

Primary School Teachers' Capability in Developing Learning Media *Basedon* Tangram Interactive Game

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Abstract. Improving the learning quality should be done by jointly addressing the problems that arise in learning activity. One of the important problems to be addressed is the teachers' difficulty in learning mathematics, especially geometry. Almost all geometry materials are verbally delivered and rarely use learning media due to the lack of instructional media. The purpose of this research is to improve the performance of teachers in primary schools in Bergas, Semarang in developing learning media especially on geometry materials. Tangram Interactive Game (TIG) is used as one of the materials given to teachers. This media is expected to inspire teachers to modify the learning media on geometry material in primary schools. Qualitative descriptive method is used in processing teachers' understanding data on geometry materials and teachers' skill in developing learning media on geometry materials. The conclusions of this research are (1) there is improvement of teacher's understanding on geometry materials showed by the improvement of pre-test and post-test result with n-gain 0,484 which is in medium category, (2) teachers' capability in developing learning materials is also in medium category and the developed media fulfills the didactic requirement in 60%, construction requirements in 75.75%, and technical requirements in 76.25%.

Keywords: mathematics learning, geometry learning media, tangram interactive game

INTRODUCTION

Teacher as educator is the most important component to determine the quality of education because a teacher takes the responsibility of the developed and applied curriculum. Professional teachers can implement meaningful learning and provide a good learning experience for students. The available facilities will be maximally empowered and the learning atmosphere becomes a triggering experience that shapes learners to be knowledgeable, responsible and able to face all future challenges. Besides, the teacher is the main actor to improve the quality of education development, especially formal education.

One of the teachers' duties is to carry out the learning activities in the classroom. Teaching is a complex process because it involves various interrelated aspects [1]. Teachers are required to have knowledge of materials (content knowledge) that will be taught in the form of facts, concepts, principles, laws, and theory. Teachers are also required to

have pedagogical knowledge pertaining to designing the learning activity plan, learning methods, classroom management, educational objectives, learning theories, learning evaluations, and their actual application skills.

The results of interviews and observation conducted in several primary schools in Bergas, Semarang indicate that there are some problems faced by teachers, that are the limited of learning media seen by the availability of only one kit for mathematics, science and social subjects, maps and globes with limited number. Even the media is only in core primary school. In addition, teachers often use Student Worksheets sold by publishers in learning activities. Teachers are less motivated to create their own learning media that can be used in learning activities. The results of interviews with several primary school teachers show their difficulties in teaching mathematics because of the abstract nature of it. The most difficult mathematics materials considered by teachers is geometry. Almost all geometry materials are delivered verbally and rarely use media due to the lack of learning media. It is, therefore, instructional media are important in teaching mathematics as they help the learners [2].

Geometry is an important part of mathematics that is often used in real life [3]. A study on prospective primary teachers [4] shows their causes in inability mastering flat geometry materials because they do not know two-dimensional figures and their properties. To help understanding the construction of two-dimensional figure shapes, tangram game can be done. A tangram is a dissected puzzle consisting of seven geometric pieces of shapes called tans [5]. The seven pieces include a square, a parallelogram, two big right triangles, a medium sized right triangle and two small right triangles. The three basic shapes consist of a triangle, a square and a parallelogram, which fit together in many ways to form polygons such as a large square, rectangle, or triangle. They can also be arranged in a variety of complex shapes such as animals, birds, sea creatures, people and other figures [5]. In addition, Tangrams allow students to develop geometric concepts by categorizing, comparing, and working out the puzzle and thereupon to solve problems in geometric contexts [6].

The objectives of this research are to improve teachers' understanding on geometry materials and describe the teachers' skills in developing geometry-based learning media. The benefits of this research are enriching the knowledge about the development of mathematics-based learning media and improving the teachers' professionalism in

teaching mathematics on geometry materials in primary and secondary level.

METHOD

This research uses descriptive qualitative method. The focus of this research is on the teachers' understanding of geometry materials and teachers' skills in developing the geometry-based learning media. The Tangram Interactive Game (TIG) materials was given to about 40 primary school teachers in Bergas, Semarang. Then, they were trained to create a geometry-based learning medium in the class. The results are assessed by 3 criteria; didactic, construction, and technical. Materials are given to teachers for three meetings.

The data of the research were collected by test and non-test techniques. A test technique is for measuring the level of teachers' understanding of the geometry materials before the material is given and thereafter. Non-test technique is done by observation of the teachers' skills in developing geometry-based learning media.

The analysis of test results data is done by seeing *n-gain* to see the improvement of teachers' understanding. The data analysis of descriptive observation result is categorized by percentage formula in Table 1.

Table 1. Category of the quality of learning media

Percentage (%)	Category
0 - < 25	Poor
25 - < 50	Medium
50 - < 75	Good
75 - 100	Verygood

RESULT

The activity of giving materials to the teachers was held three times. The first meeting was attended by 48 people, the second meeting was attended by 41 people, and the third meeting was attended by 47 people. Each meeting was held for 6 hours (6 x 45 minutes). The detail of the materials scope given to the teachers is available in Table 2.

Table 2. Materials Scope

Meeting	Materials	Duration
Meeting 1	Policy use of geometry-based learning media	2 x 45 minutes
	Geometry learning in primary schools and tangram interactive game (TIG)	4 x 45 minutes
Meeting 2	Two-dimensional figures and their measurement	6 x 45 minutes
Meeting 3	Solid figures and their measurement	6 x 45 minutes

At the first meeting, the teachers were introduced to the tangram media. The process of forming a new figure of the seven two-dimensional figures in the tangram is named

tangramming. The experience with tangram has several advantages: improving the ability knowing the vocabularies in geometry, recognizing shapes, classifying shapes, and finding the relationships among the seven two-dimensional figures in the tangram [5]. In addition, tangram activities have been given a sense of ownership of the outcome, thereby serving as an appropriate in-class exercise to facilitate geometric thinking in a large class [7]. In the second and third meetings, the teachers are given materials on geometry and measurement, so that they can increase their knowledge or brush up on the materials.

Tangram Interactive Game (TIG) is an application that can be used in PC or android. TIG consists of five components, there are introduction, material, example, exercise, and task. Briefly it can be explained that TIG contains about the history of tangram, the theory in learning geometry and tangram games.

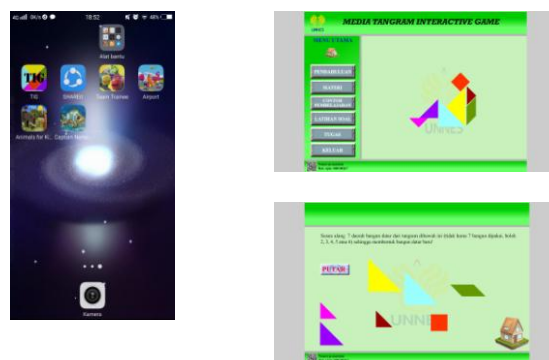


Figure 1: The Display of Tangram Interactive Game (TIG)

This activity begins with a pre-test and ends with post-test to see their mastery on geometry. The pre-test and post-test results are then analyzed by *n-gain* statistical data. The average of pre-test result is 5.3 while the mean of post-test result is 7.6. The result of *n-gain* analysis shows a significant increase of pre-test and post-test score indicated by the *n-gain* calculation that reaches 0.484 in the medium category.

The products produced by the teachers in this activity are learning media for geometry materials and the measurement both in two-dimensional figures and solid figures. The examples of learning media are about knowing two-dimensional figures, the value of phi, the nets dots of figures, and measuring the cone's surface.

The learning media produced are then used in small groups. This simulation activity is done in order media designed to get feedback and suggestions from other teachers. The purpose of this sharing is in line with the opinion that "in the context of their teaching community, the individual teacher has access to the wealth of information, resources, and knowledge of the other teachers. Participating in activities and discourse related to teaching, working together to construct new ways to improve practice, and getting feedback from

more senior professionals are all opportunities for learning about teaching[8].

The quality of learning media products is assessed by an observation sheet for its conformity with materials and materials order in the media is in good category. The use of learning media has an important role in the learning activity. If the learning media used has a good quality, the students' learning experience can be obtained through a series of materials in the learning media. Some of the learning media requirements meet didactic, constructional, and technical requirements.

The assessment results of four learning media observed with the observation sheet of learning media quality are in Table 3.

Table 3. The Quality of Geometry and Measurement Learning Media

Learning Media Requirements	Score				Average	Percent age
	Group 1	Group 2	Group 3	Group 4		
Didactic	2.4	2.6	2.2	2.4	2.4	60%
Constructional	3.5	3.13	2.88	2.63	3.03	75.75%
Technical	3.2	3	3	3	3.05	76.25%

Learning media that meets the didactic requirements such as noticing the existence of individual differences, emphasizing the process to find the concepts, and having variations of stimulus. The constructional requirement regards the use of language and writing that matches the level of students' ability and the use of illustrations (pictures, sounds, and animations) that is appropriate for students. The technical requirement includes the use of appropriate letter sizes, shapes, and color compositions.

The learning media produced by the primary school teachers in Bergas, Semarang in fulfilling the three requirements are in good category (70.67%). In addition, learning media fulfill the didactic requirement of 60%, the constructional requirement of 75.75%, and the technical requirement of 76.25%.

CONCLUSION

Based on the data analysis and discussion, some conclusions can be drawn for this research on training with Tangram Interactive Game (TIG):

The teachers' understanding on the geometry materials increases indicated by the increase of pre-test and post-test results with *n-gain* 0.484 which is in medium category.

The teachers' skills in developing learning media on geometry materials are in good category. The media developed fulfill didactic requirement of 60%, constructional requirement of 75,75%, and technical requirement of 76,25%.

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