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The Influence of PAKEM Model Using Tangram Media on Learning Motivation and Spatial Mathematical Ability of Grade II Students of SD IT Khalisaturrahmi Binjai

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Abstract

This study aims to determine: (1) The spatial ability of students taught using the PAKEM model assisted by tangram media is higher than students taught using the expository model. (2) The learning motivation of students taught using the PAKEM model assisted by tangram media is higher than students taught using the expository model. (3) The interaction between the PAKEM learning model assisted by tangram media with the students 'initial mathematics ability towards the students' mathematical spatial abilities, and (4) The interaction between the PAKEM learning model assisted by tangram media with the students 'initial mathematics ability towards students' learning motivation. This research method is a quasi experiment. The population of this study were all students of Class II SD IT Khalisaturrahmi Binjai totaling 40 students. The research sample was Class II A (20 students), and Class II B (20 students). The instruments used consisted of the KAM test, a test of students' mathematical spatial abilities, and a student motivation questionnaire. The analysis was carried out using two-way ANOVA. The results showed that: (1) The spatial ability of students taught with the PAKEM model assisted by tangram media was higher than students taught using the expository model. (2) The learning motivation of students taught using the PAKEM model assisted by tangram media is higher than students taught using the expository model. (3) There is no interaction between learning the PAKEM model assisted by tangram media with students' initial mathematical abilities against students' mathematical spatial abilities, and (4) There is no interaction between learning the PAKEM model assisted by tangram media with students' initial mathematical abilities on student learning motivation.

Keywords
PAKEM model; tangram; spatial mathematical ability; and learning motivation

I. Introduction

The PAKEM learning model is a model used in learning that aims at students to develop critical and creative thinking skills in overcoming problems as well as to train students' self-confidence and independence. This means that this learning needs to involve students to participate actively so that the teacher becomes a facilitator and entices students not to be passive and express their opinions. So all this learning requires an attractive learning design and adequate facilitators.

The PAKEM model was chosen on the grounds that learning is an active process of building meaning. Students have imagination and curiosity. So that students have a sense of being creative, learning must have a goal, namely success or goals achieved. This means that learning must be effective, if students are active, creative, successful or achieving goals, it will encourage students to enjoy learning, and ultimately enjoy learning mathematics.

But in reality, in the field this PAKEM model has never been used, the model that is often used in the field is the expository model without being accompanied by learning media so that learning becomes monotonous, students only become wise listeners, note takers, and memorizers of material. So that students are not given freedom in creativity and express opinions. Learning is only done in one direction or Student Learning Center. This learning process causes students to be less able to develop their thinking skills. As a result, students will become graduates who are rich in theoretical understanding but poor in skills, experience, and direct application or application. So here students are less able to relate learning theory to its application in real life.

Learning is a learning method that uses problems as a first step in collecting and integrating new knowledge based on experiences in real activities. In addition, by using Project Based Learning students can develop themselves in investigating a problem with their group colleagues so that their ability to do research will also develop. Abdullah (2017: 173) says that the learning process through project based learning allows teachers to "learn from students" and "learn with students". So the project based learning model directs the student centered learning process. (Simanjuntak, 2020)

Learning according to Rusman in Utomo (2020) is a system, which consists of various components that are interconnected with one another. These components include: objectives, materials, methods, and evaluation. The four components must be considered by the teacher in selecting and determining the learning model to be used. Selection of the right learning model can have a positive impact on student mastery of the subject matter being taught and student learning outcomes. According to Fred (in Djamarah 2006: 61) he has conducted research on 3,725 students in the United States. From the results of his research states that, "If you use good methods and good media in teaching and learning activities, it will get good learning outcomes"

Mathematics learning should be taught by learning real or concrete things so that learning mathematics is easy to understand and will be easy to do math problems. The PAKEM model is applied using a tool, namely the media. The learning medium used in this study is the tangram. Tangram is a learning medium that helps students to solve problems about waking up. This tangram media aims to arouse the enthusiasm for learning and develop children's creativity. Learning media helps students in conveying learning so that learning becomes interesting and meaningful for students. In addition, learning is also easily absorbed and understood to achieve optimal learning goals.

Motivation for students can develop activities and initiatives, can lead to maintaining persistence in learning activities. Without motivation, sometimes students are very lazy in learning. Motivation to learn is very instrumental in encouraging students to achieve their learning success. In mathematics learning, students' learning motivation is still low. This can be seen from the lack of desire of students in learning, less interesting learning activities because students tend to be passive and rarely ask questions. Student attention and independence are still low because students only depend on the explanation given by the teacher.

Anticipating this problem is sustainable, it is necessary to find the right learning formula, so that it can increase student motivation in mathematics lessons. A concept will be easy to understand and remember by students if the concept is presented through procedures and steps that are precise, clear and interesting. The increase in student learning motivation will increase student learning cooperation so that the process of understanding the material for students will also increase.

The low motivation to learn mathematics is also experienced by the second grade students of SD IT Khalisaturrahmi Binjai. The factor that causes the low motivation of these students is the lack of interest and interest in students towards mathematics. This condition is evidenced by the low learning motivation of grade II students of SD IT Khalisaturrahmi Binjai. This is because the teacher-centered mathematics learning process, students only take notes and only absorb information from the teacher. Teachers tend to be monotonous in controlling the class so that students are afraid to ask the teacher if they are unclear or do not understand. As a result, student learning activities are less than optimal and the classroom atmosphere is less pleasant which causes student learning motivation to be low.

In addition, the teacher is also a facilitator in delivering learning material. The delivery of material is not only for understanding and how to work on the problem. Besides that, students also have good mathematical skills in written, oral, imaginary, and so on. Mathematical competencies that must be known by students, one of which is spatial ability. Spatial ability is the ability to think and determine objects in space, pictures, colors, lines, and shapes. In line with Zarkasyi's opinion (2017: 85) is the ability to imagine, see colors, lines, shapes, and spaces in an object. to get visual information. The importance of spatial abilities according to Zarkasyi (2017: 85), namely being able to identify geometric images, imagine the shape of an object, investigate, and process it and think visually. This spatial ability can help students recognize their surrounding environment and can easily solve problems in the form of pictures, maps and enjoy imagining.

Many factors influence and contribute greatly to the weakness of students' spatial abilities, including during the learning process students are more emphasized on the process of remembering or memorizing and less or even not emphasizing the aspects of understanding. Students are only focused on listening to explanations from the teacher, writing related material in written books and working on practice questions. Therefore, learning geometry in schools should be directed at investigating and exploiting ideas and relationships between geometric properties. In learning geometry, students are expected to be able to visualize, describe and compare geometric shapes in various positions so that students can understand them.

But in reality, in the field, students' spatial abilities are still very low. At SD IT Khalisaturahmi only focuses on literacy and thinking skills. So that the ability to solve problems, analysis, and creativity that will be faced later in life is difficult to apply. As in the problem of shapes. As many as 61% of students did not understand the concept of flat shapes as in the student results below:

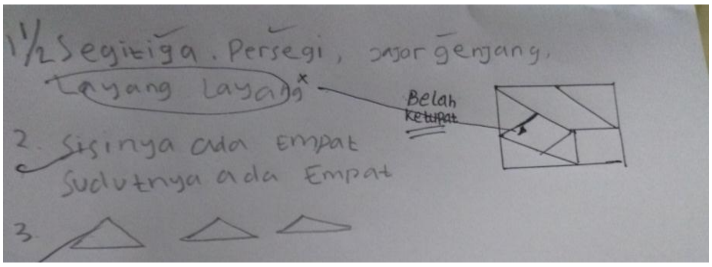

***Figure 1**. The Student's Spatial Ability Answers Process*

It seems clear that the students were correct in doing according to the steps but the students were still confused about understanding the flat shape of a kite with a rhombus. This states that students' ability to understand images is still lacking. Besides that, in question number 5 there were still errors in the students' answers, they did not understand the concept of a flat side. This can be seen from the students' answers.

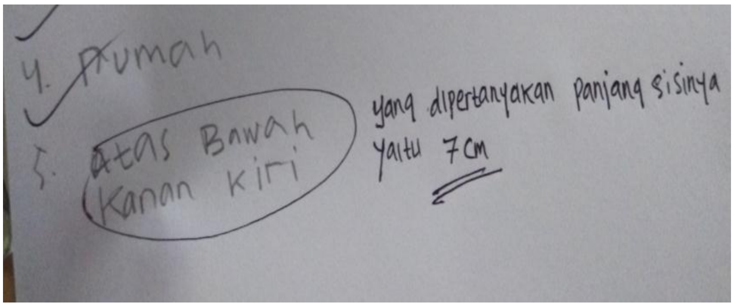

Figure 2. *The Student's Spatial Ability Answers Process*

This shows that students do not understand the concepts and requirements given by the mathematics teacher. Out of 25 students, only 9 answered correctly. 5 people who did not write anything on the answer sheet and the rest did the questions but their answers were still not correct. It can be seen that students have not been able to describe the problem as requested and students are just drawing but do not understand the visual spatial in drawing and understand and put the answer.

The answer above also revealed that based on the research, it was found that in general the students did not have good abilities regarding the properties of the rhombus so that they could not classify a rhombus object with a kite. In general, students' knowledge about examples and not examples of rhombus concepts is only limited to that given by the teacher during learning. Students do not know that a rhombus concept. Based on this, it is necessary to pay attention to understanding the concept of rhombus and visual, verbal and logical skills that must be possessed to support understanding of the concept of geometry. Based on the research results above, it can be concluded that the students' geometric ability is still relatively low. The low ability of this geometry is made possible by the weak understanding of the concepts and geometric skills of students in spatial geometry. In addition, students' geometry skills can affect the success of implementing plans in spatial terms. The geometry skills in question are the skills of students in learning geometry.

One of the efforts that can be made to increase the activities and learning outcomes of students in elementary school mathematics is by applying the PAKEM (Creative, Effective and Fun Active Learning) model. So that students do not get bored and learning becomes fun. This model is designed to activate students, develop creativity so that it is fun but still effective. This means that it can create a conducive and meaningful learning environment that is able to provide students with skills, knowledge and attitudes to live.

II. Research Method

2.1 Motivation to Study

Motivation starts with the word motive. There are so many, in fact it is common for people to say "motive" to show why someone is doing something. The word "motive" is defined as an effort to encourage someone to do something. Starting from the word "motive", motivation can be interpreted as a driving force that has become active (Sardiman in Khairani, 2020)

Ngalimun (2016: 39) says motivation comes from the word motive which means a tendency of the heart whose purpose is to encourage someone to carry out an activity to be more enthusiastic about carrying out the action.

According to Prawira (2013: 320) student learning motivation is anything that is aimed at encouraging or encouraging students who carry out learning activities to become even more active in their studies to get even better achievements. According to Suprijono (2010: 171) explains strategies to motivate students to achieve the desired goals and improve learning, namely: 1) Giving praise to students well so that it can help students to foster enthusiasm for learning. This means that it does not pose threats or the like. 2) Provide opportunities for students to apply knowledge so that the student's self-confidence will arise. 3) Asking students who are able to apply their knowledge and skills to students who have not succeeded. 4) Comparing students' achievements with their past ones to be able to take valuable lessons and lessons, not compare with other students. So that if this learning motivation strategy is applied to students, it will help students to improve and develop learning.

2.2 Spatial Ability

According to Zarkasyi (2017: 85) spatial ability is a person's ability to imagine an object, suspect, compare objects with one another, construct, determine results, present work results, and find information in order to achieve the desired goals from visual stimuli. So that spatial ability is a person's ability to see lines, colors, shapes and can understand visually. Meanwhile, according to Azustiani (2017: 5-6), the notion of spatial ability is mental ability that is concerned with understanding, manipulating, rotating, and interpreting visual relationships. good spatial skills can help in understanding mathematical concepts. The use of spatial examples, such as making charts and graphs, can help children master math concepts.

According to Piaget and Inhelder (in Tambunan 2006: 27-32) states that spatial ability is an abstract concept which includes spatial relationships (the ability to observe the position of objects in space), frame of reference (signs used as benchmarks for determining the position of objects in space).), projective relationships (the ability to see objects from multiple points of view), distance conservation (the ability to estimate the distance between two points), spatial representation (the ability to represent cognitively) mental rotation (imagine the rotation of objects in space). The use of spatial examples, such as making charts and graphs, can help children master math concepts.

Therefore, it can be concluded that spatial ability is the student's ability to understand images, graphics, and other visual abilities in order to easily achieve effective learning goals to easily interpret, manipulate and understand.

According to Syahputra (2013: 354) that spatial ability is a curriculum requirement that must be accommodated in classroom learning. In this study, students' learning motivation with spatial abilities is closely related, namely if the students' spatial abilities are low, the students' learning outcomes of flat shapes will be low as well, and vice versa, if the students' spatial abilities are high, the students' learning outcomes of flat shapes will be high too. To get optimal learning outcomes, you must have high learning motivation.

2.3 PAKEM model

PAKEM (Active, Creative, Effective, and Fun Learning) is a model that allows students to do various activities to develop their skills, attitudes, and understanding with an emphasis on learning while working. Meanwhile, teachers use various resources and learning aids, including the use of the environment to make learning more interesting, fun and effective. (Asmani, 2012: 5) Meanwhile, another understanding says that PAKEM is a learning model that implements a learning process that is oriented towards teacher creativity and the use of varied and innovative media. Applying the PAKEM model does not have to be the same portion of the four elements in every lesson, for example, maybe the active elements are more dominant than the other elements, but at other times maybe the fun and creative elements are preferred. However, these four elements must remain and animate each lesson. (Ngalimun, 2016: 203-204).

From the explanation above, it can be concluded that the PAKEM mathematics learning model is a series of mathematics learning that requires a student to be active, creative, effective and fun so that the learning delivered by the teacher can achieve the desired and memorable goals and by implementing PAKEM in teaching and learning activities students are expected will find it easier to develop their abilities, be active, creative, and work in solving problems. In addition, in PAKEM, it trains students to always be active in the mathematics learning process and to be responsible for the assignments given both individually and in groups, so that mathematics learning activities can run effectively and optimally and efficiently.

2.4 Tangram media

Tangram learning media is a learning media that contains a variety of shapes that are used to help learning mathematics. According to Ismadi (2013: 44) Tangram is a puzzle created during the Han dynasty in China. Tangram consists of a number of triangles and squares that can all be cut from a large square. The pieces must be arranged into various shapes that resemble animals, humans and other objects. So tangram is a learning medium consisting of various flat shapes that are formed in all ways that aim to activate student creativity.

According to Sundayana (2015: 65) says that the use of tangram is for:

a) Cultivate students' creativity in forming certain shapes such as geometric shapes, houses, animals, humans, and so on
b) Knowing extensive immutability
c) Knowing the properties that exist in a flat shape
d) Knowing the concept of the area of a flat shape.
e)

How to make tangram in this research is as follows:

1. Tangram is made from simple materials, namely using tools and materials, namely cardboard measuring 20 cm x 30 cm, glue, stationery and scissors.
2. Cut the cardboard into 7 geometric shapes. With the details of the form:
   a) 4 triangles
   b) 1 rhombus
   c) 1 parallelogram
   d) 1 square piece

The example of tangram in this research is

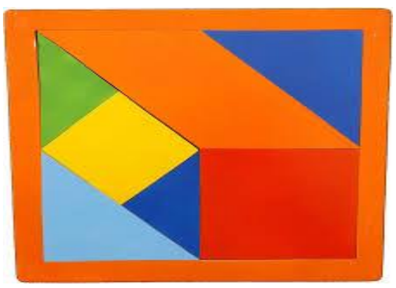

***Figure 3**. Tangram*

2.5 Students' Initial Mathematics Ability (KAM)

Students' initial mathematical abilities are the most important thing in learning. Because when a student's initial math ability test is held, it helps the teacher to package learning into the desired learning. The teacher knows the strengths and weaknesses of student learning so that teachers can improve learning into interesting and memorable learning for students.

According to Lestari (2017) it proves that students 'initial abilities greatly influence success in learning because if they already know the students' initial abilities, the student learning outcomes will be clearer and stronger to be able to improve it again by continuously practicing mathematics lessons and reading a lot from sources anywhere can use books, the internet and so on so that it can provide students with knowledge.

Learning solutions in choosing an effective learning model that can be applied in class by looking at the weaknesses and strengths of the results of the students' initial ability tests so that it will be easier to package learning into interesting and memorable learning so that students do not get bored easily and are always focused on learning. So learning mathematics will feel meaningful if it links students' initial abilities with new information that the teacher will convey. In this way, students can increase their knowledge and not be difficult to accept learning.

III. Research Methods

This study uses a quantitative approach with experimental methods. This research step begins with the determination of a specific object of study, a theoretical framework in accordance with the object of study, a hypothesis is generated, data collection instrumentation, sampling techniques and analysis techniques. This study was designed with two classes used as an experimental class and a control class. This research was conducted at SD IT Khalisaturrahmi Binjai on Jalan Samanhudi, Tanah Merah Village, Binjai Selatan District, Binjai City Regency. This research was conducted in the odd semester of the 2020/2021 school year. This research can only be done for a finite population and not too many subjects. The sample used for the experimental class and control class will be selected by two classes, namely class A is the experimental class, and class B is the control class. Based on the above statement, this study uses a control class and an experimental class. The experimental class consisted of 20 people and the control class was 20 people. This study uses a quantitative research approach with experimental methods in the form of a quasi experimental design. The validity of the research is an attempt to keep the results of the hypothesis testing from this study in accordance with their objectives. Disturbances that are likely to affect the results of the study are controlled through a review of internal validity and external validity. In accordance with this study, researchers used test instruments and questionnaires. The written test of the flat shapes of the two sample groups given different learning models is a description of the questions, amounting to 5 questions. Meanwhile, a questionnaire was used to determine student learning motivation from the two sample groups. There are 25 types of statements. Data collection techniques in this study were observation, documentation, questionnaires, and tests. In this study, researchers used quantitative data analysis techniques. According to Syahputra (2016: 169) this analysis technique uses the equation Yijk = + + + +, i = 1, 2, 3, j = 1, 2 meaning that this assumption must be obeyed and otherwise tested statistically.

IV. Discussion

4.1 Results of Students' Initial Mathematics Ability Test

The initial mathematics ability test (KAM) was given to determine the average equivalence of the experimental class and control class, as well as to group students based on KAM, namely high, medium, and low. To get an overview of the students' KAM, the mean and standard deviation were calculated. The complete calculation results can be seen in the attachment, while the summary results are presented in table 1 the following:

Table 1. Descriptions of Students' Initial Mathematics Ability Based on the Learning Model

Initial Test	N	X_{max}	X_{min}	$\bar{X}$	SD
Experiment Class	20	80	20	49	17
Control Class	20	80	20	46	17

Table 1 illustrates that the mean initial test results for the two classes have almost the same value, namely the experimental class average value of 49 and the average value for the control class 46. Furthermore, it is also known that the standard deviation for the experimental class 17 and for the control class 17. From this standard deviation value, it can be seen that the abilities of the two samples are not much different.

Furthermore, from the arithmetic mean and standard deviation, students were grouped into low, medium, and high ability students with the criteria: low group X <- SD, moderate group - SD ≤ X <+ SD, and high group X ≥ + SD. After calculating, from the experimental preliminary test data obtained = 49 and SD = 17, so that + SD = 66 and - SD = 32.Whereas for the control class the scores = 46 and SD = 17, so + SD = 63 and - SD = 29 The simple calculation results can be seen in the following table.

Table 2. Distribution of Student's Initial Ability Research Sample

Research Sample Class	Students Initial Abilities		
	High	Moderate	Low
Experiment Class	1	16	3
Control Class	1	15	4
total	2	31	7

Based on table 2. the ditas obtained in the experimental class for the ability level of the high category 1 student, medium 16, and low 3 students. Whereas for the control class the level of student ability for the high category 1, medium 15, and 4 students low.

4.2 Description of Students' Spatial Mathematical Abilities

Mathematical spatial ability test is the final test in this study. Mathematical spatial ability tests in the form of essay questions related to the material being experimented on, namely flat shape material. Problem 5 consists of 5 indicators, namely a. Identify the shape based on the shape it sees, b. Describe a geometric shape based on the properties and attributes of its components but cannot see the relationship between several geometric shapes, c. Sort geometric forms based on their properties, d. Doing problem solving that involves the characteristics of a familiar shape, and e. Understand the existence of axioms as root statements that can be used in proving the truth of a theorem. The results of the summary percentage of the achievements of experimental students can be explained that the mathematical ability of students with learning the PAKEM model assisted by tangram media based on the achievement of each indicator has a percentage of 80% on indicator 1, 75% on indicator 2, 85% on indicator 3, 80% on indicator 4, and 50% on indicator 5. So it can be concluded that the indicator most controlled by students is indicator 3, namely sorting geometric shapes based on their properties.

It can be explained that students' mathematical spatial abilities with expository learning based on each indicator have a percentage of 85% on indicator 1, 30% on indicator 2, 50% on indicator 3, 25% on indicator 4, and 20% on indicator 5. So it can be concluded that The indicator that the student has the highest is indicator 1, which is identifying the shape based on the shape he sees.

4.3 Description of Student Motivation

The data processing and analysis of the final test aims to determine the spatial ability and motivation of students to learn mathematics after obtaining the PAKEM model assisted by tangram media in the experimental class, then the spatial ability and motivation to learn mathematics after receiving expository learning in the control class. Data processing on the learning motivation questionnaire was collected and analyzed to determine how much influence the PAKEM model assisted by tangram media. The results of the student learning motivation questionnaire from the experimental class and control class are as follows:

Table 3. Data Description of Students' Mathematical Learning Motivation in Both Learning Groups

Statistik	**Learning**	
	Tangram Media Assisted PAKEM Model	**Model Ekspositori**
N	20	20
Average	77,1	74,15
Standard Deviation	11	11,99

In table 3. Above, it can be seen that the average student learning motivation questionnaire of the two groups of students who were taught using the PAKEM model assisted by tangram media obtained 77.1, while students who received expository learning scored 74.15.

In the explanation above, this study uses a statistical test with a two-way ANOVA which aims to test the presence or absence of the influence of the PAKEM model assisted by tangram media on students' learning motivation and mathematical spatial abilities of students, and whether or not there is an interaction between PAKEM learning model assisted by tangram media. on student motivation and mathematical spatial abilities of students.

a. Normality Test of Student's Learning Motivation Data and Student's Spatial Mathematical Ability

As stated in CHAPTER III, that one of the requirements in quantitative analysis is the fulfillment of the assumption of normal distribution of the data to be analyzed. The hypothesis formula for testing normality is:

H0 = samples come from populations that are normally distributed
H1 = samples come from populations that are not normally distributed.

The test criteria used is if the value of significance (sig) is greater than $\alpha = 0.05$ then H0 is accepted. The data normality test used the Kolmogrov-Smirnov test. The results of the data normality test for the final test of students' mathematical spatial abilities and student learning motivation in the experimental class and in the control class can be seen in the following table:

Table 4. The results of the students' mathematical spatial ability test normality test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
TAE	,166	20	,148	,918	20	,090
TAK	,188	20	,061	,877	20	,016

a. Lilliefors Significance Correction

Information:
TAE: Experimental Class Final Test
TAK: Final Test Control Class

From table 4. these results provide a significance value greater than the level of significance (sig) α = 0.05. This shows that the students' mathematical spatial ability score data from the two sample groups has normal variance. From these data, the PAKEM model using the experimental class tangram and expository learning for the control class has a significance value greater than 0.05, namely (0.148> 0.05) and (0.61> 0.05), then the data is obtained a normal distribution. In the PAKEM model using tangram media and expository learning with normal distribution.

Table 5. Results of Normality Test for Student Motivation Questionnaires

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
MBE	,172	20	,124	,854	20	,006
MBK	,134	20	,200*	,911	20	,067

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Information:
MBE: Learning Motivation for Experiment Class
MBK: Learning Motivation for Control Class

Table 5. The data on student learning motivation for the experimental class and the control class has a significance value greater than 0.05, namely (0.124> 0.05) and (0.200> 0.05), the student learning motivation data for the PAKEM model using tangram media and expository learning is normally distributed.

b. Homogeneity Test of Student's Spatial Mathematical Ability and Student's Learning Motivation

The test of suitability (homogeneity) of variance against the control group and the experimental group with a significance level of α = 0.05. The homogeneity test was carried out using the Homogeneity of variances test (Levene Statistic). The calculation results of the mathematical representation ability test in both groups showed that the variance of the two groups had the same variance, meaning that both groups came from the same population.

The statistical hypothesis formulations to test the variance homogeneity of the two data groups are:

H0: =: Both samples come from populations that have homogeneous variances

H1: ≠: Both samples come from populations that have homogeneous variances

The test criteria performed is if the value of significance (sig) is greater than α = 0.05, then H0 is accepted. In summary, the results of the calculation of the homogeneity test between the experimental group and the control group of students' mathematical spatial abilities and student learning motivation can be seen in the table:

The test criteria performed is if the value of significance (sig) is greater than α = 0.05, then H0 is accepted. In summary, the results of the calculation of the homogeneity test between the experimental group and the control group of students' mathematical spatial abilities and student learning motivation can be seen in the table:

Table 6. Homogeneity Test Results of Students' Mathematical Spatial Ability Test in Experiment Class and Control Class

Test of Homogeneity of Variances

Mathematical Spatial Ability

Levene Statistic	df1	df2	Sig.
,187	1	38	,668

Table 7. Homogeneity Test Results of Student Motivation Test in Experiment Group and Control Group

Test of Homogeneity of Variances

Student's motivation to study

Levene Statistic	df1	df2	Sig.
,019	1	38	,891

Based on table 6. it gives a significance value (sig) = 0.668 which is greater than α = 0.05, then H0 = accepted. It is the same as in table 7. the value (sig) = 0.891, greater than α = 0.05, then H0 = accepted. Thus, both samples come from populations that have homogeneous variances. Based on the hypothesis test conducted, it was stated that the sample group of the study came from a population with normal distribution and homogeneous variance, both by grouping the learning model in each class or as a whole based on class. Therefore the data requirements have been met, namely the sample data is normally distributed and homogeneous.

b. Hypothesis testing

- First and Third Statistical Hypotheses

Hypothesis I: Testing the first research hypothesis which states that the spatial ability of students taught using the PAKEM learning model using tangram media has higher results than students taught using expository learning.

Statistical Model: $Y_{ijk} = \mu + \alpha_i + \beta_{ij} + (\alpha\beta)_{ij} + \varepsilon_{ijk}$

Statistically, the hypothesis can be formulated:

$H_0 : \beta_{11} = \beta_{12}$

$H_1 : \beta_{11} > \beta_{12}$

Information:

β_{11}: Students' higher spatial abilities are taught using the PAKEM model assisted by tangram media

β_{12}: Students' higher spatial abilities are taught using an expository model

Hypothesis III: This research hypothesis examines that there is an interaction between the PAKEM learning model assisted by tangram media and the initial mathematical ability of students' spatial abilities.

Statistical Model: $Y_{ijk} = \mu + \alpha_i + \beta_{ij} + (\alpha\beta)_{ij} + \varepsilon_{ijk}$

Statistically, the hypothesis can be formulated:

$H_0 : (\alpha\beta)_{ij} = 0$

H1: there is at least one $(\alpha\beta)_{ij} \neq 0$; I = 1, 2: j = 1, 2, 3

Information:

$(\alpha\beta)_{ij} \neq 0$ is that there is an interaction between the PAKEM learning model assisted by tangram media with the initial mathematical ability of students' spatial abilities.

The following are the results of the two-way ANOVA calculation using the help of SPSS software which is presented in table 4.8, namely:

Table 8. Anova Test of Students' Spatial Mathematical Ability

Tests of Between-Subjects Effects

Dependent Variable: Students' Spatial Mathematical Ability

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	22149,091[a]	5	4429,818	53,582	,000
Intercept	103253,880	1	103253,880	1248,931	,000
KAM_ Learning	16946,714	2	8473,357	102,491	,000
Class	1575,006	1	1575,006	19,051	,000
KAM_Learning * Class	93,151	2	46,576	,563	,575
Error	2810,909	34	82,674		
Total	150400,000	40			
Corrected Total	24960,000	39			

a. R Squared = ,887 (Adjusted R Squared = ,871)

Based on the results of the two-way ANAVA test in table 8. above, it is obtained that F_{count} in hypothesis I is 102.491 and Ftable in hypothesis I is F (2.34) = 3.28, thus $F_{count} > F_{table}$ is 102.491> 3.28. While the p-value for learning is 0.000 <0.05, that is enough evidence to reject H0 and accept H1. It means that the mathematical spatial ability of students who learn using the PAKEM model is higher than students who learn using expository learning can be accepted.

Whereas in hypothesis III above, it is obtained Fcount = 0.563 and F_{table} in Hypothesis III, namely F (2.34) = 3.28, thus $F_{count} \leq F_{table}$ is $0.563 \leq 3.28$. Whereas in the interaction of the learning model with KAM, the p-value is obtained = 0.575> 0.05 or in other words there is not enough evidence to reject H0, thus there is significantly no interaction between learning the PAKEM model assisted by tangram media with the initial mathematical ability of students' spatial abilities . This shows that the third hypothesis, there is an interaction between the PAKEM learning model assisted by tangram media with the initial mathematical ability of students' spatial abilities, cannot be accepted.

- Second and Fourth Statistical Hypotheses

Hypothesis II: This research hypothesis examines the learning motivation of students who are taught with the PAKEM model assisted by tangram media which has higher results than students taught with expository ordinary learning.

Statistical Model: $Y_{ijk} = \mu + \alpha_i + \beta_{ij} + (\alpha\beta)_{ij} + \varepsilon_{ijk}$

Statistically, the hypothesis can be formulated:

$H_0 : \beta_{21} = \beta_{22}$

$H_1 : \beta_{21} > \beta_{22}$

Information :

β_{21}: Students' learning motivation is higher when taught using the PAKEM model assisted by tangram media

β_{22}: Student motivation is higher taught by the expository model

Hypothesis IV This hypothesis examines there is an interaction between the PAKEM learning model assisted by tangram media and the initial mathematical ability of students' learning motivation.

Statistical Model: $Y_{ijk} = \mu + \alpha_i + \beta_{ij} + (\alpha\beta)_{ij} + \varepsilon_{ijk}$

Statistically, the hypothesis can be formulated:

$H_0 : (\alpha\beta)_{ij} = 0$

H1: there is at least one $(\alpha\beta)_{ij} \neq 0$; I = 1, 2: j = 1, 2, 3

Information:

$(\alpha\beta)_{ij} \neq 0$ is that there is an interaction between the PAKEM learning model assisted by tangram media and the initial mathematical ability of students' learning motivation.

Table 9. Two-way Anava Test Results Data Final Test with SPSS

Tests of Between-Subjects Effects

Dependent Variable: Student's motivation to study

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	4223,251[a]	5	844,650	22,354	,000
Intercept	89026,835	1	89026,835	2356,079	,000
KAM_Learn	3577,197	2	1788,598	47,335	,000
Kelas	1,374	1	1,374	,036	,850
KAM_Learn * Class	2,326	2	1,163	,031	,970
Error	1284,724	34	37,786		
Total	239751,000	40			
Corrected Total	5507,975	39			

a. R Squared = ,767 (Adjusted R Squared = ,732)

Based on the results of the two-way ANAVA test in table 9. above, it is obtained F_{count} in hypothesis II, namely 47.335 and F_{table} in hypothesis II, namely F (2.34) = 3.28, thus $F_{count} > F_{table}$, namely 47.335> 3.28. While the p-value for learning is 0.000 <0.05, that is enough evidence to reject H0 and accept H1. It means that the learning motivation of students who learn using the PAKEM model is higher than students who learn using expository learning can be accepted.

Whereas in hypothesis IV above, it is obtained that F_{count} = 0.031 and F_{table} in hypothesis IV, namely F (2.34) = 3.28, thus $F_{count} \leq F_{table}$ is $0.031 \leq 3.28$. Whereas in the interaction of the learning model with KAM, the p-value is obtained = 0.970> 0.05, or in other words there is not enough evidence to reject H0, thus there is significantly no interaction between learning the PAKEM model assisted by tangram media and the initial ability of mathematics to student learning motivation students. This shows that the fourth hypothesis, there is an interaction between the PAKEM learning model assisted by tangram media and the initial ability of mathematics to student learning motivation, cannot be accepted.

V. Conclusion

Based on the results of the research that has been used, it is concluded that there is an effect of the PAKEM model using the tangram media on student learning motivation and mathematical spatial abilities. This can be seen from the answers to the research questions as follows:

1. Learning using the PAKEM model using the tangram media is significantly better at improving students' mathematical spatial abilities than the expository model. The students' spatial abilities learned using the PAKEM model assisted by the tangram media was higher than those taught using the expository model. From the results of the pre-test it was revealed that the average pretest of the experimental class was 49 and in the control class it was 47. From the results of the final test it was revealed that the average final test of the experimental class was 67 and in the control class it was 45. the PAKEM model assisted with tangram media was higher than the expository model.
2. Learning using the PAKEM model using the tangram media is significantly better at increasing student motivation than the expository model. The learning motivation of students taught with the PAKEM model assisted by tangram media was higher than those taught using the expository model. From the preliminary test results, it is revealed that the average final test of the experimental class is 79 and in the control class it is 74. So it is clear that the learning motivation of students who are taught using the PAKEM model assisted by tangram media is higher than the expository model.
3. There is no interaction between learning the PAKEM model assisted by tangram media with the initial mathematical ability of students' spatial abilities, because there is no joint influence contributed by the learning model (PAKEM using tangram and expository media) with the initial mathematics ability (low, moderate , and height) on students' spatial abilities.
4. There is no interaction between the PAKEM learning model assisted by tangram media and the initial mathematical ability of students' learning motivation, because there is no joint influence contributed by the learning model (PAKEM using tangram and expository media) with the initial mathematics ability (low, moderate, and high) on student learning motivation.

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