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Developing Worksheet Based on Multiple Intelligences to Optimize the Creative Thinking

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Abstract
The research and development of worksheet based on multiple intelligences aims to develop and describe the effectiveness of worksheet based on Multiple Intelligences to optimizing the ability of creative thinking students. The type of research used is research and development that refers to the theory of Borg & Gall. The population of this research is the students of 5th grade of Primary School in Metro East. The sample of this research was 33 students of 5th grade in Primary School is determined using purposive sampling technique. Data were collected used questionnaires and test questions. The results showed that worksheet based on Multiple Intelligences effectively optimize the creative thinking students.
Keywords: Student worksheet, Multiple intelligences, Creative thinking

1. Introduction

21st century education requires students to process the information they learn through the activities of analysis, assessing, and creating. Students should be able to use the information obtained to create something new, be able to make sensible opinions, communicate the knowledge gained, and work with other students to build a more optimal ability. So the ability that must have students in the 21st century is creativity, critical thinking, communication, and collaboration (Bialik 2015, p. 5). For many years, educators have implemented traditional teaching methods in the classroom that have tended to classify students as a homogeneous group where teachers use the executive approach to transmit knowledge to all the students with a similar set of teaching methods (Sulaiman et al. 2011, p. 428). Gunst (Dolati 2017, p. 189) who conducted a research on elementary school stated teachers tend to use teaching strategies that are aligned with their self-reported multiple intelligence. However, teachers need to be able to move beyond their strongest intelligence and incorporate several approaches in classrooms where students have varying abilities, interests, and aptitudes.

Each student is a unique and different individual, so learning in the classroom should be able to facilitate the student's diverse abilities. According to Gardner's theory (Gardner 2011, p. 25) multiple intelligences has several implications for teachers in term of classroom instruction. Since all children do not learn in the same way, they cannot be assessed in the same way. Knowing how each student learns will allow the teacher to properly assess the child's progress. Yalmanci (2013, p. 27) Gardner's Multiple Intelligences theory has two important advantages in education. First, it paves the ways for planning the education program in a way that students realize their potentials and move toward their desires. Second, it makes it possible for us to reach students who are more active because learning would be more attractive in a condition that learners are trained through the use of these intelligences. This happens when the teacher's lesson plan includes a variety of activities that are related to various types of intelligences (Carlin et.al. 2013, p. 170).

The ability of creative thingking is ability that must have students in the 21st century. Creativity is unique, different, variety, and innovative. So that, learning should be based multiple intelligences. Gardner (2011, p. 98) proposed that each person has different capabilities and tendencies in different areas and that each individual has several types of intelligences that are intermingled in different ways. This research was focus in mathematics subject, because for many studies mathematics only practice logical-mathematical type in learn without used the other intelligences. Mathematics is used to practice thinking and reasoning skills so as to solve real-life problems. Burns (2014, p. 8) states the goals of mathematics instruction today are clear—develop children's ability to think and reason mathematically and help them learn the concepts and skills they need to do so, skills in all of the content areas of mathematics to a range of problem-solving situations.

TIMSS or Trend in International Mathematics and Sciences Study is international study center at fourth and eighth grades in special advanced mathematics and physics programs. The result of the TIMSS study in 2015 for 4th grade students shows that Indonesia ranked 44 out of 56 countries with an average score of 397. The average score of all countries is 500 so that Indonesia is categorized as country average significantly lower (International Association for the Evaluation of Educational Achievement [IEA] 2015, pp. 19-20).

Accordingly, the action of the local education system to implement the higher order thinking skills (HOTS) element proposes to enable rational science subjects in various students in the hopes of expanding the scope of intelligence. The act opened more branches of evaluation in addition to evaluation or assessment only oriented towards verbal-linguistic and logical – mathematical intelligences.

According to Gardner (2011, p. 64) one's intelligence - suddenly - is not measured from the results of standard psychological tests, but can be seen from one's habit of two things. First, one's habit of solving a problem. Second, a person's habits create new products that have cultural value (creativity). The ability to think creatively is a high-level thinking ability. Creative thinking skills is higher order thinking skills (Runisah 2016, p. 347). According to Guilford there are four aspects of the ability to think creatively is fluency, flexibility, originality and elaboration. The four aspects according to Guilford are used as indicators in this study to measure the creative thinking ability of students. This research was focus in mathematics subject, because for many studies mathematics only practice logical-mathematical type in learn without used the other intelligences. According to Susanto (2014, p. 109) creative thinking can be interpreted by thinking that can connect or see things from a new point of view. According to Guilford (2014, p. 518) there are four aspects of the ability to think creatively is fluency, flexibility, originality and elaboration. The four aspects according to Guilford are used as indicators in this study to measure the creative thinking ability of students.

Susanto (2014, pp. 111-113) describes the indicator on creative thinking skills are (1) Fluency; answer with a number of answers, fluently in exposing ideas, can see the error or lack of a situation, object, or statement. (2) Flexibility; capable of providing different ways to solve problems, giving various interpretations of images, stories, or problems. (3) Originality; give different answers to others, choose the asymmetry in the drawing or create the design, after reading or hearing the idea of working to find a new solution. (4) Elaboration; seeking deeper meaning for answers by taking detailed steps, developing other people's ideas, drawing lines, colors and details about the pictures themselves or others.

The efforts to facilitate students to get used to solve problems and to develop their creativity are through a structured and varied activities. These activities can be arranged in such a way in a teaching materials in the form of Student Worksheet. According to Prastowo (2015, p. 204) Student Worksheet is a printed material in the form of sheets of paper containing materials, summaries, and instructions on the implementation of learning tasks to be done students, which refers to the basic competencies that must be achieved. Student Worksheet can be useful in many ways including academic achievement. For example, as a supplement to books, providing additional information for a particular class, can help students construct knowledge, otherwise Student Worksheet will be able to attract students when combined with specific teaching methods (Lee 2014, p. 96).

The preparation of Student Worksheet is done with the aim to provide instructional materials that suit the curriculum requirement according to the needs and the characteristics and environment of the students, increase the learning resource for the students, and facilitate the teacher in carrying out the learning. Based on these objectives, the preparation of Student Worksheet should consider the needs and potential of different students. This potential is then referred to as intelligences.

Based on research conducted Gardner (2011, p. 15) gives result that each individual has more than one intelligence, called multiple intelligences. According to Jasmine (2016, p. 5) multiple intelligence is the existence of multiple intelligences or more than one intelligence on someone. Gardner (2011, pp. 98-180) specifies that multiple intelligences of each individual consist of linguistic intelligence, music intelligence, logical-mathematical intelligence, spatial intelligence, kinesthetic intelligence, and the personal intelligences.

Derakhshan's research results (2015, pp. 70-71) mention that multiple intelligence strategy should be applied in classes in order to boost up the students' learning skills. Yalmanci (2013, p. 33) explains that when using multiple intelligences strategies in learning then students will be more successful in academics. Worksheet base on Multiple intelligences that can support students in learn by doing so that can make learning more pleasant. Worksheet can be useful for develop varied activities in many ways with support multiple intelligences that considered several different of intelligences. Different capabilities each student can be facilitate with worksheet base on multiple intelligences, so that student can be exist the creativity in learn.

Therefore, the alternative used to develop and improve the ability of creative thinking is with the development of Mathematics Students Worksheet based multiple intelligences. The purposes of this research and development are (1) Produce students worksheet mathematics product based on multiple intelligences in 5th grade of Primary School to optimize the creative thinking students. (2) Describe the effectiveness of student worksheet based on multiple intelligences on the creative thinking ability of students in learning mathematics in 5th grade of Primary School.

2. Methods

2.1 Analysis Product

The type of research used is Research and Development (R & D) model of Borg & Gall. Research and Development (R & D) model of Borg & Gall has steps (Borg 1989, p. 781) consisting of (1) Research and Information Collecting, (2) Planning, (3) Develop Preliminary Form of Product, (4) Preliminary Field Testing, (5) Main Product Revision, (6) Main Product Revision, (7) Operational Product Revision, (8) conducting final product trials, (9) revising the final product, and (10) disseminating and implementing the product. From those ten steps the researchers set to implement until the seventh step. The feasibility analysis of Student Worksheet is

obtained from the product validation result calculated using the formula:

$$\text{Final Score} = \frac{\text{obtained score}}{\text{Maximum Score}} \times 100$$

The final score is converted to the following assessment criteria.

Table 1. Criteria Product Validation Result

Criteria	Value
Very Good	76 – 100
Good	51 – 75
Less	26 – 50
Very Less	≤ 25

2.2 Analysis Effectiveness

The study population was 279 students. Sampling technique used is purposive sampling technique and obtained sample amounted to 33 students in 5th grade of Islamic Primary School. Creative thinking students is measure with study result which is the questions test arrange based indicator of creative thinking ability. Tests of creative thinking skills of students are prepared based the indicators of creative thinking. This test is done by students twice as much as on pre-test and post-test. The indicator of creative thinking ability test is as follows.

Table 2. Indicator of Creative Thinking Ability Test

Aspect of Creative Thinking Skill	Indicator of Creative Thinking Ability
Fluency	– Answering the questions coherently and thoroughly. – Answer more than one answer.
Flexibility	– Answering questions varied. – Provide alternative ways of completion
Originality	– Gives an answer other than the usual. – Give different answers to other friends.
Elaboration	– Develop or enrich the idea of an answer to a question. – Add or detail detailed answers.

The effectiveness of the use of Students Worksheet is determined by using the N-Gain formula as follows.

$$\text{N-Gain} = \frac{\text{post-test score} - \text{pre-test score}}{\text{maximum score} - \text{pre-test score}}$$

Interpretation of N-Gain calculations using the Hake classification as follows.

Table 3. Interpretation of N-Gain calculations

Index Gain	Criteria
$g > 0,7$	High
$0,3 < g \leq 0,7$	Middle
$g \leq 0,3$	Low

Study result determined by using the paired-sample t-tets by SPSS 20 program. The t-test criteria are: 1) If the significance value ≤ H_0 is rejected and H_1 is accepted. 2) If the value of significance> 0.05 then H_0 is accepted and H_1 is rejected.

3. Results and Discussion

3.1 Result

(1) Development of Student Worksheet

Student worksheet is developed in accordance to the student worksheet framework that has been compiled. The preparation of the student worksheet draft consists of: (a) cover, (b) introduction, (c) mapping of core competencies, basic competencies, indicators, and learning objectives, (d) instructions on using student worksheet, (e) material (f) bibliography. Initial product testing is done by validating student worksheet on material and design aspects. Student Worksheet validation is done by lecturers of material experts, professors of design experts, and teachers as practitioners.

The student worksheet material expert test aims to gain input on the appropriateness and correctness of instructional materials based on scholarship on the developed student worksheet. The result of material validation by the material experts based on the aspect assessed obtained the value of 82,85 (very good criteria). Based on the expert assessment of the material obtained some suggestions that are (1) indicator related to differences in volume and capacity need to be corrected, and indicators related process indicators that need to be added to the indicator results to be measured using instrument questions. (2) The purpose of using student worksheet is better to use operational sentences. (3) The writing section of the cube and beam volume formulas in Lesson 3 is improved.

Expert test design aims to get advice about the accuracy of student worksheet design. The result of design validation by the designer based on the assessed aspect earned 87,50 (very good criteria). Based on the assessment of design experts obtained some suggestions, namely (1) cover page improved to be more interesting for students. (2) adding the mapping of Core Competencies. (3) Include a moral message. Initial product test is also done to practitioner that is Teachers of 5th grade. The validation result by practitioner get the value 88,89 (very good criteria). Based on the assessment by practitioners, the following suggestions were obtained (1) adding concept maps, and (2) adding examples of problems and solutions.

(2) The effectiveness of Student Worksheet

Field product trials were conducted in 5th grade Primary School. The subjects were 33 students. Before implementing the first lesson, students performed the pre-test. After studying using student worksheet based Multiple Intelligences, students did post-test. It is intended to determine the effectiveness of student worksheet based Multiple Intelligences by looking at whether or not improvement of learning outcomes before and after implemented learning using student worksheet based multiple intelligences.

Based on the recapitulation of learning data of large group students, it is known that there is an increase of pre-test and post-test result with average N-Gain of 0,34 (medium category). The average score on pre-test is 67,477 and it increases in post-test to 82,296. Analysis to compare learning outcomes before and after learning using paired t-test. Before analysis using t-test, test of requirement of analysis is test of data normality using Kolmogorov-Smirnov T-tested by SPSS 20 program, with test criteria: 1) if significance value > 0,05 then data is normal distribution. 2) If the significance value < 0,05 then the data is not normally distributed.

Normality test results are known significance value of 0,823 > 0,05 then it can be concluded that the data is normally distributed. After the data were tested for normality, the effectiveness test was performed using paired t-test. Based on the calculation is t_{value} = -9,510 with significance value 0,000 < 0,05, so H_0 is rejected and H_1 accepted. This shows a significant improvement in students' creative thinking ability reflected in higher learning achievement after using Student Worksheet based Multiple Intelligences. Based on these calculations, the accepted hypothesis is "Student Worksheet based on Multiple Intelligences effective to optimize students' creative thinking ability".

3.2 Discussion

Student Worksheet products based on Multiple Intelligences developed have fulfilled the concept of learning and learning. Based on the theoretical constructivism learning theory, learning is the result of constructing students as a result of interaction with the environment. Student Worksheet based Multiple Intelligences is developed by applying 7 types of intelligence, namely: 1) language intelligence is developed by observing activities and analysis texts on volume and content, making and reading poems about cube and beam volume, and analysis stories. 2) Musical intelligence is developed by singing and making lyrics about volume and content, and singing the volume of cubes and beams. 3) Kinesthetic intelligence is developed by making the beam nets, and doing the game finds the volume of cubes and beams. 4) Visual-spatial intelligence is developed by drawing cube and beam sketches, watching video activities, observing demonstrations finding cube and beam volumes, and working on labyrinth-shaped questions and images. 5) Interpersonal intelligence is developed by group interaction in singing and making lyrics of volume and content, and gaming involves finding the volume of cubes and beams. 6) Intrapersonal intelligence is developed with individual activities such as doing questions, making and reading poetry, and doing self-reflection. 7) Logical-mathematical intelligence is developed by counting activities, finding the cube and beam volume formulas, and solving the problem of cube and beam volumes.

Yalmanci (2013, p. 27) stated Gardner's Multiple Intelligences theory has two important advantages in education. First, it paves the ways for planning the education program in a way that students realize their potentials and move toward their desires. Second, it makes it possible for us to reach students who are more active because learning would be more attractive in a condition that learners are trained through the use of these intelligences. This happens when the teacher's lesson plan includes a variety of activities that are related to various types of intelligences (Carlin 2013, p. 170).

Derakhshan's research results mention that multiple intelligence strategy should be applied in classes in order to boost up the students' learning skills (Derakhshan 2015, p. 169). Dolati (2017, p. 10) stated that teachers tend to use teaching strategies that are aligned with their self-reported multiple intelligence. However, teachers need to be able to move beyond their strongest intelligence and incorporate several approaches in classrooms where students have varying abilities, interests, and aptitudes.

The effectiveness test is performed with a learning outcome test designed and assessed based on four indicators of creative thinking ability is fluency, flexibility, originality, and elaboration. Based on the test results learned that the fluency ability seen when students can answer the problem with coherent and thorough although there are some that are not true in answering. But no one meets the indicators answer more than one answer. In the ability to think flexibly students are able to answer questions with diverse and provide different answers

alternative. This indicates that the student is confident with the written answer. In students' original thinking skills give different answers to the examples given during the lesson, although some students have similar answers but none at all. In detailing the ability of students to write in accordance with the steps that must be done and able to develop answers through various explanations.

The results of this study indicate that the use of student worksheet-based Multiple Intelligences can optimize the creative thinking ability of students. This is supported by research conducted by Ahvan on 270 research subjects that showed "there is relationship between the multiple intelligences and the academic performance achievement levels of high school students" (Ahvan 2016, p. 141). The results of research on the development of student worksheet-based Multiple Intelligences in accordance to the opinion of Toman that student worksheet developed with constructivism approach allows students to participate actively during learningactively participate during the learning process, to learn the subject better, and increase student success noticeably (Toman 2013, p. 178). Accordance to Anwar that creative thinking is a way of generating ideas that can in some way be applied to the world. This often involves problem solving utilizing particular aspects of intelligence, for example linguistic, mathematical and interpersonal (Anwar 2012, 44).

4. Conclusion

The products produced in this research and development are Student Worksheet-based Multiple Intelligences on 5th grade Primary School subjects through material experts validation, media design experts, and teachers as users. Student Worksheet products based on Multiple Intelligences effectively improve creative thinking students.

This research would be better if you add two types of intelligence that has not been visible, natural intelligence and intelligence of existence. In musical intelligence, visual-spatial, and interpersonal needs to be facilitated with appropriate activities and in accordance with the characteristics of the intelligence. While the creative thinking ability of students is more developed in the aspect of ability to think flexible with the indicators able to provide an alternative answer.

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