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Cooperative Learning Model based on Tudang Sipulung with Ethnomathematics Approach

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Abstract

Mindset the learner's dislike of mathematics creates interest and their motivation in learning to be low and impact on their learning outcomes. Therefore, teachers as facilitator required get choose method that true consequently learning get interaction Educational, Inspiring and fun. So, the purpose in this research is investigate Effectiveness of Cooperative Model based on Tudang Sipulung with an Ethnomathematics Approach because this method can be made solution from the problems. Sample in this research is class IX.1 which selected by cluster random sampling and from population entire student class IX Junior High School in Makassar City. Data Collected by Indicators Effectiveness Learning that is result learn that Analyzed in a descriptive and inferential whereas activity and response student both Analyzed in a Descriptive. Result analysis Descriptive show (1) average pretest and posttest student that is 25.29 and 86.55 (2) averages N-Gain student that is 0,82 with category tall (3) average activity student that is 3,40 with category active (4) average percentage response student that is 89,60% with category very positive. Result analysis inferential show (1) value average result learn student >76.9 (2) average N-Gain student >0.29. From this result concluded that Application of Cooperative Model Based on Tudang Sipulung with Ethnomathematics Approach effective Applied at Learning mathematics student class IX Junior High School in the City Makassar.

Keywords: effectiveness, mathematics learning, cooperative model, tudang sipulung, ethnomathematics.

1. Introduction

Indonesia has the educational objectives stated in Article 3 of Law Number 2 of 2003 concerning the National Education System, namely to develop the potential of students to become human beings who have faith and piety in God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. To realize these educational goals is certainly not easy. Each teacher needs to set various strategies that are suitable to be applied in a class with various characters of students and according to situations and conditions. Babari, Priyono (Karim, 2007) argues that to realize the goals of national education, quality variables are always put forward because the quality of education refers to the quality of processes and products. It is called quality in terms of process if the learning process in education takes place effectively and students experience a meaningful process, supported by adequate sources of funds and infrastructure. Meanwhile, products or individuals from education can be seen in quality when the implementation of things obtained in education is carried out.

The educational process is an ongoing activity, and involves many components, such as students, educators, learning methods, infrastructure and facilities, educational environment, social, cultural and economic conditions. The components work together, intertwined with a learning process in education.

Learning is a conscious effort in transferring knowledge, knowledge possessed by educators to students. According to (Irwantoro & Suryana, 2016) learning is a composed combination that includes humane, material, facilities, equipment and procedural elements that influence each other to achieve learning objectives. In carrying out the learning process, things that need to be considered are learning is a programmatic teacher activity, the implementation of learning based on a program or learning plan, learning is carried out to teach students actively, and in learning, learning resources are provided for students (Irwantoro & Suryana, 2016). Therefore, every educator and one

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education must be able to plan learning, carry out the learning process and conduct assessments to increase the efficiency and effectiveness of learning.

The effectiveness of learning is the result of a learning process where learning tools such as models, methods, techniques and other things are able to help teachers and students to achieve the objectives of learning. Learning is said to be effective if the treatment given is able to provide an improvement between the test before treatment and the test after treatment, students are active in learning and the learning carried out gets a positive response from students (Uno & Nurdin, 2014). reveals that learning is considered effective if the scores that have been achieved by students meet the minimum limit of competencies that have been determined, both theoretically and practically. (Mulyatiningsih, 2011) added that to determine the effectiveness of a treatment, you can use the gain score (increase in score) measured before the treatment (*pretest*) and after treatment (*posttest*) or compare the results between the control group and the experimental group.

Mathematics is one of the sciences, knowledge that is imprisoned in a learning. According to Rahayu (Sari, 2017) mathematics is one of the subjects given from elementary school to college to equip students with the ability to think logically, analytically, systematically, critically and creatively as well as the ability to cooperate. Furthermore (Fuadi, Johar, & Munzir, 2016) this way of thinking can be developed through learning mathematics, because mathematics has a strong and clear structure and interrelationship between its concepts so that it allows students to be skilled in rational thinking. However, who would have thought that mathematics has always been the scourge of most students, from elementary school to high school and even universities, especially Indonesia. There are not a few of them who avoid encountering mathematics. Students' interest and learning motivation become low due to the mindset of dislike for mathematics and certainly have an impact on their mathematics learning outcomes (Thamrin, Rusli, & Bernard, 2018). Other problems of mathematics education are: low competitiveness in international events, low average final school exam scores when compared to other subjects, and low student interest in learning because children assume that mathematics feels very difficult plus the teaching methods applied by teachers are not attractive. This fact is like getting justification from this is supported by the results of TIMSS where the achievements of second grade junior high school students are ranked 34 out of 38 countries and the 2015 PISA results are ranked 63 out of 70 countries (Hadi, 2017).

The same problem researchers got at the State Junior High School in Makassar City in November 2021 when carrying out initial observations was: (1) learning continues to be carried out with a teacher-centered method, where the teacher explains and students listen and capture the material provided so that students get more information from the teacher directly, (2) students tend to be passive in learning, (3) students understand the examples given, but find it difficult to apply concepts to other problems. Especially the problem in learning mathematics material to build a curved side room is that students have difficulty understanding concepts so that the application of concepts to problems that are in line is difficult to do.

To overcome this, teachers must be able to design learning in such a way that the results of the application can be a shadow of the learning objectives. The selection of learning models is the main thing that needs to be done because the learning model serves as a guide for educators and learning designers so that the implementation of learning can run systematically. According to Trianto (Afandi, Chamalah, & Wardani, 2013), the learning model is a plan that is used as a guide in planning learning in the classroom. There are many learning models, but the selection of learning models must be in accordance with the needs or problems that exist in the classroom. As in the problem above, the learning model chosen is cooperative.

The cooperative learning model is a form of learning in which students will learn and work in small groups collaboratively and the selection of members is heterogeneous. This learning model focuses on students, making the classroom more active because there will be a lot of interaction created, training cooperation between students and training student responsibilities. Nurulhayati (Rusman, 2011) expressed her opinion about the cooperative learning model, which is a learning strategy that involves students actively in a small group that interacts with each other. However, the application of this learning model alone is not enough to be applied because only a few students contribute to providing ideas on the problems they will solve in small groups, students also sometimes have high selfishness when doing small groups such as their opinions that they want to listen to and do not respect the opinions of their group friends. The solution to this problem is the application of *tudang sipulung* as a technique in learning.

Tudang sipulung is a culture of the Bugis community of Makassar which is used as a space for the public to find a solution to a problem where every community who follows it must give its opinion on the problem at that time even though its opinion is the same as the opinion of other people. *Tudang sipulung* is a democratically running discussion room where each participant has the same rights and obligations.

In addition, another problem that students have to face is that students must be able to connect learning with daily life and students are forced to learn concepts in the abstract. A contextual approach is a suitable approach to the problem.

The Ethnomathematics approach is a learning approach that is carried out by relating mathematics learning materials with existing cultures. Ethnomathematics serves to express the relationship between culture and mathematics. Nursyahidah (Fauzi & dkk, 2020) argues that Ethnomathematics is a mathematical idea created from the daily life of people in their environment. Ethnomathematics can be used as one of the ways that students can understand, articulate, process and use mathematical ideas, concepts and practices that can solve problems related to their daily activities (Ajmain, Herna, & Masrura, 2020). Ethnomathematics has various objects that can be used in mathematics learning, especially building curved side rooms, such as traditional cakes in Makassar, Bugis and Mandar. The traditional cakes in question include the ball-shaped Bugis onde-onde cake, the cone-shaped paso cake and the tubular putu coppa.

The objective of the study

Based on the formulation of the problem above, the goal to be achieved in this study is to determine the effectiveness of *Tudang sipulung* based cooperative model with an ethnomathematics approach in learning geometry to build curved side rooms in grade IX students of SMP Negeri in Makassar City.

2. Literature Review

2.1 Learning Effectiveness

The effectiveness of learning is the result of the learning process where learning tools such as models, methods, techniques and other things are able to help teachers and students achieve the objectives of learning. Effectiveness is related to the success rate of implementing learning to achieve a goal. (Armayasanti, 2018) reveals that the effectiveness of a learning occurs when students receive and relate the information provided. This means that students not only receive the material given by the teacher passively but can also respond to the material actively.

Learning effectiveness is the success of teachers and students in carrying out the learning process until they achieve the expected goals. (Uno & Nurdin, 2014) reveals that learning is considered effective if the scores that have been achieved by students meet the minimum limit of competencies that have been determined, both theoretically and practically. (Mulyatiningsih, 2011) added that to determine the effectiveness of a treatment, you can use the gain score (increase in score) measured before the treatment (*pretest*) and after treatment (*posttest*) or compare the results between the control group and the experimental group. This means that the effectiveness of learning can be seen from the level of student achievement to the predetermined values. Thus, the indicators of measuring the effectiveness of learning in this study are learning outcomes, student activities and student responses.

2.2 Cooperative Learning Model

The cooperative learning model is one of the variations of the model where students will interact actively and positively in a small group to solve a problem. So that in one group, each member of the group has the same responsibility for the success of his group. In this learning model, the teacher not only imparts knowledge to students, but must also build on the knowledge that students have in mind so that students have the opportunity to gain hands-on experience in applying the ideas they have. According to (Rusman, 2011) cooperative learning is a form of learning in which students learn and work in small groups collaboratively and the members consist of four to six heterogeneously selected people. Students in these small groups have two responsibilities, namely studying for themselves and helping their fellow group members to learn. Abdulhak (Rusman, 2011) further explained that cooperative learning is carried out through *a sharing* process between learning participants (students), so as to realize a common understanding among the learning participants themselves. This learning model can create an interaction and communication between teachers and students, as well as students and students which has an impact on more active learning

Cooperative learning models are developed to achieve at least three important goals, namely academic learning outcomes, acceptance of individual diversity and development of social skills. This learning model has six main steps or stages in its application, here is its elaboration (in Table 1).

However, although the cooperative model has been designed in such a way that learning will run quite effectively. We cannot deny that the cooperative model certainly has its advantages and disadvantages. The advantages according to Vienna Sanjaya (Busahwi, 2021) are:

1) Students do not always depend on the teacher, but their trust in thinking alone can increase, find information from various sources and learn from other students.
2) Students can develop their abilities and express their ideas in words verbally and compare them with the ideas of others.
3) Students will be helped to value others more, be aware of all their limitations and accept all differences.
4) Students are assisted in empowering their responsibilities in learning.
5) Students' social abilities will increase, develop a sense of self-esteem, create positive interpersonal relationships, and exercise their ability to manage time.
6) Students will practice in solving their own problems.
7) Student motivation can increase and students receive stimulation to think.

Table 1. Cooperative Learning Model Steps

Phase	Teacher Activities
Phase 1 delivers goals and motivates students	The teacher conveys the lesson objectives to be achieved in the lesson activities and emphasizes the importance of the topic to be studied and motivates students to learn.
Phase 2 presents information	The teacher presents information or material to students verbally.
Phase 3 organizes students into study groups	The teacher explains to the students how to form a study group and guides each group to make the transition effectively and efficiently.
Phase 4 guides the study and work group	The teacher guides the study groups as they work on their assignments.
Phase 5 evaluation	The teacher evaluates the learning outcomes of the material that has been studied or each group presents the results of its work.
Phase 6 awards	Teachers look for ways to appreciate individual and group efforts and learning outcomes.

Source: (Rusman, 2011)

Meanwhile, the disadvantages of cooperative learning according to (Herman & dkk, 2022) are the following:

1) The cooperative model requires more energy, thinking and time.
2) In order for the learning process to run smoothly, it requires the support of adequate facilities, tools and costs.
3) During the discussion activities, there is a tendency for the topic of the problem being discussed to expand, thus affecting the predetermined time.
4) During discussions, sometimes dominated by one of the students, this results in the other students becoming passive.

2.3 Tudang Sipulung

Tudang Sipulung comes from two words, namely *tudang* which means to sit, and *sipulung* which means to gather. *Tudang sipulung* is a culture of the Bugis community of Makassar which is used as a space for the public to find a solution to a problem. (Fatmawati, 2018) explaining the purpose of *tudang sipulung*, which is to determine matters related to activities that will be carried out in the future. Faisal (Herminar, 2018) explained that *tudang sipulung* is conceptually a space for the public to voice their interests in order to find solutions or problems they face.

(Herminar, 2018) explaining that *tudang sipulung* is a democratically running public space. This means that each participant in this gathering has equal rights and obligations as other participants. Participants who were asked for their opinions expressed their opinions even though their opinions were the same as those of other participants.

The implementation of the gathering as a problem-solving process, must be based on communication conditions that truly reflect joint decisions and are beneficial to all parties. The concept of *tudang sipulung* is in line with Vygotski's theory which views that learn to carry out an active organization of their experiences and the importance of social influence. Vygotski suggests that each lesson will pass two levels, namely the social level of collaborating with others and the individual level by internalizing.

2.4 Ethnomathematics Approach

The Ethnomathematics approach is a learning approach that is carried out by relating mathematics learning materials with existing cultures. Ethnomathematics serves to express the relationship between culture and mathematics. Fauzi and Lu'luillmaknun (Fauzi & dkk, 2020) stated that ethnomathematics is a learning strategy by linking cultural elements into mathematics. Nursyahidah (Fauzi & dkk, 2020) also argues that Ethnomathematics is a mathematical idea created from the daily life of the community in their environment.

The ethnomathematics approach is a culturally based mathematics learning approach and grows and develops in society. According to Barton (Wahyuni, Tias, & Sani, 2013) ethnomathematics includes mathematical ideas, thoughts and practices developed by all cultures. Ethnomathematics can be used as one of the ways that students can understand, articulate, process and use mathematical ideas, concepts and practices that can solve problems related to their daily activities (Ajmain, Herna, & Masrura, 2020).

According to Shirley (Andriyani & Kuntarto, 2017) mathematics learning should be adapted to the student's culture. This is because of the variety of cultures that students have, the difficulty of students understanding mathematics and the difficulty of students connecting mathematics with real life make the main factors of the importance of integrating learning with culture in learning. One of them is by utilizing an ethnomathematics approach.

The ethnomathematics approach as a learning approach can help students in understanding the material on mathematics learning. Because the material is directly related to student culture in daily community activities. Ethnomathematics describes all the things that make up the cultural identity of a group such as language, values, beliefs, habits, food, clothing and so on.

However, in this study, the ethnomathematics referred to here is traditional cakes typical of Bugis, Makassar and Mandar. Physically, traditional cakes typical of Bugis, Makassar and Mandar have distinctive forms and have hardly changed since ancient times. If you look closely, traditional cakes typical of Bugis, Makassar and Mandar contain geometric concepts.

Hypotheses:

Based on the theory and frame of thought, the hypothesis of this study consists of descriptive hypotheses and statistical hypotheses as follows:

1) Descriptive Statistical Hypothesis

The descriptive hypothesis of this study is a cooperative model based on *tudang sipulung* with an effective ethnomathematics approach to be applied in mathematics learning class IX.1 SMP Negeri in Makassar City.

2) Inferential Statistical Hypothesis

a) The learning outcomes of students after being taught using a cooperative model based on tudang sipulung with an effective ethnomathematics approach are significantly at least 77 (minimum completion criteria value)

   H_0: $\mu = 76{,}9$
   H_1: $\mu > 76{,}9$
   Information:
   $\mu =$ Average parameters of learning outcomes

b) The average increase in learning outcomes after the application of cooperative model based on *tudang sipulung* with an ethnomathematics approach is at least in the moderate category (numbered gain 0.3)

   H_0: $\mu_g = 0{,}29$

   H_1: $\mu_g > 0{,}29$

   Information:

   $\mu_g =$ Average parameters of improved learning outcomes

c) Student activities after being taught using a cooperative model based on *tudang sipulung* with an effective ethnomathematics approach are at least in the active category.

d) The response of students after being taught using a cooperative model based on *tudang sipulung* with an effective ethnomathematics approach is at least in the positive category.

3. Research Methods

This type of research is quantitative research. The research method used is *pre-experimental design*. This study involved one class as an experimental and treatment class with the aim of determining the effectiveness of cooperative model based on *tudang sipulung* with an ethnomathematics approach in mathematics learning for grade IX students of State Junior High Schools in Makassar City which was selected by Cluster Random Sampling from the population of all class IX state junior high schools in Makassar City. The research design used in this study was *One Group Pretest-Posttest Design* (Sugiyono, 2012). The design illustration of this study is as table 2.

Table 2. Research Design of One Group Pretest-Posttest Design

Pretest	**Treatment**	***Posttest***
O_1^*	X^{**}	O_2

Description: * and *** is the learning outcomes of students before and after the application of the joint court-based cooperative model with an ethnomathematics approach. ** is a treatment by applying a joint learning model based on the sipulung tudang with an ethnomathematics approach

The variabel involved in this study is a cooperative model based on tudang sipulung with an ethnomathematics approach, hasil learning student mathematics,student activities, respons students. The research instruments used in this study are (1) students' mathematics learning outcomes, (2) student activity observation sheets, (3) student response questionnaires and (4) observation sheets for the implementation of learning. The data collection techniques used are observation sheets, tests and questionnaires which are then analyzed by descriptive and inferential statistical analysis with the following explanations:

1) Descriptive Statistical Analysis

Descriptive statistical analysis is used to provide an overview of the factors studied, namely:

a) Data Analysis of Learning Implementation

The data to be analyzed regarding the implementation of learning is obtained from the observation sheet of the implementation of learning observed during the learning. The analysis was carried out on the results of observations from observer observers of teachers in carrying out learning.

Data analysis techniques for the implementation of learning using average analysis. The level of analyzing the implementation of learning will be calculated by summing each aspect and then dividing it by many aspects that are assessed. The category of implementation for each aspect or all aspects by applying a cooperative model based on *tudang sipulung* with an ethnomathematics approach is shown in the table 3.

Table 3. Categories of Learning Implementation Value

Average Score	**Category**
$1.00\ 1.50 \leq \bar{x} \leq$	Done poorly
$1.50\ .50 < \bar{x} \leq \mathbf{2}$	Done pretty well
$2.50\ .50 < \bar{x} \leq \mathbf{3}$	Well done
$3.50 < \bar{x} \leq \mathbf{4.00}$	Very well done

Source: Widyoko (Wahyuddin & Nurcahaya, 2018)

b) Data Analysis of Mathematics Learning Outcomes

In this study, descriptive statistical analysis was used to describe students' mathematics learning outcomes. The type of data is in the form of learning outcomes which is further categorized as the interval of student learning outcomes in Table 4.

Furthermore, the category of learning outcomes is based on the guidelines for the percentage of student learning completion set at the State Junior High School in Makassar City.

Based on Table 5, students who obtain a score equal to or more than 77 can be declared complete in the learning process and students who obtain a score below 77 are declared incomplete in the learning process.

Table 4. Categorization of Student Learning Outcome Intervals

The Value of Learning Outcomes	Category
0 - 34	Very Low
$\mathbf{35-54}$	Low
$\mathbf{55-64}$	Keep
$\mathbf{65-84}$	Tall
$\mathbf{85-100}$	*Very High*

Source: (Purwanto M. N., 2002)

Table 5. Minimum Completion Criteria

Value Interval	Category
$\geq \mathbf{77}$	Complete
$< \mathbf{77}$	Incomplete

*Source: (*SMP Negeri di Kota Makassar*)*

Gain is the difference between the pretest and posttest values. Gain shows an improvement in students' math abilities after the learning process. Improving the completeness of student learning outcomes before and after learning is carried out with the numbered gain (g) formula (Purwanto, 2010)

$$g = \frac{S_{post} - S_{pre}}{S_{mak} - S_{pre}}$$

Information:

g: nominalized gain

S_{pre} : pretest score

S_{post} : posttest score

S_{mak} : ideal maximum score

The height of the normalized *gain* (*N-Gain*) can be categorized as follows in table 6.

Table 6: Categorization of Gain Values

Gain Value Interval (g)	Category
g ≥ 0.7	Tall
0.3 ≤ g 0.7<	Keep
g 0.3<	Low

Source: (Purwanto, 2010)

c) Analyze Student Activity Data

Data from student observations during learning activities were analyzed by looking for the average of each aspect of the several meetings held.

Then the average is converted descriptively based on the categories of student activity (Table 7).

Table 7. Categories of Student Activity Aspects

Average Score	Category
1.00 1.50< $\bar{x} \leq$	Inactive
1.50 .50< $\bar{x} \leq \mathbf{2}$	Less Active
2.50 .50< $\bar{x} \leq \mathbf{3}$	Active
3.50 < $\bar{x} \leq \mathbf{4.00}$	Very Active

Source: Ardin (Amral, Mulbar, & Minggi, 2018)

d) Student Response Questionnaire Analysis

Student response data is obtained from the results of questionnaires provided by students after learning ends. The response questionnaire is given several types of responses and then analyzed with percentages. Activities performed to analyze response data:

1) Counting the number of students who gave positive responses according to the aspects asked
2) Calculates the percentage of the number of students who give a positive response divided by the number of all students then multiplied by 100%

Then the average is converted descriptively based on the categories of student response aspects as follows in table 8.

Table 8. Categories of Student Response Aspects

Average Student Response (RS)	Category
RS < 50%	Not Positive
50% rs ≤ < 70%	Less Positive
70% rs ≤ < 85%	Positive
RS ≥ 85%	Very Positive

Source: Lasabuda (Ridwan, 2018)

2) Inferential Statistical Analysis

Inferential statistical analysis is used to test research hypotheses using t-tests. However, before the hypothesis test is carried out, a prerequisite test is first carried out which consists of a normality test.

a) Normality Test

For the normality test used kolmogorov Smirnov test.

Hypothesis:

H_0: The sample is from a normally distributed population.

H_1: The sample is from an abnormally distributed population.

The test criteria if the probability value is greater than the real level of 0.05 then H0 is accepted and H1 is rejected.

b) Hypothesis Testing

The statistical hypotheses tested are:

1. H_0: $\mu = 76{,}9$
   H_1: $\mu > 76{,}9$
2. H_0: $\mu_g = 0{,}29$
   H_1: $\mu_g > 0{,}29$

The test was performed using a t-test. The data tested are *posttest* data with *One-Sample* T Test analysis. With the H test criteria $_0$ is accepted if the significant value of Pvalue ≥ 0.05, on the other hand if the significant value of Pvalue < 0.05 then H_0 is rejected.

c) Effectiveness Criteria

The effectiveness criterion consists of 3 criteria, namely:

(1) Mathematics Learning Outcomes

The results of learning mathematics students are said to be effective if descriptively and inferentiation meet the following criteria:

1) The average score of student learning outcomes for posttest exceeds KKM (77)
2) The average normalized gain is at least in the moderate category

(2) Student Activities

Student activity is said to be effective if descriptively the student activity score is at least in the active category (≥ 60%).

(3) Student Responses

Student activity is said to be effective if descriptively the student's response score is at least in the positive category ($\geq 70\%$).

4. Results and Discussion

The research was carried out in class IX which is a sample of five classes in class IX of SMP Negeri in Makassar City. This research was carried out with 1 pretest giving meeting, 1 *posttest* giving meeting and 4 mathematics learning meetings for building a curved side room through a joint-based cooperative model with an ethnomathematics approach.

4.1. Descriptive Statistical Analysis Results

The results of the descriptive analysis show a description of the characteristics of the distribution of learning outcome scores of each research group and at the same time become the answer to the problems formulated in the study.

a. Learning Implementation Analysis

The observed implementation of learning is the teacher's activity in managing learning in the experimental class by applying a cooperative model as a learning model, Tudang Sipulung as a learning technique and ethnomathematics as a learning approach.

The following is Table 9 data on the results of observations on the implementation of a cooperative model based on Tudang Sipulung with an ethnomathematics approach.

Table 9. Data Results of Observations on the Implementation of a Cooperative Model based on Tudang Sipulung with an Ethnomathematics Approach

The th meeting-	Average Score	Category	Information
I	3,40	Well done	2.50 .50$< \bar{x} \leq 3$
II	3,44	Well done	2.50 .50$< \bar{x} \leq 3$
III	3,88	Very well done	$3.50 < \bar{x} \leq 4.00$
IV	3,83	Very well done	$3.50 < \bar{x} \leq 4.00$
Average	**3,64**	**Very well done**	$\mathbf{3.50 < \bar{x} \leq 4.00}$

Based on Table 9, it can be seen that the implementation of learning the average score of learning implementation from the first to the fourth meeting is 3.64.

b. Analysis of Student Learning Outcomes

From the results of processing data on student mathematics learning outcomes based on the results of pretest, posttest and student gains, it is found in table 10.

Table 10. Description of Class IX.1 Pretest Values

Statistics	*Pretest*	*Posttest*	*Gain*
Sample	31	31	31
Mean	25,29	86,55	0,82
Median	27,00	85,00	0,81
Mode	22,00	80	0,75
Standard Deviation	8,494	6,985	0,10
Variance	72,146	48,789	0,01
Maximum	47	98	0,97
Minimum	7	77	0,65
Range	40	21	0,32

Based on table 10, it can be seen that the average score of students' posttest is 86.55 which is greater than KKM which is 77 and is in a very high category which means it meets the criteria for effectiveness. The student's mathematics learning outcome at a normalized gain of 0.82 is in the high category, which is greater than 0.3.

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Table 11. Classification of N-Gain in The Taught Class by Applying a Cooperative Model based on Tudang Sipulung with an Ethnomathematics Approach

Gain Value Interval (g)	Number of Students	Percentage	Category
g ≥ 0.7	28	90,3%	Tall
0.3 ≤ g 0.7<	3	9,7%	Keep
g 0.3<	0	0%	Low
Average		**0,82**	**Tall**

Based on Table 11, the increase in learning outcomes of students taught with the Tudang Sipulung-based Cooperative Model with an Ethnomathematics Approach of 3 students was in the moderate category with a percentage of 9.7% and 28 students were in the high category with a percentage of 90.3%. This means that the improvement of student learning outcomes taught with a Tudang Sipulung-based Cooperative Model with an Ethnomathematics Approach is in the high category.

Table 12. Completion of Posttest Results After Following Learning by Applying a Tudang Sipulung-based Cooperative Model with an Ethnomathematics Approach

No.	KKM	Category	Frequency	Percentage
1.	≥ 77	Complete	31	100%
2.	< 77	Incomplete	0	0%

In Table 12, it can be seen that the final test scores (posttest) of all class IX.1 students meet the Minimum Completion Criteria (KKM) or with the Complete category.

c. Student Activity Analysis

Student activity data is obtained through observation instruments of student activities carried out during the learning process. The following is a summary of the average scores of student activity observation results presented in Table 13.

Table 13. Average Student Activity Observation Results Score

The th meeting-	Average Score	Category	Information
I	3,29	Active	2.50 .50< $\bar{x} \leq 3$
II	3,00	Active	2.50 .50< $\bar{x} \leq 3$
III	3,64	Very Active	3.50 < $\bar{x} \leq 4.00$
IV	3,68	Very Active	3.50 < $\bar{x} \leq 4.00$
Average	**3,40**	**Active**	**2.50 .50< $\bar{x} \leq 3$**

Based on Table 13, it can be seen that student activities for the four student activity observation meetings on learning that apply the Tudang Sipulung-based Cooperative Model with an Ethnomathematics Approach are said to be active. This is indicated by the average score of learning implementation from the first to the fourth meeting of 3.40.

d. Student Response Analysis

The instrument used to obtain student response data is a student response questionnaire. The following is Table 14 average score of student response questionnaire to learning that applies a cooperative model based on tudang sipulung with an ethnomathematics approach.

Table 14. Average score of student response questionnaire to learning applying a tudang sipulung-based cooperative model with an ethnomathematics approach

Average Score (%)	Category
89,60	Very Positive

Based on table 14, it can be seen that students' responses to learning with a Tudang Sipulung-based Cooperative Model with an Ethnomathematics Approach are very positive with an average percentage of 89.60%.

4.2. Inferential Statistical Analysis

a. Normality Test

The Normality test is performed to find out whether the data is normally distributed or not. This normality test uses the SPSS (*Statistical Package for Social Science*) application version 26 using the *Kolmogorov-Smirnov criterion.* A normality test is performed to test the distribution of the treated classes.

Hypothesis:

H_0: The sample is from a normally distributed population.
H_1: The sample is from an abnormally distributed population.

With the test criteria H_0 is accepted if the value$p_{value} > 0{,}05$, is significant otherwise if the value is significant then $p_{value} < 0{,}05H_0$ is rejected. The Normality Test Results for Pretest, Posttest and Normalized Gain Data are found in Table 15.

Table 15. Normality test results against normalized pretest, posttest and gain data

	Statistics	**Df**	**Significance**
Pretest	0,102	31	0,200
Posttest	0,148	31	0,080
Gain	0,139	31	0,134

Based on the *Kolmogorov-Smirnov* Normality Test, then the significance or p_{value} = 0.200 for the pretest, significance or = 0.080 for p_{value} the posttest and significance or = 0.134 for p_{value} the Gain of 31 students. Since p_{value} pretest = 0.200 $> \alpha$, p_{value} posttest = 0.080 and $> \alpha$, p_{value} gain = 0.134 $> \alpha$. This means that the pretest, posttest and gain data are normally distributed.

b. Hypothesis Test

1) Hypothesis Testing of KKM Achievement learning outcomes

This hypothesis testing is used to determine the completeness of student learning outcomes after applying the *Tudang Sipulung*-based Cooperative Model with an Ethnomathematics Approach based on individual Minimum Completion Criteria (KKM). This test was carried out with the *One Sample T* Test using *SPSS 26* (*Statistical Package for Social Science)* Software.

The proposed hypothesis is formulated in the form of a statistical hypothesis as follows:

H_0: $\mu = 76{,}9$
H_1: $\mu > 76{,}9$
With:

H_0 = Student learning outcome equals to 76.9

H_1 = Greater student learning outcomes 76.9

With the test criteria H_0 is accepted if the significant $p_{value} \geq 0.05$, on the contrary if the significant $p_{value} < 0.05$ then H_0 is rejected with a degree of significance $\alpha = 0{,}05$

The results of the posttest hypothesis test against the minimum completion criteria (77) can be seen from table 16.

Table 16. Posttest hypothesis test results against minimum completeness criteria

	Test Value (*Test Value* = 76.9)					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of The Difference	
					Lower	Upper
Posttest	7,691	30	0,000	9,648	7,09	12,21

Based on Table 16, it can be seen that p_{value} for posttest data it is 0,000 with an average posttest of 86.55. If used $\alpha = 0{,}05$, it can be seen in the table $p_{value} < 0.05$ which shows that the average student's posttest score is significantly greater than 76.9. Thus, it can be concluded that H_0 is rejected so that it can also be said that the average

student's posttest score is more than 76.9 after the application of the *Tudang Sipulung*-based Cooperative Model with an Ethnomathematics Approach.

2) Hypothesis Testing of Average Normalized Gain Value learning outcomes

Testing the average normalized gain value of learning outcomes was carried out with the *One Sample T Test* using SPSS 26 (*Statistical Package for Social Science) Software*.

The proposed hypothesis is formulated in the form of a statistical hypothesis as follows:

H_0: $\mu_g = 0{,}29$
H_1: $\mu_g > 0{,}29$

With:

H_0 = average parameter normalized *gain* score equal to 0.29

H_1 = average parameter normalized *gain* score greater than 0.29

With the test criteria H_0 is accepted if the significant $p_{value} \geq 0.05$, on the contrary if the significant $p_{value} < 0.05$ then H_0 is rejected with a degree of significance $\alpha = 0{,}05$.

The results of the normalized gain hypothesis test can be seen from table 17.

Table 17. Numbered gain hypothesis test results

	Test Value (*Test Value* = 0.29)					
	t	Df	Sig. (2-tailed)	95% Confidence Interval of the Difference		
				Mean Difference	Lower	Upper
Gain	30,311	30	0,000	0,52871	0,4931	0,5643

Based on Table 17, it can be seen that p_{value} for normalized gain data is 0.000 with an average normalized gain of 0.52871. If used $\alpha = 0{,}05$, it can be seen in the table $p_{value} < 0.05$ which shows that the average normalized gain score of students is significantly greater than 0.29. Thus, it can be concluded that H_0 is rejected so that it can also be said that the average increase in student learning outcomes is more than 0.29 after the application of the *Tudang Sipulung*-based Cooperative Model with an Ethnomathematics Approach.

c. Results of Learning Effectiveness Analysis

In determining the effectiveness of a learning, the three indicators of effectiveness that have been set must meet the criteria of the three indicators. The three indicators in question are learning outcomes measured through pretest and posttest, student activity and student response. The results of the analysis of the level of effectiveness of learning are presented in Table 18.

Table 18. Results of the analysis of the level of effectiveness of learning

No.	Indicators	Criterion	Achievement	Decision
1.	Student Learning Outcomes Average *posttest* score Average normalized *gain* value	$\mu > 76{,}9$ $\mu_g > 0{,}29$	Very High Category ($\mu = 86.55$) High Category ($\mu_g = 0.82$)	Fulfilled
2.	Student Activities	Minimum Active Category ($2.50.50 < \bar{x} \leq 3$	Active Category ($\bar{x} = 3.40$)	Fulfilled
3.	Student Responses	Minimum Positive Category (70% ≤ RS < 85%)	Very Positive Category (RS = 89.60%)	Fulfilled

Based on Table 18, it can be concluded that the criteria for learning outcomes, student activities and student responses are each met. This means that the application of the *Tudang Sipulung*-based Cooperative Model with an Ethnomathematics Approach is effectively applied to mathematics learning for grade IX 1 students of State Junior High School in Makassar City.

5. Conclusion

The conclusion that can be drawn from this study is that learning using a Tudang Sipulung-based Cooperative Model with an Ethnomathematics Approach is effectively applied in class IX 1 of State Junior High School in Makassar City with material on Building Curved Side Rooms, namely (1) the average student posttest ratio of 86.55 is in the high category (2) average gain normalized students of 0.82 were in the high category (3) skor average student activity of 3.40 with the active category (4) percentage of the average student response score of 89.60% with the very positive category. As for the next researcher, they can use this research as a source of data and comparison material in developing other variables in the learning process.

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