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PROBLEM-SOLVING ASSESSMENT IN MODIFYING TASKS

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Abstract

An assessment has many benefits, especially in efforts to modify tasks. Often the teacher overrides the process of assessing students in problem-solving. Teachers use easy methods to teach. This causes students only to be able to practice questions and solutions conceptually and cannot develop their creativity in problem-solving. In this study aims to assess prospective teachers to accomplish problem-solving so that they can be creative in modifying tasks for students. The main aspect of this study is to provide an assessment of the problem-solving ability so that prospective teachers can change the new assignment. Students were practicing using an approach to a multi-dimensional perspective SPUR. Can make students excited and try to be creative in modifying the task.

Keywords: Assessment, Problem Solving, Modifications, Tasks

Assessment means valuation. According to (Nortvedt & Buchholtz, 2018) in the context of education, assessment can be designed to target students, or teachers, either as individuals or as representatives of a group, and for many purposes. One of the main objectives of assessment in mathematics education is to provide evidence that can be used to make decisions about or improve mathematics education, which then raises questions about which aspects of mathematical competence should also be assessed how and for what purpose. In this definition, the assessment provides excellent benefits in the world of education that is helping students or teachers in the activities of teaching and learning process.

The role of assessment in learning is considered to have an impact by (Wiliam.Dylan, 2004 Suurtamm, 2012). In three decades have seen an increase in the focus on assessment. Strong focus on knowledge-based examinations and assessments, assessments for learning, national tests, and international comparative studies gradually entered the stage. At present, there are various assessment formats and objectives. Around the world, multiple forms of assessment are used to obtain information that can be used to inform decisions about mathematics education at the individual, institutional, and national levels. (Nortvedt & Buchholtz, 2018).

Learning has invited experts to provide definitions of the meaning of the word "learning." Piaget(Pritchard, 2009) said that "learning is a process of adjustment to environmental influences." Piaget also added that the adjustment process was carried out through two methods, namely the assimilation process and accommodation.

Mathematics is one of the most important sciences for everyone. Almost all countries make mathematics as a science must be studied by every citizen. Achievement in Mathematics is a fundamental indicator of school system performance in many countries (Visser & Isdale, 2015). Mathematics learns about an order, about organized structures, mathematical concepts are arranged hierarchically, structurally, and systematically, starting from the simplest concepts to the most complex concepts. In mathematics, the basic object learned is abstract, so that it is called a mental object; an

object is a mind object. The basic objects include: Concept, is an abstract idea that is used to classify a set of objects. For example, a triangle is the name of an abstract concept. In mathematics there is an important concept that is "function", "variable", and "constant". The concept is closely related to the definition; the definition is the expression of a concept, with the definition of the organization can make illustrations or drawings or symbols of the concept in question. The principle is a complex mathematical object. The principle can consist of several concepts associated with a relationship/operation; in other words, the principle is the relationship between various basic objects of mathematics. Principles can be axioms, theorems, and character. Operations are the work of counting, algebraic work, and other mathematical work, such as addition, multiplication, combination, slice (Hasratuddin, 2014).

In the final demands of learning, students are expected to solve problems. In 1992, mathematical problem solving was made the primary goal of the school mathematics curriculum in Singapore. Since then, even though the curriculum has been revised twice, in 2001 and 2007, the mathematical solving problem remained its primary goal. This means that the teachers must have the ability to guide students to solve the problem. (Berinderjeet Kaur, Yeap Ban Har, 2009).

Students are required to have the ability to think creatively in problems solving faced in accordance with technological developments. Creative is born not because of luck, but it is a skill that needs to be honed and carried out repeatedly. Creative students will try to find breakthroughs in solving existing problems. Creativity needs to be sharpened because it is expected to be able to produce innovations in providing problem-solving.

One of the general goals of the current education system is to educate students as creative individuals. It makes them acquire the talent to produce innovative ideas to solve the problems that may arise during their life cycle. Creativity, as a process, it is formed from the phases given. The first stage is the preparation. In this phase, the problem is explained and explained. The required data is collected, and the material is examined. This phase, individuals or individuals assess existing problems starting from different points for problem-solving. The second phase is incubation. This phase is expressed as the phase where the product ripens out of consciousness. The third phases are discovery. This is the phase where the mind in the preparation phase is realized. The fourth phase is the elimination. In this phase, ideas are implemented which arise in the preparation and new thinking (Kaplan, 2014).

According to (Lor, 2018) design thinking is an innovative, creative, and human-centered process and mindset that employs collaborative multidisciplinary teams to produce products, services, or user-focused experiences. This has been applied outside the first field of design work for business, engineering, technology, and more recently, education, because of its ability to promote creativity and innovation by applying an empathetic, flexible and repetitive approach. To make the teaching and learning approach reasonable, it must be based on learning theories that are tested.

The ability of prospective teachers to modify assignments is essential in helping students in problems solving. This certainly requires a measurement in advance of the ability to solve problems. Prospective teachers who can solve problems well are expected to be able to modify tasks in their

learning activities. The main aspect of this study is to provide an assessment of the problem-solving ability so that prospective teachers can change the new assignment. This research offers excellent benefits in the development of further research in improving the ability to modify tasks.

METHOD

The study was conducted on prospective students of the 2018/2019 academic year. The type of research used is Research and Development (R & D), referring to the development model by (Borg, W.R. & Gall, 1989) which was adapted according to research needs. The stages of development research include 1) research and information collecting, which is carried out, among others, recognizing problems found in the field, analyzing the learning process, analyzing test questions, linear equation material, two variables, formative and summative tests, and tests in mathematics textbooks; 2) planning, which is carried out, among others, determining the material to be developed, formulating development goals with indicators of problem solving skills; 3) develop preliminary from products, which are carried out, among others, preparing cases based on the material taken, making assessment grids, developing initial product assessment, problem solving skills; 4) preliminary field testing, which includes product validation by assessment experts, material experts, linguists, and user practitioners, and limited scale testing; 5) main product revision, which is carried out, among others, improvements in accordance with the suggestions for the results of the preliminary field testing. (Muhammad Rosikhul Ulum, Heri Yanto, 2017)

Data collection is done through non-test and test techniques. The non-test technique was carried out to obtain qualitative data. The non-test technique is carried out by analyzing or assessing the assessment by expert assessors and user practitioners, while the test technique is carried out to obtain qualitative data. Qualitative data is obtained from the results of reviews by experts and user practitioners. Descriptive percentage of Purwanto in (Novitasari & Ramli, 2015). Data analysis by calculating the scores achieved from all aspects assessed and then calculating them with the following formula:

$$N = \frac{k}{Nk} x\ 100\% \qquad (1)$$

Information:

N: Percentage of the feasibility of aspects

K: score results of data collection

No: maximum score (highest criteria score x number of aspects x number of validators).

After getting the score obtained compared to Table 1 to find out the expert assessment criteria. This table is based on the criteria expressed by (Sudjana, 2009)

Table 1. Basis for developing scoring guidelines

Criteria Interval	Criteria
86%≤N≤100%	Very good
72%≤N≤85%	Good

58%≤N≤71%	Enough
44%≤N≤57%	Less
N≤44%	Very Less

This became the basis for developing scoring guidelines that were validated by experts.
According to (Kaur & Yoong, 2011) One approach to multi-dimensional perspectives on understanding is known by the acronym SPUR for Skills, Properties, Uses, and Representations. Skills represent procedures that students must master fluently; ranging from the application of standard algorithms to the selection and comparison of algorithms to the discovery or discovery of algorithms, including procedures with technology. Properties are the principles underlying mathematics, starting from naming property that is used to justify conclusions to derivations and evidence. Uses is the application of concepts to the real world or other concepts in mathematics and from routine "word problems" to the development and use of mathematical models. Representations are graphs, images, and other visual depictions of concepts, including standard representations of concepts and relationships with the discovery of new ways to represent concepts.

RESULTS AND DISCUSSION

The form of instruments provided to prospective teachers is, as shown in Figure 1. The instrument provided aims to assess the ability of prospective teachers to solve the problems. There are 3 questions with different problem models. They have different levels. Starting with basic questions to questions that require creativity in solving them.

Question 1 is a question that can assess the prospective teachers has understood or not in the concept of linear equations (Skills). Students are given two linear equations. They are given the task of determining the values of x and y. from the problems is given expected that teacher candidates can solve basic problems in linear equations and develop assignment given to students.

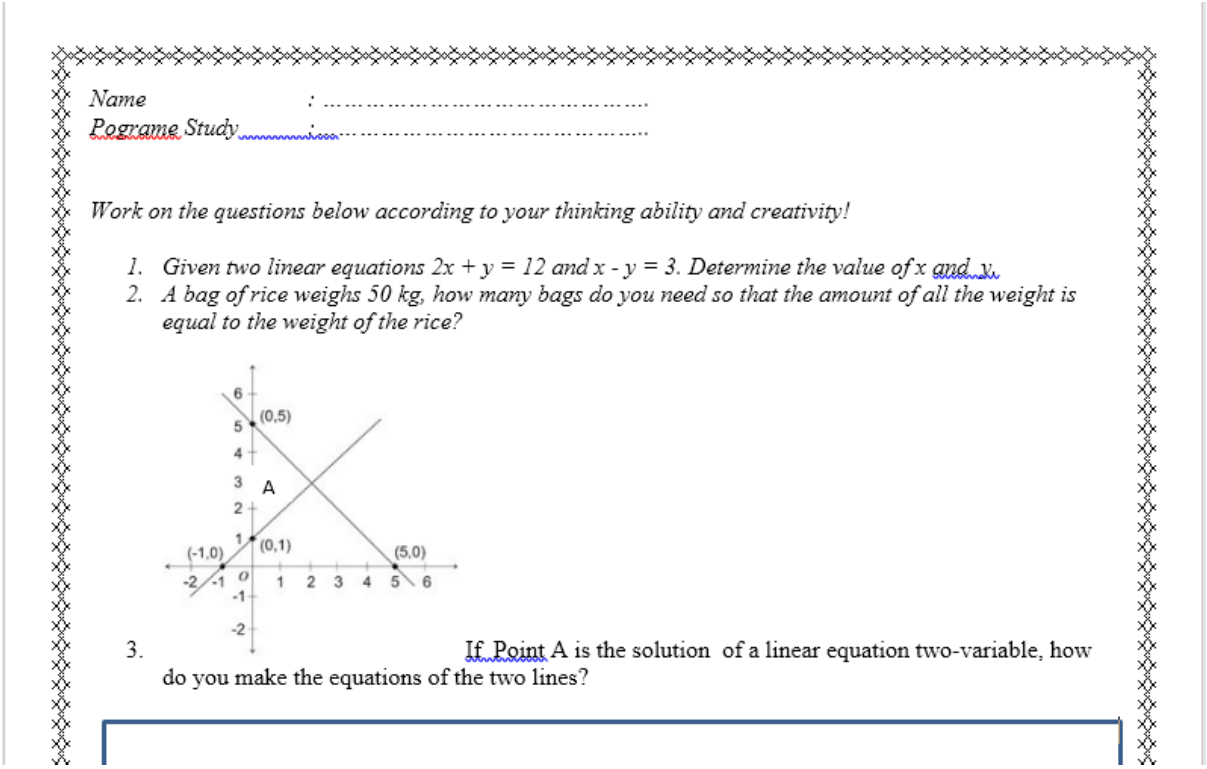


Figure 1. Instrument question

Question 2 assesses the principles underlying mathematics (property) and also the application of concepts to the real world or other concepts in mathematics (Uses). Question number 2, the prospective teacher must solve the open-ended problems in life. this is intended, so that prospective teachers have a broad insight in assessing their students and introduce to students if several problems have completed more than one. While in questions 3 and 4 are other visual depiction problems from the concept.

Table 2. Result of Instrument Validation

No.	Indicator	Score	Criteria
1.	Are the items in accordance with the problem-solving content	87	Very Good
2.	What is the content of the material in question Contextual?	88	Very Good
3.	Are the questions formulated?	85	Good
4.	Does the discourse or graph in the instrument function?	85	Good
5.	Is the assessment rubric correct?	86	Very Good
6.	Is the language used easily to understand	88	Very Good

Expert validation data in Table 2. by obtaining an average rating of validation results of 86.5 with very good criteria.

The results using multidimensional SPUR. Items in this test were also analyzed based on content. Among the 35 respondents, not all meet the SPUR results, as shown in Table 1.

Table 3. Multidimensional Approach

Multidimensional Approach	Total Answer Correct	Total Answers Incorrect	Total
Skills	21	14	35
Properties	25	10	35
Uses	16	19	35
Representations	11	24	35

Based on Table 3 It is known that the difficulty level of prospective teachers in solving the problem in the Multidimensional Level Skills Approach get the appropriate answers for 21 prospective teachers from 35 people or 60%. This means that more than 50% of prospective teachers have an understanding of concepts representing procedures that students must master fluently; starting from the application of standard algorithms to the selection and comparison of algorithms. However, these figures have not shown very good results in fulfilling the expectation that all prospective teachers who will graduate from universities must have an understanding of the concepts to be taught so that they have good skills in modifying the questions to be given to students.

While the criteria for multidimensional approach Properties gives the most results in answering according to the expected results which are equal to 25 prospective teacher students or by 71% and 45%, this means that in question 2 which is an open-ended problem in solving problems in the level of Properties and Uses have the highest value. This is presumably from the results of interviews of several prospective teacher students who said that this was because the application of questions based on the real-life had a better level of drawing so that the possibility of being able to work on problem-solving problems was easier than at the other levels. While the application of using graphs gives, question 4 of the instrument is another visual representation of the concept, including a standard description of concepts and relationships with the discovery of new ways to represent concepts. At this level, there are 11 students. Through interviews, there was an answer that represented most of the respondents were they still had difficulties if the questions were in the form of graphics and the information provided was not as complete as the concept questions and the real-world applications, so many misinterpreted the commands and made a lot of mistakes on statement number 4.

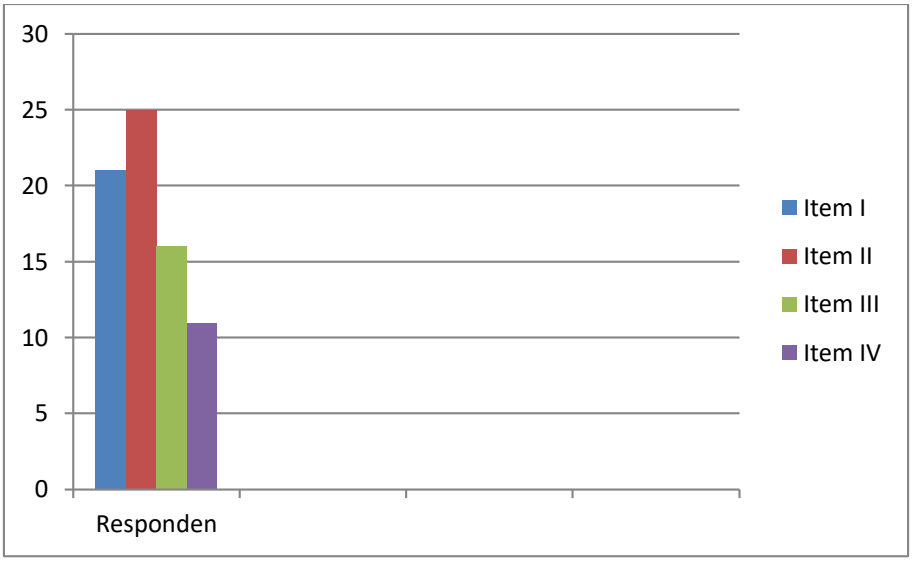
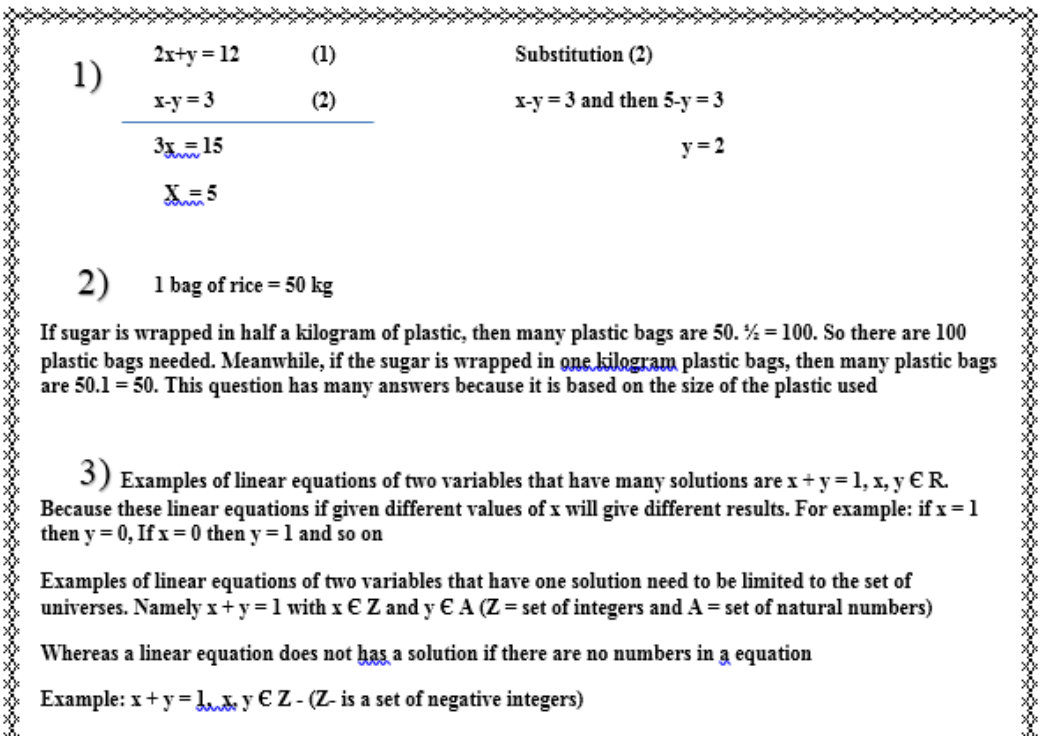


Figure 2. Graph of level problem-solving analysis SPUR

The results of the prospective teacher level analysis can also be seen in Figure 2. The results of the previous analysis are also based on the results of interviews conducted on two prospective teachers who have different levels of difficulty in solving problems in the instruments provided.

The graph shown in Figure 2 states that more than 50% of prospective teachers can complete point 1, namely in the "Skills" and "Properties" classes. The total population is 35 prospective teachers while the graph shows that there is a decrease in the number of prospective teachers who can solve problems in points 3 and 4. Where more than 50% of prospective teachers who have not been able to implement the "Uses" and "Representation" in modifying the new task.



1) 2x+y = 12 (1)
x-y = 3 (2)
3x = 15
X = 5

Substitution (2)
x-y = 3 and then 5-y = 3
y = 2

2) 1 bag of rice = 50 kg

If sugar is wrapped in half a kilogram of plastic, then many plastic bags are 50. ½ = 100. So there are 100 plastic bags needed. Meanwhile, if the sugar is wrapped in one kilogram plastic bags, then many plastic bags are 50.1 = 50. This question has many answers because it is based on the size of the plastic used

3) Examples of linear equations of two variables that have many solutions are x + y = 1, x, y ∈ R. Because these linear equations if given different values of x will give different results. For example: if x = 1 then y = 0, If x = 0 then y = 1 and so on

Examples of linear equations of two variables that have one solution need to be limited to the set of universes. Namely x + y = 1 with x ∈ Z and y ∈ A (Z = set of integers and A = set of natural numbers)

Whereas a linear equation does not has a solution if there are no numbers in a equation

Example: x + y = 1, x, y ∈ Z - (Z- is a set of negative integers)

Figure 3. Results Analysis of problem-solving instrument

Through the results of interviews conducted on the question, the number one instrument obtained the results of the interview as follows in Figure 4.

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Me	: What method did you imagine for the first time when you saw the instrument question that first appeared?
Lili	: A mixture of substitution and elimination methods
Me	: Why did you choose that method? What sentence do you refer to using the method?
Lili	: Because with mixed methods, it is easier to solve two-variable linear equations. I am referring to sentences with linear equations 2x + y = 12 and x-y = 3. There are two unknown variables, x, and y. We must also understand the concepts of linear equations.
Me	: Why don't you use the elimination method to find the value of the variables x and y?
Lili	: I think, using a mixed-method of substitution and elimination can represent our conceptual understanding of two-variable linear equations if we use elimination besides doing the same work twice and for a long time so I prefer to use mixed methods to solve.

Figure 4. Analysis of the results of interviewing instrument questions number 1

Based on the results of interviews, respondents said that they could directly see the question as a two-variable linear equation question because she understands the basic calculation concept. So it is easy for him to solve the second problem.

Me	: pay attention to the results you write on the second question instrument, you seem to be hesitant to answer. This is indicated by the words "dependent."
Lili	: At first I hesitated with question number 2, but when I looked deeper there was a possibility this was a type of open-ended question ... so I answered by giving an example option if ... Depends on the size ...
Me	: Where do you know that this is an open-ended question?
Lili	: Hehehhejust guessing, I was afraid it was a trap
Me	: What do you know about open-ended questions?
Lili	: As far as I know, the open-ended question has many finishes as possible.

Figure 5. Analysis of the results of interviewing instrument questions number 2

The instrument question number two, the respondents explained how she could solve it by giving examples of possible answers. Conceptually, respondents can estimate the answer when they know that it is an open-ended question. Initially, the respondent thought that the question was lacking, but after rethinking that there is a possibility that question instrument number 2 has many possible answers that can be formed so that answers are given by giving examples of solutions possibility that can be used to answer the question.

Me	: Are you sure that the answers to the instruments in question 3 you answered correctly?
Lili	: I am not sure either ... but I give you an example that is open-ended too ...
Me	: How do you know that the linear equation that you are example has a lot of completion?
Lili	: yes, I just tried substituting any real numbers that might be in the equation that I was exemplifying ... I found there were many possible answers.
Me	: Can you be asked to develop questions and answers that consist of two two-variable linear equations?
Lili	: Definitely and able

Figure 6. Analysis of the results of interviewing instrument questions number 3

Based on the statement expressed by respondents that the example of linear equations is obtained by trying several problems and choosing x and y so that if substituted x and y in the equation that is made there will not be found the same results of the two-equation sections. This lacks an essential concept to make a result that can be used as a benchmark in creative thinking. Coincidentally produces the right value.

Me	: question number 4, do not you do it?
Lili	: hehe yeah I just found out if I have not done it. Sorry, but I can even though without writing the answer
Me	: oh, yes? What is the result of analyzing your answer to question instrument number 3
Lili	: Only by looking at the points on the line where line I through points (0.5) and (5.0) so that the line equation formed is 5x + 5y = 25 and line II through the point (-1.0) with (0.1). So the equation of the line is y = x + 1
Me	: how can you get answers as you explained?
Lili	: dabbling hehehhe

Figure 7. Analysis of the results of interviewing instrument questions number 4

On the fourth instrument question the respondent tries to try but is given an explanation in the form of a trick that is used to work that is only by looking at the points on the line where line I goes through points (0.5) and (5.0) so that the line equation is formed is 5x + 5y = 25 and line II through point (-1,0) with (0,1). So the equation of the line is y = x + 1. From the things that happened to the fourth instrument, the question can be done by prospective people with skills. However, there are still fundamental abilities possessed by the respondents. Prospective teachers are required to have creativity in modifying assignments. This relates to the needs of students in teaching and learning activities in the classroom. If the teacher cannot modify the task to be given to students and knows creative ways to solve it, students will tend to be unable to be creative. So by practicing using the approach to multi-dimensional perspectives SPUR has several benefits including the word Skills having special benefits that can help prospective teachers to make students improve their skills in understanding the basic concepts of the material provided. This can be done by giving basic questions about the content given. This can be done by replacing the variables and numbers used with other numbers. This is needed so that prospective teachers can teach basic concepts and modify the assignments given to students. Properties have special benefits so that prospective teachers can change the task by utilizing each property related to the problem to be delivered. Whereas, Uses provide mandates that are interrelated with Property because

the author feels the benefits of these two aspects to form a unity. In both of these aspects, it can usually be used simultaneously by giving story questions by changing numbers or adding properties to the task so that it can modify the task. In the aspect of Representations can provide benefits for prospective teachers in modifying the question by describing the task through graphics or images that can support the assignment of tasks. This can make students creative because students can imagine the assignments given through the pictures provided. Students can easily present the problems obtained through images.

CONCLUSION

A prospective teacher can modify the assignment given to students by practicing using an approach to a multi-dimensional perspective SPUR. This can provide benefits for prospective teachers and students. For prospective teachers offer benefits as an exercise to be able to modify the tasks to be given to students. The teaching and learning process can run well if the prospective teacher can revive the learning atmosphere with the quality assignments provided. While students can provide benefits to help students think creatively. The varied and good tasks given by the teacher can make students excited and try to be creative in solving them.

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