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by Septi Matematika 1

Submission date: 28-Feb-2023 09:43PM (UTC+1100)

Submission ID: 2025172741

File name: IOP_-_SEPTI_TRIYANI_new.pdf (311.89K)

Word count: 3597

Character count: 19318

9 Designing Task to Support Student's Creative Thinking Process In Problem Solving Of Fraction In Elementary School

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Abstract. To recognize the creative thinking process of students in problem solving of fraction in elementary school needed the task which is possible to support student's creative thinking. The task has to be suitable with the objective or the goal to be measured, and fulfill the validity and reliability as an assessment instrument. In this research, the task is designed so that it can explore student's creative thinking process with indicator of fluency, flexibility and novelty. The task is designed in open ended problem so that student can use many strategies or give many answers. The designed task about dividing some cakes to some people so that each person gets the same part. Descriptive-Qualitative research is conducted to understand that the designed task is valid and reliable. The rational analysis is done descriptively from the written data which is made by evaluator (researcher, colleagues and teachers), from the result of written task experiment and interview based task to students at 5th grade of SDN Kertajaya Surabaya and students at 5th grade of SDN Pacar Keling V Surabaya. Its result is the "standard" prototype of task as an assessment instrument to support student's creative thinking process and also some other findings.

⁶ Introduction

Creative thinking is a process that is used when we bring in / bring up a new idea. It combines many ideas that have not been done yet. When one applies creative thinking in problem solving, divergent thinking produces many ideas. It will be useful in finding the solution. As in elementary school, to support student's creative thinking process in problem solving it is needed the task that can really identify that. The task must be in accordance with the goals or objectives that will be measured. It also have to satisfy validity and reliability as a tool of assessment. Thus the content aspect (material), level of ability, context and form of task must be tailored and fulfill criterion or notion of creative thinking as intended. In this research, the task is designed to assess student's creative thinking process in learning fraction of grade 5th of elementary school.

Creative thinking can be interpreted as a combination of logical thinking and divergent thinking based on intuition but still in consciousness [11]. Another view of creative thinking is proposed by [5] which explains that creative thinking is a thought of authenticity and reflective that produce a complex product. That thinking involves synthesizing ideas, building new ideas and determining their

effectiveness. It also involves the ability to make decisions and produce new products. [6] cites the idea of Shaw and Simon giving an indication of creative thinking, namely (1) the product of mental activity has novelty and is valued both subjectively and objectively; (2) the thinking process is also new, asking for a transformation of the initial ideas that is accepted or rejected; (3) the thinking process is characterized by a strong and stable motivation, and can be observed beyond the time taken into consideration or with high intensity.

[2] says that creative thinking always seems to show flexibility. Even [6] identified that the flexibility of mental processes as a component of mathematics creative ability in school. [2] shows the criteria according to Torrance in creativity, i.e. eloquence (the number of responses received), flexibility (number of different responses), and authenticity (the prohibition of responses in relation to a group of partners). In the context of mathematics, the eloquence criterion seems less useful than with flexibility. For example, if a student is asked to make a matter of a value of 5, students may start with 6-1, 7-2, 8-3, and so on. The value of the student high, but does not show creativity. Flexibility also emphasizes the number of different ideas used. So in math to judge divergence products can use the criteria of flexibility and authenticity. Another criteria is appropriateness. The mathematical response may indicate authenticity which is high, but useless if it does not fit in general mathematical criteria.

[12] explains that to assess children's creative thinking and adults are often used The Torrance Tests Creative Thinking (TTCT). The three key components assessed in creativity using TTCT are fluency, flexibility and novelty. Fluency refers to the number of ideas created in response to a command. Flexibility looks on the approach changes when responding to commands. Novelty is the authenticity of the idea created in response to the command.

The ideas of these aspects of creative thinking are adapted by some experts in mathematics. Fluency refers to the number of problems posed, flexibility refers to the many categories of categories different from the problems created and the authenticity of seeing how elasticity (different from habit) a response in a set of all response. Getzel & Jackson in [12] also developed a test for assessing the eloquence and authenticity of problem solving that have answers diverse or various ways / approaches. Thus the activities submissions and troubleshooting that review fluency, flexibility and novelty can be used as a means to assess creativity as a product creative thinking of the individual.

For further studies, creative thinking is defined as a process used someone in synthesizing (interweaving) ideas, building new ideas and apply them to produce new products fluently and flexible. [12] provides an indicator for assessing students' creative thinking (fluency, flexibility and novelty) using problem solving. The relationship can be illustrated in the following table.

Table 1. The relationship of creativity in problem solving.

Problem Solving	Creativity
Students explore open ended problems, with many interpretations solution methods, or answers	Fluency
Students solve (or express or justify) in one way, then in other ways. Students discuss many solution methods	Flexibility
Students examine many solution methods or answers (expressions or justifications); then generate another that is different	Novelty

The three components to assess creative thinking process can be operationalized as follows.

- Fluency in problem solving refers to diversity of answer to the problem that is made rightly. Two answers are a variety is not necessarily different. Some answers to the problem are said to vary but no different if the answers are not the same as the others, but appears to be based on a particular term or sequence.
- Flexibility in problem solving refers to the student's ability solving problems in different ways.

- Novelty in problem solving refers to the student's replying ability problem with several different answers but true or one unusual answer done by the individual (student) at the stage their development or level of knowledge.

Based on the above study, then the task of assessing creative thinking process must meet the following characteristics.

1. Problem-solving ([12]; [11]; [8]; [7])
2. Be divergent in the answer and how to solve, so elicits criteria for flexibility, novelty and sequence. ([12]; [11]; [6]; [2])
3. Associated with more than one knowledge / mathematical concepts of students before and in accordance with the level of ability. This is to generate divergent thinking as a characteristic of creative thinking process.
4. Information should be easily understood and clearly caught meaning or meaning, does not lead to multiple interpretations and sentence composition using standard rules of good and correct.

To find out if the tasks are designed in accordance and meet the above characteristics, then performed the validation to the expert and tested to find out reliability of the task. Thus the purpose of this study is to know that the tasks are designed to identify students' creative thinking process has fulfilled the requirements of validity and reliability as an appraisal tool.

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2. Methods

This research is included a descriptive-qualitative research. This research seeks to describe and interpret the nature of the task designed by researchers [1]. Data in the form of written statements (validator assessment) and oral (interview to students) were analyzed descriptively.

The criteria used to assess the designed task are validity and reliability of the task [4]; [10]; [9]. A measuring device/assessor is said to be valid (meets validity), if the tool can measure what is thought to have been learned (owned) which relates to the content of the lesson or material tasks appropriately. In this study, the task is designed to be valid, if it meets its characteristics and purpose to know the creative thinking ability of students. Validity has several types such as validity of forecast, comparability validity, content validity, and construct validity.

Validity in this study includes the type validity of content and construct. Content validity reviewing the accuracy of the materials used 5th grade elementary students and the task is possible for students to give many answers as well as the way of completion. Construct validity reviews about accuracy in the arrangement / construction of tasks such as the obvious question point, can be understood and easily to get the meaning, does not lead to multiple interpretations and actually measure the ability to think creatively (fluency, flexibility, and novelty). To assess the validity it is done by rational analysis by asking suggestions, opinions, comments, or assessments to two lecturers of State University of Surabaya, one teacher in SD N Kertajaya Surabaya and one teacher in SDN Pacar Keling V Surabaya.

Reliability refers to consistency by which the assessment procedure measures what must be measured [10]. Type of reliability consists of three types, namely stability (consistency of results on different test occasions), alternate form (consistency of results between two or more formats of a different test), and internal consistency (consistency of means of the assessment instrument). In this research use internal consistency type, that is to see if the task can function equally (homogeneous) to identify indicators of creative thinking process of students. The degree of reliability is not measured / analyzed numerically, because the task form of a performance task is not rated or numerically scanned (using interval scale). The result of the task is to notice how students can show indicators of creative thinking process (fluency, flexibility and novelty) or not. In this study is not just to see the product of student's creative thinking, but more important is to explore how is the process of student's thinking to produce that product.

Reliability can actually be achieved if the task has been fulfilled validity [10], so that if validity has been met, then automatically the reliability is achieved. In addition, [3] summarizes some expert opinions that validity is more important than reliability for open ended tasks. Magone [3] describes the procedure for validating cognitive complexity and the quality of the content of the task material for

assessment, among others by the logical analysis of the contents and expected performance, internal reviews and external experts, and qualitative analysis of response of students collected from piloting test.

In this study the procedure is as follows.

1. Designing tasks and examples of alternative solutions to identify creative thinking process. The task is in the form of problem solving that allow students to show indicators fluency, flexibility and novelty. The task is about dividing some cake to some people so that each person get same part. The material is related to concepts of fraction that have been studied by students. Thus rationally has designed according to the characteristics or character of the task to identify student's creative thinking process. The task is draft-1. The task is formulated as below.
There are three people. The first person has 5 cakes, the second person has 3 cakes (Each cake has the same shape and size) and the third person did not have a cake. If the whole cake will be shared for the three people with each person getting the same share, then:
 - a. *make a variety of possibilities that can be done to distribute the cake! how do you make those possibilities for sharing the cake?*
 - b. *select one possible distribution of the cake as you did in part (a), then point it out indifferent ways to solve the possibility!*
2. The task of draft 1 is validated in terms of content by two lecturers of doctoral program in Department of Mathematics, Faculty of Mathematics and Natural Science, State University of Surabaya. The first lecturer is promotor and the second is a co-promotor of researcher's dissertation. Instrument or validation sheet designed by the researcher and the validator can also provide comments or suggestions on the task script directly. The validation results are used by researcher to revise the task. This validated task is called draft 2.
3. The draft 2 was validated to the teacher in SDN Kertajaya Surabaya and the teacher in SDN Pacar Keling V Surabaya. Then, experiment was conducted to some students in both school. The revised result of draft 2 is a prototype of the final task. Validity the task is known from the results of content validation and construct by the lecturers and the teachers. The reliability is known from the test results and interviews to the two students.

3. Result and Discussion

The draft-1 tasks designed were validated to 2 lecturers and 2 teachers. The results are as following.

1. Not all validators fill in the instrument or validation sheet provided. Validators that do not fill validation sheets provide comments, suggestions or questions directly on a task or alternative script completion of each of these tasks. Only one validator filled out and write down the written recommendation, the task is worthy of use with the repair.
2. Most comments and suggestions pertain to revisions to terms, words, sentences, writing, punctuation, and symbols used.
3. One of the results of discussion with lecturers is to make some possibilities of student's answers.
4. Based on the discussion and direct suggestions that are not written, the conclusion is the task is possible to explore student's creative thinking process.
5. The designed tasks is need to be revised and tested on the students to know the legibility.

This result was followed up by revising the task and improving from the aspect both the construct and the language. Revision of draft-1 tasks generates draft-2 that was validated by two lecturers and two teachers. The result are as following.

1. The suggestion from one of lecture is that the question b don't need to be printed in the task, but it is given along the interview if the students don't give answer that show flexibility.
2. The suggestion from another lecturer is that is the question b is need to be printed in the task to see all aspect of creativity.
3. According to the suggestions, the task is still written in the draf 1, but the question of b is asked to student when the answer of student haven't appear flexibility.

4. The general conclusion is that the task can be used to identify student's creative thinking process and from the aspect of the content and the construct it is valid. Because of revision that is recommended only on words / terms used not on the characteristics and the purpose of the task. Next, the draft of this task was tested to students in one of class of SDN Kertajaya Surabaya and SDN PacarKeling V Surabaya. Figure 1 is one of the student's answer of the task (subject RF).

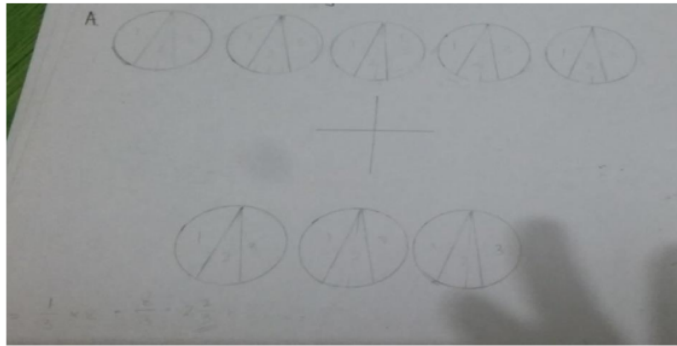


Figure 1. Student's answer by dividing all cakes into 3 parts.

Student's answer the task by using picture that represents the cakes. From Figure 1, the strategy is by dividing each cakes into three part. Then each part is for each person. The student also show in mathematics form that each person gets $\frac{1}{3} \times 8 = \frac{2}{3} = 2 \frac{2}{3}$.

Student's also can show the result in other form as Figure 2 below.

Figure 2. Student's answer in mathematics form.

Then, the student was interviewed. Subject RF was asked to use other ways to solve the problem. The other answer is as Figure 3 below.

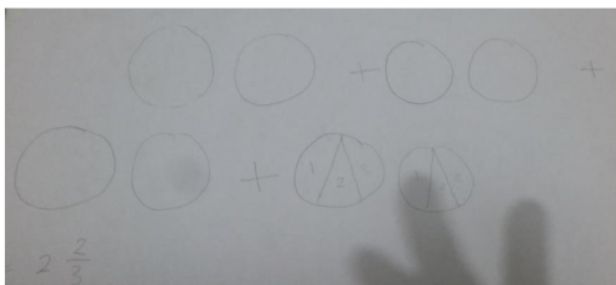


Figure 3. Student's answer by dividing two remaining cakes into 3 parts.

is by distributing two cakes for each person. Then, each of the remaining of two cakes is divided into some parts.

The two main strategies used is *first*, by dividing each cake into some part (three part as in Figure 1 and nine part as in Figure 4b). *Second*, by distributing two cakes for each person. Then, each of the two remaining cakes is divided into some parts (as in Figure 3 and Figure 4a). As in Figure 5a and 5b it also shows that the student is getting fluent in dividing the cakes into some other parts even without using a picture.

It can also be seen that the student chose to divide the cake into 3,6,9,12, 15,... From the interview, the student said that it was because there are three people. Those numbers can be divided by three, so for her it was easier to distribute the cakes in that way than to divide the cake into other parts. However she said it was still possible to divide the cake into any part, but it is still difficult for her to represent it in mathematical form.

From some of the student's answers above, it shows that the student can answer the task fluently as she can give many answers correctly. The student also can answer the task flexibly as she can change her strategy and give an answer by different representation (picture and mathematical formula). It can be concluded that the given task can support student's creative thinking process in learning fraction.

The overall conclusion of the design process (design) of this task is generated a task prototype (revised 2nd draft assignment) to identify student's creative thinking process that is valid and reliable.

4. Conclusion

This research has produced a prototype task to explore the creative thinking process of elementary students in learning fraction that are valid and reliable. In designing the task, it is important to give attention to the aspects of the content (material), context, construction and language. The content or material must have been studied or known by students, and it is related to more than one student's mathematical concepts or knowledge. The context of the problem should be known by the student and it should be appropriate to the class level or cognitive development of students. Construction or task form can be a problem solving that is designed in an open ended problem so that the composition of the question leads to the divergence of answers and solutions. For the language of the task, it is not all students can understand the task directly. Therefore it needs to be as optimal as possible to design the sentence structure according to the rules of language and to consider the sentence structure that is easier to be understood by students. However, it is necessary to realize that the more important is the aspect content or task material. If students could not understand the composition of the task sentence, then researchers need to read out or indicate the purpose of the task order so that the goal assessment or purpose of the assignment is achieved.

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