpulkan selanjutnya dianalisis menggunakan perhitungan rata-rata pretest dan posttest serta Rasch Analysis. Hasil analisis data menunjukkan bahwa meninjau empat indikator yaitu fact finding, problem finding, idea finding, solution finding dan skor yang paling tinggi adalah pada indikator fact finding dengan rata-rata 67,57 untuk kelas yang mengguanakan creative problem solving. Dalam menerapkan model pembelajaran creative problem solving perlu memperhatikan manajemen waktu yang dialokasikan agar setiap pelaksanaan dapat dilaksanakan dengan baik. Model pembelajaran creative problem solving dapat diujicobakan pada materi lain sesuai dengan kondisi sekolah.*

Kata kunci: *pemecahan masalah secara kreatif, fluida statis, analisis Rasch.*

▪ INTRODUCTION

Competence in the 21st century requires the education system to be able to prepare competent students in solving more complex problems. These competencies include knowledge, skills, and other attributes that help students achieve their full potential (Ontario, 2016). In achieving this, education is expected not only to emphasize aspects of knowledge but also to skills in student problem solving. Therefore, learning in this century emphasizes the role of the teacher as a facilitator who involves students in an innovative and commutative learning process (Oktaviani & Nugroho, 2015). This student-centered learning is able to grow and develop students' problem solving skills and creativity in facing global challenges.

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The success of students in the learning process is obtained if the students are able to solve problems using the basic knowledge they have. Problem solving ability is a very complex cognitive process that involves analyzing, interpreting, reasoning, predicting, evaluating and reflecting. This ability is one of the goals that teachers want to achieve, because through problem solving abilities students can actualize what they get from learning and then apply it in their lives. This ability is closely related to the creativity of students. Confidence related to the creative capacity possessed by students results in creative performance and mindset (Royston & Reiter-Palmon, 2019). Creative thinking skills are the ability to generate new ideas or ideas and are categorized as high order thinking skills. Students who have the ability to think creatively find it easier to solve problems from different perspectives based on the knowledge they already have in the learning process. These skills are fundamental in various fields of study, one of which is physics.

Physics is a field of science that deals with more complex concepts of knowledge. This field emphasizes not only physical concepts but also problem solving with mathematical language. Learning physics also means learning concepts and looking for relationships with other concepts. So that students are required to be skilled in applying the concepts of physics and the equations of these concepts effectively in everyday life. To achieve this goal, the design of the physics learning process does not only require learning that fosters problem solving abilities but also develops students' creativity (Dube & Lubben, 2011). Therefore, it is very important to integrate learning that can increase students' creativity and problem solving abilities. The learning in question is the Creative Problem Solving learning process (Thomas, 2009).

Creative Problem Solving (CPS) is an ability that emphasizes more on finding alternative actions or ways in the process of solving a problem that is more efficient and accurate. Therefore, the aspect of creativity is very much needed in the CPS-based learning process. Creative problem solving familiarizes students with solving problems from the creative ideas developed (Oktaviani & Nugroho, 2015). The creative problem-solving process is very different from problem solving itself. The problem solving process only understands a problem from the description displayed (Isaken et al., 2016). The syntax of the Creative Problem Solving learning model is problem clarification, expressing ideas, evaluation and selection, and implementation. Creative Problem-Solving is an applicable skill needed in various environments such as the world of education, the workplace, as well as in the realm of interpersonal relationships (Royston & Reiter-Palmon, 2019). So that learning based on Creative Problem Solving is needed to be developed in the classroom.

Based on the research results of Hartantia, et al (2013), it was found that CPS learning can encourage students to solve the problems given by using a more creative way but the results are still very less significant because at the beginning of learning students are not given brainstorming first, so they are not used to it. and slow to implement. This learning can also increase students' interest in learning because the material being studied becomes more interesting (Amelia. A.A et all, 2021).

Based on the description above, the development of Creative Problem Solving-based learning is very necessary to be applied in the classroom. Therefore, a research entitled "Analysis of Students' Creative Problem-Solving Ability in Static Fluids: Pilot study" was conducted by involving students of class XI IPA 1 from one of the schools

in the city of Palopo. This study aims to conduct an initial test of students' creative problem solving abilities on static fluid material.

▪ METHOD

This research is a descriptive study involving class XI students from one of the schools in the city of Palopo. The sample selection used a convenience sampling technique, namely the sample was chosen spontaneously because of the elements of availability, suitability of criteria, and other practical considerations according to the researcher's point of view (Hidayanti et al., 2019; Mertens, 2010). Furthermore, the research class is determined with the criteria that the majority of students can attend online classes and show the highest physics learning outcomes. Thus, the researcher used class XI IPA 1 as the research class. The method used in this study is a descriptive method which was carried out at SMAN 4 Luwu, North Sulawesi. The research sample was 36 students.

Data on creative problem-solving abilities were obtained by giving an essay test with a total of 5 numbers. Aspects of student creativity in terms of fluency in generating ideas (fluency), flexibility in thinking about various perspectives (flexibility), and originality in different new ideas (originality) (Barojas et al., 2001, Dewi et al., 2019). Thus, the indicators of creative thinking skills in solving problems include being creative in fact finding, creative in problem finding, creative in idea finding, and creative in solution finding (Kuswanto., 2018, Gunawan et al., 2019, Heliawati.,). The creative problem-solving skill test grids developed are presented in Table 1.

Table 1. Creative problem-solving skill instrument grid

Question Indicator	Troubleshooting Ability Indicator	Number of Questions
Using the basic laws of hydrostatics in everyday life problems	*Fact finding* *Problem finding* *Idea finding* *Solution finding*	1
Using Pascal's law equations in solving physics problems		1
Distinguishing floating, floating, and sinking events in liquids		1
Applying Archimedes' law in everyday life		1
Calculating the surface tension of a liquid layer		1

Data analysis using the Rasch model was carried out with Winstep software version 5.0.0.0. The Rasch model can describe the ability of the research class as a whole and can review the abilities of each individual in more detail. The level of student ability is represented by a logit value, namely the higher the logit value, the better the student's ability is measured (Chan et al, 2014)

To explain students' problem solving abilities creatively, researchers used output tables from variable maps and person measures (Maielfi, 2020). Variable maps describe the distribution of students' abilities with a logit scale and show questions that on average can be answered correctly by students. Meanwhile, the person measure shows the level of student ability by displaying the order of the highest to lowest logit values.

▪ RESULT AND DISSCUSSION

Analysis of the level of creative problem solving ability with the Rasch model is obtained from the person measure value. Table 2 presents data on the level of students' ability and standard deviation of the person measure output.

Table 2. The results of the analysis of creative problem-solving abilities with the Rasch model

	Logit Measure	
Person Measure	Rata-rata	Standar Deviasi
	-1,19	1,61

The average ability of students based on table 2 is in the low category. The average logit value is below the average logit item (0,0). Students tend not to be able to answer the questions tested correctly. In addition, the value of the standard deviation shows a value that is greater than the standard deviation of the item (0.99). This indicates that the distribution of students' ability levels is very wide. Students have very many variations in scoring. Furthermore, the level of student ability on each indicator is visualized in Figure 1.

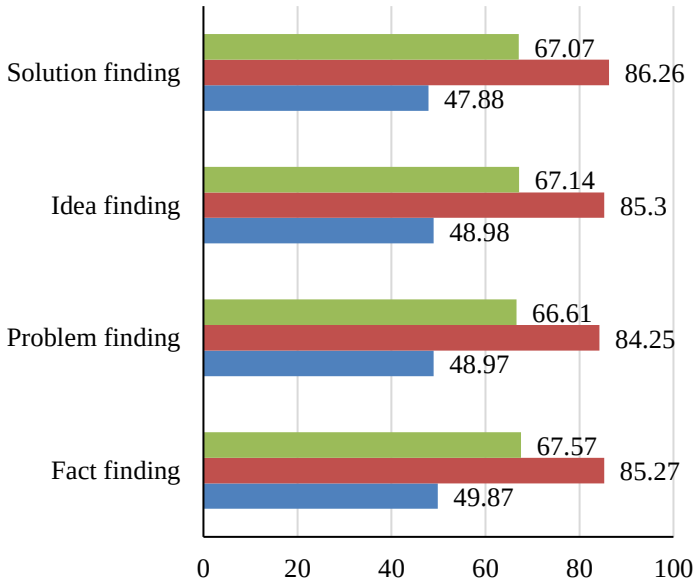

Figure 1. Graph of analysis of creative problem-solving abilities on each indicator. Pretest, posttest, and average score are presented in blue, red, and green

Based on Figure 1, it can be seen that the increase in creative problem solving abilities in each stage has increased. In the fact finding stage, the average pretest score was 49.87, while the posttest score was 85.27. In the problem finding stage, the average pretest score was 48.97, while the posttest score was 84.25. At the idea finding stage, the average pretest score was 48.98, while the posttest score was 85.30. In the solution finding stage, the average pretest score is 47.88 while the posttest is 86.26.

The comparison of N-Gain when students use CPS by not using CPS can be seen from Figure 2 below:

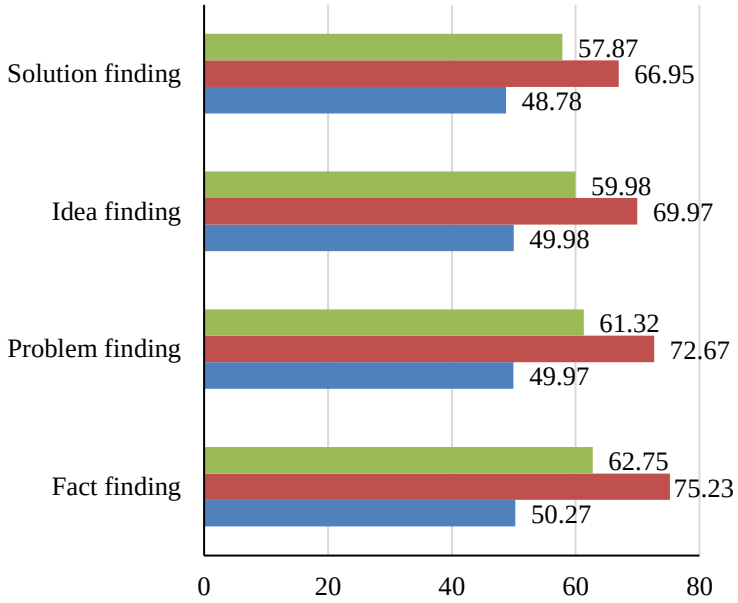

Figure 2. Graph of ability analysis that does not use creative problem-solving on each indicator. Pretest, posttest, and average score are presented in blue, red, and green

Based on Figure 2, it can be seen that the increase in creative problem solving abilities in each stage has increased. In the fact finding stage, the average pretest score was 50.27, while the post-test score was 75.23 with an average value of both 67.57. In the problem finding stage, the average pretest score is 49.97 while the posttest score is 72.67 with an average of 66.61 with an average value of both. At the idea finding stage, the average pretest score was 49.98, while the posttest score was 69.97. In the solution finding stage, the average pretest score is 48.78, while the posttest is 66.95.

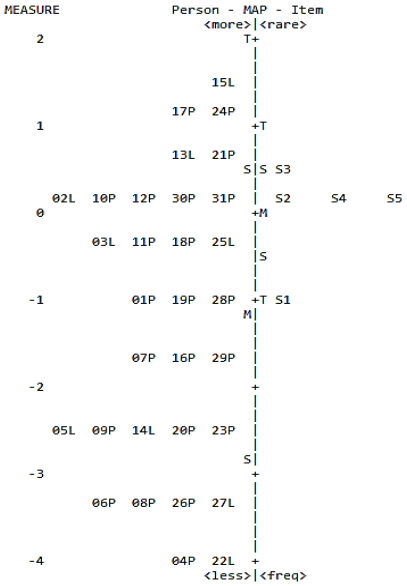

Figure 3. Wright map of creative-problem-solving abilities

Figure 3 explains that half the students in the research class could not answer the questions tested, namely students who had a logit value below item number 1 (S1). In addition, there are 5 students with codes 13L, 15L, 17P, 21P, and 24P who have the possibility to answer all the questions tested. Overall, the items tested were not evenly distributed at the level of student ability so that students tended to have difficulty giving the correct answer.

▪ CONCLUSION

Implementation of learning using Creative problem solving is able to improve creative problem solving skills by reviewing four indicators, namely fact finding, problem finding, idea finding, solution finding and the highest score is on fact finding indicators with an average of 67.57 for classes using Creative Problem Solving.

The Creative Problem Solving learning model can be an alternative in overcoming problems in schools with a large number. Therefore, this strategy is suitable to be applied by schools in Indonesia. In implementing the Creative Problem Solving learning model, it is necessary to pay attention to the time management allocated so that each implementation can be carried out properly. The Creative Problem Solving learning model can be tested on other materials according to school conditions.

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