



Two-Dimensional Shape in Geometry using Tangram Card Game: Ideas and Implication

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ABSTRACT

Geometry not only about the concept, but also need other skills, such as visualizing, knowing various forms of shape, describing images, and the ability to recognize differences and similarities between flat shape. Constructivism learning is needed equipped with media to be able to make it easier for teachers and students to understand the geometry concept. Tangram is an educational game consisting of seven pieces of flat shape forms. The challenge in the game of tangram is to arrange the pieces into another form that is exemplified, such as people, houses, birds, cats or other forms. Based on the application of Tangram on seven volunteers in student's community learning, the following results were obtained: aspects of feeling happy and diligent in learning high percentage (28.60%), aspects of willingness and interest in learning highest percentage (42.90%), aspects of intelligence and independence in learning, highest percentage (28.60%), and aspects of achievement in learning the highest percentage (43.90%). The data was obtained from seven volunteers through the Likert Scale 1-4. As for school-age student who studied with the assistance of volunteers obtained results: at the beginning the student were asked to arrange two-dimensional use two pieces of Tangram, they did not have difficulty. It was only after being asked to form flat wakes of three, four, and five pieces of Tangram that they had difficulty, especially parallelograms and trapezoids. This is because student lack real examples in everyday life for parallelograms and trapezoids.

Keywords: *Geometry, Tangram, Mathematics*

1. INTRODUCTION

Geometry is a subject in mathematics that is still considered difficult for students. This difficulty is because geometric material involves the properties and relationships between points, lines, shape and space [1]. Furthermore, teaching two-dimensional geometry material in a teacher-centred manner causes students to have difficulty understanding three-dimensional material [2], [3]. Students need other geometry skills, such as visualizing, getting to know various forms of flat wakes, describing images, tightening two-dimensional images, giving specific labels/names on the two-dimensional figure, and the ability to recognize differences and similarities between two-dimensional figures [4]–[7]. A

mathematical teaching aid is a concrete object created, designed, assembled or deliberately constructed and developed concepts or principles in mathematics. Games using props in learning geometry are one of the teaching aids. Playing real and interactive games with concrete physical objects associated with the game environment leads to learning [8]. Tangram is a puzzle game that originated in ancient China. Activities carried out by students in the Tangram game form various patterns using seven geometric shapes [9]. While playing Tangram, students simultaneously understand two- and three-dimensional objects such as people, house, birds, cats or other forms. The props can be presented an abstract concept as models so that students can manipulate the object by being seen, held, groped, or twisted to make it easier to understand mathematics [5], [10].

The emergency curriculum was released by the Ministry of Education and Culture to be used as an alternative curriculum during the pandemic. The curriculum is structured as a simplification of basic competencies, focusing on essential competencies, and further learning prerequisites, not widened but deep. Meanwhile, the prototype curriculum is a curriculum of choice (options) that can be applied by education units starting from the 2022/2023 school year (FY) is also being prepared by the government. If we look at the policies that will be taken by stakeholders, later before the national curriculum is evaluated in 2024, the education unit is given several curriculum options to be applied in schools. The prototype curriculum has several key characteristics that support learning recovery. Here are the main characteristics of this prototype curriculum: Project-based learning for the development of soft skills and character (faith, taqwa, and noble morals; mutual cooperation; global diversity; independence; critical reason; creativity). Focus on essential materials so that there is ample time for deep learning for basic competencies such as literacy and numeracy. Flexibility for teachers to do learning that suits the student's ability (teach at the right level) and make adjustments to the local context and content. Tangram as a learning medium can be used to help teachers design challenging and creative activities for students through project-based learning. Project-based learning is important

for character development because: a) Provides opportunities for experiential learning, b) Integrates the essential competencies learned by learners from different disciplines, c) Flexible learning structures. Through Tangram, it is also expected to be able to practice 4C (Critical Thinking, Creativism, Collaboration, and Communication) skills among students. 4C skills are needed to meet 21st Century Learning Here are the main points you need to follow (the AIP author template package contains comprehensive guidance):

2. MATERIAL AND METHODS

This research is carried out through community service activities by providing training and assistance (see Figure 1). Training and assistance in using Tangram as a medium for learning two-dimensional Geometry were held as many as two meetings starting from January to April 2022.

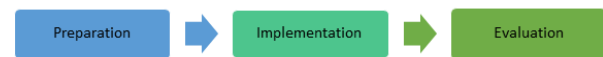


FIGURE 1. Research Stage in Implementation Tangram

Detail the activities carried out at each stage are presented in table 1.

TABLE 1. Stages of Research activities through Community Service

Preparation	Implementation	Evaluation
1. Coordination and observation with Partners	1. Training for Volunteers on the steps of utilizing Tangram as a medium of Learning Geometry Build flat	Supervision and Evaluation of Motivation and Creativity of Volunteers
2. Licensing Management	2. Assistance for volunteers in delivering Two Dimensional Geometry Learning to student / Students by using Tangram Media	and Student on Learning Two Dimensional Geometry using Tangram
3. Making Teaching Materials for training and mentoring		

The instruments used in this study consisted of pre-test questions and activity sheets. Pre-test questions used to measure students' interest in learning mathematics using games. Meanwhile, the observation sheet used to determine the implementation of geometry learning using Tangram.

3. RESULTS AND DISCUSSIONS

3.1. Preparation Stage

The activities at this stage began by coordinating with the Rumah Singgah Anak Negeri (RSAN) partners in Bengkung, Candiretno, Secang, Magelang. Coordination aims to discover the conditions and problems partners face

about learning two-dimensional geometry. The results of identifying the problems obtained are used as a basis in manufacturing Teaching Materials for training and assistance. In addition, the coordination results also agreed on the time, implementation of training and mentoring, and preparation of the necessary materials after the initial coordination continued with the management of permits. The division of tasks between teams in Table 2.

TABLE 2. Role and Division of Research Team Tasks

Name	Positions in The Team	Task and Role
Dr. Ganung Anggraeni	Head	<ol style="list-style-type: none"> 1. Create a proposal concept 2. Coordination with Partners 3. Initial discussions with the Research Team 4. Conceptualize teaching materi
Laela Sagita, M.Sc	Member	<ol style="list-style-type: none"> 1. Developing learning tools 2. Designing training and mentoring strategies 3. Developing teaching materials
Titis Sunanti, M.Si	Member	<ol style="list-style-type: none"> 1. Developing evaluation instruments 2. Developing teaching materials 3. Become a contact person with the journal
Bintang Wicaksono, M.Pd	Member	As supervisor evaluation of community service activities developing teaching materials
Putri Kamaliawati and Zurotul Nur Latifah	Member	<ol style="list-style-type: none"> 1. Preparing Materials and coordinating activities 2. Document training and mentoring activities

3.2. Implementation Stage

Training and mentoring for seven volunteers were held on April 16, 2022, from 14.00 to 16.00, at Secang Magelang. The activity began by explaining the Concept of Learning Two-Dimensional Geometry using Tangram. Initially, the volunteers had difficulty making Tangram, but after being given an explanation and technique-cutting Tangram, the volunteers were able and skilled in making Tangram media. The next activity is to make two-dimensionaol using 2, 3, 4, and 5 pieces of Tangram (see Figure 2). The following activities that are challenging and interesting are when the volunteers are tasked to explore pieces of Tangram into forms, such as letters, numbers, people, animals, houses, and other forms (see Figure 3).



FIGURE 2. Form a two-dimensional of 3, 4, and 5 pieces Tangram

Training and mentoring for student by volunteers was held on April 24, 2022, at 13.00 to 16.00 at Secang Magelang Hospital. Four Volunteers attended in the first

meeting, while the student who attended ten people with elementary and junior high school education backgrounds. Before the training and mentoring began, the student divided into three groups, with one volunteer accompanying them. Starting with introducing the training principles of Tangram by the research team and identifying the tools and materials to be used. The next stage of participants was divided into three groups to get assistance using Tangram from PLD RSAN. Participants had difficulty because arranging to build a room using Tangram pieces was the first thing they had never gotten before.

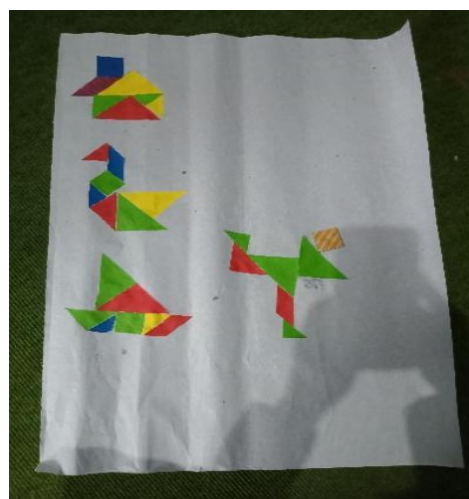


FIGURE 3. Exploration of Tangram (letters, numbers, people, animals, houses)

3.3. Evaluation Stage

Evaluations are carried out for volunteers and school-age student during training and mentoring. The evaluation

of the volunteers was conducted using Google Form by providing 14 questions using a Likert scale of 1-4. The aspects evaluated are feelings of pleasure, willpower and interest, intelligence and independence, and achievement in learning. Data analysis is performed using Descriptive Statistics with the help of SPSS version 20 as follows.

Happy and Diligent

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.80	2	28.6	28.6	28.6
2.00	1	14.3	14.3	42.9
2.40	1	14.3	14.3	57.1
2.80	1	14.3	14.3	71.4
3.00	2	28.6	28.6	100.0
Total	7	100.0	100.0	

FIGURE 4. SPSS Descriptive Statistics Result for Happy and Diligent Indicator

2. **Interest and Will.** SPSS result for interest and will indicator shown in figure 5 : average score 1.75, 1

Interest and Will

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.75	1	14.3	14.3	14.3
2.25	2	28.6	28.6	42.9
2.50	3	42.9	42.9	85.7
2.75	1	14.3	14.3	100.0
Total	7	100.0	100.0	

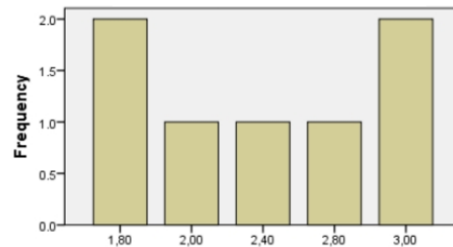
FIGURE 5. SPSS Descriptive Statistics Result for Interest and Will Indicator

3. **Independence and Intelligence.** SPSS result for interest and will indicator shown in figure 6 : average score 1.67, 2 people, percentage 14.3%, average score **Independence and Intelligence**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.67	1	14.3	14.3	14.3
2.00	1	14.3	14.3	28.6
2.33	2	28.6	28.6	57.1
2.67	2	28.6	28.6	85.7
3.00	1	14.3	14.3	100.0
Total	7	100.0	100.0	

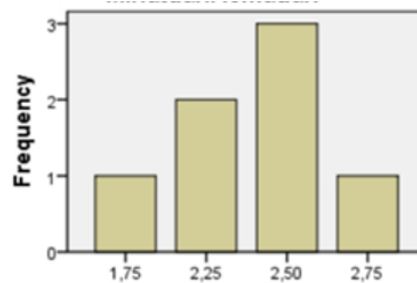
1. **Happy and Diligent.** SPSS result for happy and diligent indicator shown in figure 4 with an average score of 1.2 respondents with a percentage of 28.6%, an average score of 2.1 respondents, with a percentage of 14.3%, an average score of 2.40, 1 person percentage of 14.3%, an average score of 2.80, 1 person, a percentage of 14.3%, and an average score of 3.2 people, a percentage of 28.6%

Happy and Diligent



respondent with a percentage of 14.3%, average score 2.25, 2 respondents, with a percentage of 28.6%, average score 2.50, 3 people, percentage 42.9%, average score 2.75, 1 person, percentage 14.3%.

Interest and Will



2.00, 1 person, percentage 14.3%, average score 2.33, 2 people, percentage 24.6%, average score 2.67, 2 people, percentage 28.6%, average score 3.00.1 people, percentage 14.3%.

Independence and Intelligence

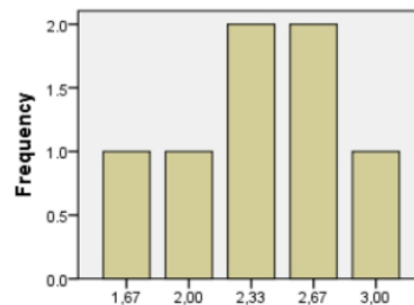


FIGURE 6. SPSS Descriptive Statistics Result for Independence and Intelligence Indicator

4. **Achievements in Learning.** SPSS result for interest and will indicator shown in figure 7: average score 1.50, 2 people, percentage 2.86%, average score 2.00, 3

Achievements in Learning

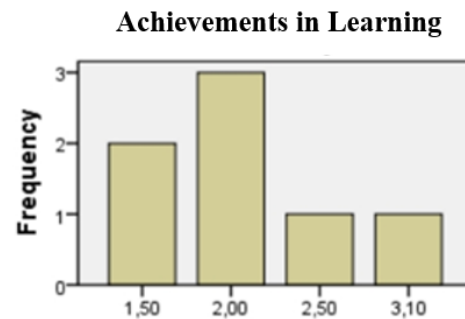
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.50	2	28.6	28.6	28.6
2.00	3	42.9	42.9	71.4
2.50	1	14.3	14.3	85.7
3.10	1	14.3	14.3	100.0
Total	7	100.0	100.0	

FIGURE 7. SPSS Descriptive Statistics Result for Achievement in Learning Indicator

Based on the application of Tangram to seven volunteers of Secang-Magelang, the following results were obtained: aspects of feelings of pleasure and perseverance in learning (3.00%), aspects of willingness and interest in learning (2.50%), aspects of intelligence and independence in learning (2.67%), and aspects of achievement in learning (2.00%). The data was obtained from seven volunteers through the Likert Scale 1-4. As for school-age student who studied with the assistance of volunteers obtained results: at the beginning the student were asked to arrange two-dimensional forms from two pieces of tangram, they did not have difficulty. It was only after being asked to form flat wakes of 3, 4, and 5 pieces of Tangram that they had difficulty, especially to parallelograms and trapezoids. This is because student lack real examples in everyday life for the forms of parallelograms and trapezoids. And after getting assistance from volunteers, student show high enthusiasm and motivation. It can be seen from the observation notes contained in the attachment.

The difficulties experienced by students in reconstructing Tangram with 3, 4, and 5 indicate that the Tangram game is a type of game that can construct students' knowledge. This is in line with Piaget and Pappert's framework that the Tangram game is a type of constructivism game [11], [12]. Students are required to build their intellectual structures and understand and perform imaginary movements of two and three-dimensional objects when using Tangram in their activity [9]. Students experimented with putting together pieces of two-dimensional shape to produce different shapes [13]. The study shows that the application of Tangram in learning two-dimensional geometry shows a high level of student involvement [14], [15]. However, there is no significant difference in the learning achievement scores obtained between the two interventions [14].

people, percentage 42.9%, average score 2.50, 1 person, percentage 14.3%, average score 3.10 1 Orang, percentage 14.3%.



CONCLUSION

Constructivism learning is needed equipped with media to be able to make it easier for teachers and students to understand the geometry concept. Tangram is an educational game consisting of seven pieces of flat shape forms. The challenge in the game of tangram is to arrange the pieces into another form that is exemplified, such as people, houses, birds, cats or other forms. Tangram can be used to help teachers design challenging and creative activities for students. The difficulties experienced by students in reconstructing Tangram with 3, 4, and 5 indicate that the Tangram game is a type of game that can construct students' knowledge. Student lack real examples in everyday life for the forms of parallelograms and trapezoids. And after getting assistance from volunteers, student show high enthusiasm and motivation.

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