

Differences in Spatial Ability and Student Learning Motivation by Contextual and Guided Discovery Learning Oriented to Mandailing Culture

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Abstract The objectives of this study were to: (1) analyze differences in students' mathematical spatial abilities through contextual learning models and guided discoveries oriented to Mandailing Batak culture, (2) analyze differences in student learning motivation through contextual learning models and guided discoveries oriented to Mandailing Batak culture, (3) knowing whether there is an interaction between the learning model and the KAM of students towards the spatial abilities of students, (4) knowing whether there is an interaction between the learning model and the KAM of students towards students' learning motivation. The instruments used consisted of: (1) spatial ability tests, (2) learning motivation questionnaires. Data analysis was performed by analysis of two-way variance (ANOVA). Research results show: (1) there are differences in spatial abilities of students through through contextual learning models and guided discoveries oriented to Mandailing Batak culture, (2) there are differences in student learning motivation through contextual learning models and guided discoveries oriented to Mandailing Batak culture, (3) not the interaction between the learning model and the KAM of students towards the spatial abilities of students, (4) there is no interaction between the learning model and the KAM of students towards students' learning motivation.

Keywords: contextual teaching and learning, guided discovery learning, spatial ability, learning motivation

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1. Introduction

According to NCTM, one of the standards given by geometry in schools is so that children can use visualization, have the ability of spatial reasoning and geometry modeling to solve problems [1]. Basically, geometry has a greater opportunity for students to understand than other branches of mathematics. This is because geometrical ideas have been known by students since before they entered school, for example lines, fields and spaces. Geometry is the study of shapes, lines and spaces occupied. This shows that to learn geometry requires a spatial intelligence. The concept of spatial thinking is interesting enough to be discussed considering that many studies find that children find many difficulties to understand objects or geometry [2].

Piaget and Inhelder states that the ability to think spatially is an ability to observe the relationship of the position of objects in space, the ability to see objects from various points of view, the ability to estimate the distance between two points, and other abilities related to building space [3]. This understanding by Piaget and Inhelder confirms that the ability to think spatially is the ability to

think about the nature and problems of a building. If viewed from the context of daily life, spatial ability also needs to be improved, this refers to the opinion of Barke and Engida which suggests that spatial ability not only plays an important role in success in mathematics and other subjects, but also spatial ability very influential on various types of professions [4].

In the National Academy of Science it is said that many fields of science that require spatial abilities in the application of such knowledge include astronomy, education, geography, geosciences, and psychology [2].

Some of the statements above state how important spatial ability is mastered by students, but the reality on the ground is the exact opposite of what is expected. In fact, students' spatial ability is still relatively low and problematic. Fauzan states that the spatial ability possessed by high school grade X students in West Sumatra Indonesia is still low. There are several things found in his research, namely students are focused on displays in the form of images, students need teaching aids related to the material being studied and students do not master basic geometrical concepts. Several findings in Fauzan's research confirm that students have difficulty in understanding the topic of geometry because students' spatial abilities are still relatively low [5].

Kariadinata suggested that many geometry problems that require spatial visualization in problem solving and in general students find it difficult to construct geometric shapes [6].

Based on the results of the Trends in International Mathematics and Science Study (TIMSS) survey report, the results of Indonesian students' achievements in the field of mathematics consisting of 4 contexts: Numbers, Algebra, Geometry and Opportunities, in the ranking of the last 2015 TIMSS results for secondary schools, Indonesia received a score 397 and was ranked 45th out of 50 countries, meaning that it was only able to answer 4% of the questions correctly. In addition to the TIMSS and PISA assessment results, one of the evidence that students' mathematical spatial abilities are still low is the results of observations of researchers through preliminary studies, which show students in MTs PP Dar Al-Ma'arif Basilam Baru still have difficulties in several indicators of mathematical spatial ability. Researchers conducted tests on 20 students related to the material carried out at the school by giving questions about spatial ability.

Students' disinterest in mathematics makes the learning outcomes of students in this subject far from expectations. This shows that the lack of student interest in learning is due to the low motivation to learn. According to Tella, "The issue of motivation of students in education and the impact on academic performance are considered as important aspects of effective learning. However, a learner's reaction to education determines the extent to which he or she will go in education. [7] The form of students' reactions can come from various factors that often influence the process and achievement of learning goals. Motivation is a factor that influences the achievement of a goal.

In addition, Yunus and Ali stated, "motivation refers to a student's willingness, need, desire, and compulsion to participate in, and be successful in the learning process" [8]. This means that motivation is the individual's reason for behaving in certain situations, thus motivation contributes to the ability to solve problems. Therefore, the importance of motivation makes it something that must be considered by the teacher. During this time, the teacher only taught by giving material, giving examples and giving exercises and then closing the class by giving Homework (homework). For this reason, efforts are needed to improve students' spatial ability together with increased learning motivation. His efforts should be a supporting factor that can help improve students' spatial abilities and motivation to learn mathematics.

For this reason, efforts are needed to improve students' spatial ability together with increased learning motivation. His efforts should be a supporting factor that can help improve students' spatial abilities and motivation to learn mathematics. In addition to internal factors that exist in students themselves, external factors that have often been considered to be able to break spatial ability and learning motivation are the use of varied learning models. During this time the teacher is still carrying out learning in one direction where the teacher is the only source of learning and students are passive. The Ministry of National Education's findings at the SMP / MTs level were also found in the aspects of implementing KBM: (1) Learning does not refer to the lesson plan that has been made, so it

is not directed, only follows the flow of the textbook, (2) Implementation in the class is not supported by infrastructure. Chalkboard that can be used for term use, and teaching aids, (3) Learning methods in the classroom are less varied, teachers tend to always use the lecture method, (4) Evaluation does not refer to indicators that have been taught, teachers take questions in textbooks existing, (5) Students have difficulty using mathematical learning tools, such as a ruler, run, calculator, bow. This certainly will create a boring learning atmosphere so that students feel bored and not enthusiastic [9]. The teacher lacks applying varied learning models in the classroom. Therefore through the learning model, students are expected to be more active and have a high willingness to learn. Using the learning model will create a fun, not monotonous and boring learning atmosphere that has been encountered by students in class.

Some learning models have a significant influence on improving a number of students' mathematical abilities, such as reasoning, communication, connection, and representation abilities and are considered effective in creating a pleasant learning atmosphere. Among the learning models that have been widely applied by teachers in schools, the authors wish to further examine the application of contextual learning models and guided discovery learning models. From these two models, researchers want to see which of them is more effective in improving spatial ability and student motivation. In previous studies, each of the learning models above is able to improve students' mathematical abilities when compared to ordinary learning, direct learning or conventional learning.

As research conducted by Suhartini, Syahputra and Surya, which states contextual learning has a more significant effect than the effect of conventional learning on students' mathematical problem solving abilities [10]. Other research conducted by Zunaedy, Surya and Syahputra "Improving Students' Mathematical Understanding and Disposition Ability through Guided Discovery Learning Models in MTsN 1 Padangsidempuan" the results of the study showed that the increase in students' mathematical understanding and disposition abilities taught with the guided discovery model was higher than the Guided Discovery Model students who are taught by direct learning [11]. From the results of both studies show that the problem-solving ability of students who get the treatment of contextual learning models and guided discovery learning is higher than students who get direct learning or regular learning.

In every opportunity, learning mathematics should begin with the introduction of problems that are appropriate to the situation (contextual problem). By proposing contextual problems, students are gradually guided to master mathematical concepts. Trianto says, "in contextual learning theory learning only occurs when students process new information or knowledge, so that the information or knowledge can be understood by them in their own frame of reference (memory, experience, and response)" [12]. This theory is in line with Bruner's learning theory of meaningful learning.

In contrast to contextual learning, guided discovery learning is a learning process designed to teach concepts and conceptual relationships, where students think,

observe, digest, understand, make guesses, explain, analyze so that they can construct and discover their own general principles desired with guidance and instructions from the teacher and his worksheet, in the form of directing questions. The guided discovery learning model encourages students to acquire knowledge that they do not yet know through notification, but some or all of it is discovered by themselves. According to Casad, the guided discovery approach is the process by which students are encouraged to rediscover, try to provide knowledge through the discovery and discovery of others [13]. This does not mean that the things that students find are new because they are already known by the teacher. In the process of finding, students make guesses, guess, try and match their experiences to arrive at information or things that must be found. With this learning pattern will greatly affect the ability of understanding and spatial ability of students towards mathematics.

Culture-based learning is learning that integrates culture in the learning process and one form is emphasizing learning with culture. Learning with culture can make students not isolated from their local culture and increase students' appreciation of local culture. Culture-based learning is also constructivistic learning [14]. In culture-based learning, it is integrated as a tool for the learning process to motivate students to apply knowledge, work cooperatively, and perceive relationships between various subjects.

In culture-based learning, culture becomes a method for students to transform the results of their observations into creative forms and principles about nature. Thus, through culture-based learning, students are not just imitating and / or just accepting the information conveyed, but students create meaning, understanding, and meaning from the information obtained. Knowledge, not just a narrative summary of the knowledge possessed by others, but a collection (repertoire) that someone has about thoughts, behaviors, relationships, predictions and feelings, the result of transformation of the various information received [15].

As for one of the local cultures found in North Sumatra and researchers made reference is the Batak / Mandailing Culture. Integrating Mandailing culture into mathematics learning is expected to encourage students to be motivated to learn, and to love and appreciate the culture of the motherland.

Based on the explanation above, in the learning process there is a need for a learning plan to improve spatial ability and student motivation. For this reason, the writer wants to apply the two learning models, namely contextual learning and guided discovery learning which is oriented towards mandailing Batak culture, to find out which influence is more significant in increasing spatial ability and student motivation.

2. Research Method

This research is a quasi-experimental study with a sample of two classes, namely experimental class I and experimental class II. The population of this research is all students of class XII MAS PP Dar Al-ma'arif Basilam Baru Kotapinang which consists of 3 classes with the

number of students in each class is 30 students. The sample in this study was taken by random sampling technique, which was taken as many as two classes where the sampling was done by drawing and taken two classes, namely classes XII-B and XII-C. Class XII-B as experimental class I with the treatment of contextual learning models and XII-C as experimental class II with the treatment of guided discovery learning models.

This research involves independent and dependent variables. The independent variables in this study are the learning model, contextual learning for the experimental group 1 and the guided discovery learning model for the experimental group 2. The dependent variable is the spatial ability and learning motivation. Besides that, control variables are also included, namely the students' initial mathematical abilities (high, middle, and low). The instrument used in this study consisted of spatial ability test instruments in the form of objective tests (multiple choice) and for student motivation data using learning motivation questionnaires. Whereas students' initial mathematical ability tests are drawn from questions that are prerequisites of the material.

Quantitative data were obtained through students' initial mathematical ability tests, spatial ability tests and student learning motivation. Data obtained from students' initial ability scores, spatial abilities and students' learning motivation are grouped according to learning (contextual learning and guided discovery learning) and the level of initial mathematical ability (High, Medium, Low). Data processing begins with testing the statistical requirements needed as a basis for testing hypotheses. Next, an analysis of variance (ANAVA) of two paths is used to test the first, second and third and fourth hypotheses. Data processing was performed with the help of SPSS version 16.0.

3. Result and Discussion

Data analysis consisted of analysis of mathematical problem solving ability, and analysis of learning motivation.

3.1. Normality Dan Homogeneity

The following is a summary of the results of normality test calculations from the post test of spatial ability of students in Table 1.

Table 1. Normality Test Results of Spatial Ability

One-Sample Kolmogorov-Smirnov Test			
		CTL	DL
N		30	30
Normal Parameters ^a	Mean	71.00	67.17
	Std. Deviation	5.931	6.390
	Absolute	.183	.199
Most Extreme Differences	Positive	.134	.199
	Negative	-.183	-.131
Kolmogorov-Smirnov Z		1.004	1.092
Asymp. Sig. (2-tailed)		.266	.184

Based on [Table 1](#) above, it can be seen that the significance values are 0.266 for experiment I and 0.184 for experiment II, respectively. The significance value of the two classes is greater than the significance level of 0.05. This shows that the experimental class I and experimental class II came from populations that were normally distributed.

The results of the post test homogeneity spatial test calculation are shown in the following [Table 2](#):

Table 2. Homogeneity Test Results of Spatial Ability

Levene Statistic	df1	df2	Sig.
.603	1	58	.441

From [Table 2](#) it can be seen that the significance value of 0.441 is greater than the significance level of 0.05 so H_0 which states there is no difference in variance between groups of data can be accepted.

The following [Table 3](#) presents the results of the normality of the post test data on student motivation

Table 3. Normality Test Results of Posttest Student Learning Motivation

One-Sample Kolmogorov-Smirnov Test

		CTL	DL
N		30	30
Normal Parameters ^a	Mean	78.43	75.73
	Std. Deviation	4.199	4.510
	Absolute	.092	.126
Most Extreme Differences	Positive	.074	.098
	Negative	-.092	-.126
Kolmogorov-Smirnov Z		.505	.689
Asymp. Sig. (2-tailed)		.961	.730

Based on [Table 3](#) above, it can be seen that the significance values are 0.961 for experiment I and 0.730 for experiment II, respectively. The significance value of the two classes is greater than the significance level of 0.05, then H_0 which states that the data are normally distributed for the experimental class I and the experimental class II can be accepted.

The results of the post test homogeneity test calculation of student learning motivation are shown in the following [Table 4](#):

Table 4. Homogeneity Test Results of Posttest Student Learning Motivation

Levene Statistic	df1	df2	Sig.
.526	1	58	.471

From [Table 4](#) it can be seen that the significance value of 0.471 is greater than the significance level of 0.05 so H_0 which states there is no difference in variance between groups of data can be accepted.

3.2. Hypothesis Test

The first and third hypothesis test results with the two-way ANOVA test using the SPSS 16.0 Program are described in the following [Table 5](#).

Based on [Table 5](#), it can be seen that the significance value for the model is 0.021 (sig. <0.05), which means that there is a significant difference between the average mathematical spatial ability of students in the contextual learning class with guided discovery learning, and thus the H_0 is rejected and H_a is accepted. This shows that there are differences in the spatial ability of students who get contextual learning with students who get guided discovery learning oriented towards mandailing culture.

Table 5. Hypothesis 1 and 3 Test by Two Way ANAVA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1033.889 ^a	5	206.778	8.029	.000
Intercept	217285.473	1	217285.473	8.437E3	.000
KAM	762.743	2	381.372	14.808	.000
MODEL	146.046	1	146.046	5.671	.021
KAM * MODEL	24.494	2	12.247	.476	.624
Error	1390.694	54	25.754		
Total	288775.000	60			
Corrected Total	2424.583	59			

At the significance for the kam * model line of 0.624 (sig.> 0.05), thus H_0 is accepted and H_a is rejected. This shows that there is no interaction between learning models (contextual learning and guided discovery) mandailing culture oriented with KAM students on students' mathematical spatial abilities. This can also be described in the following graph 1:

From [Figure 1](#) above shows that contextual learning is more influential in achieving students' potential mathematical spatial abilities because the average score obtained by students in this class is higher than the average score obtained in the guided discovery learning class. So there is no interaction between learning and students' initial mathematical abilities with students' mathematical spatial abilities. This means that there is no joint influence contributed by the learning model and KAM of students on students' mathematical spatial abilities.

The second and fourth hypothesis test results with the two-way ANOVA test using the SPSS Program are described in the following [Table 6](#):

Table 6. Hypothesis 2 dan 4 by Two Way Anava

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	912.608 ^a	5	182.522	33.077	.000
Intercept	270889.811	1	270889.811	4.909E4	.000
KAM	791.941	2	395.971	71.759	.000
MODEL	100.618	1	100.618	18.234	.000
KAM * MODEL	1.275	2	.637	.115	.891
Error	297.975	54	5.518		
Total	357721.000	60			
Corrected Total	1210.583	59			

Based on Table 4.18, it is seen that the significance value for the model is 0,000 (sig. <0.05), which means that there is a significant difference between the average scores of students' learning motivation in the contextual learning class and the guided discovery learning class, thus H0 is rejected and Ha accepted. This shows that there are differences in learning motivation of students who learn through contextual learning models with Mandailing

culture-based guided learning learning models.

At the significance for kamr * model of 0.891 (sig. <0.05), thus H0 is accepted and Ha is rejected. This shows that there is no interaction between learning models (contextual learning and guided discovery) mandailing culture oriented with KAM students on student motivation. This can also be described in the following graph 2:

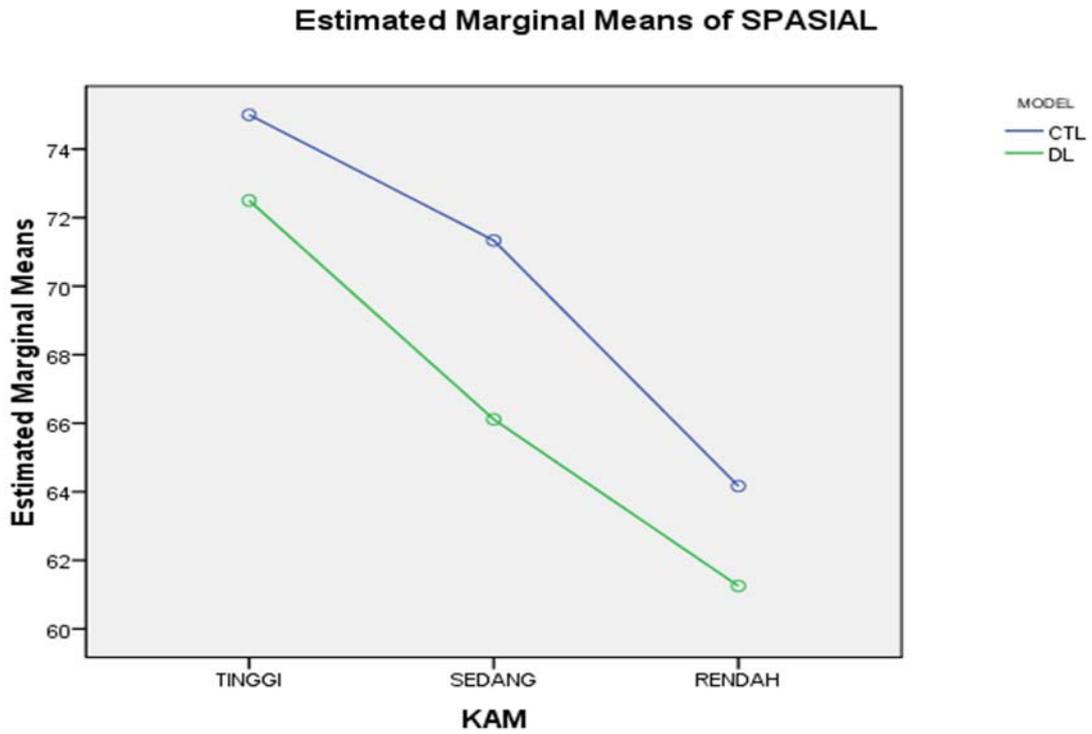


Figure 1. Interaction between Learning Model and KAM Against Student's Mathematical Spatial Ability

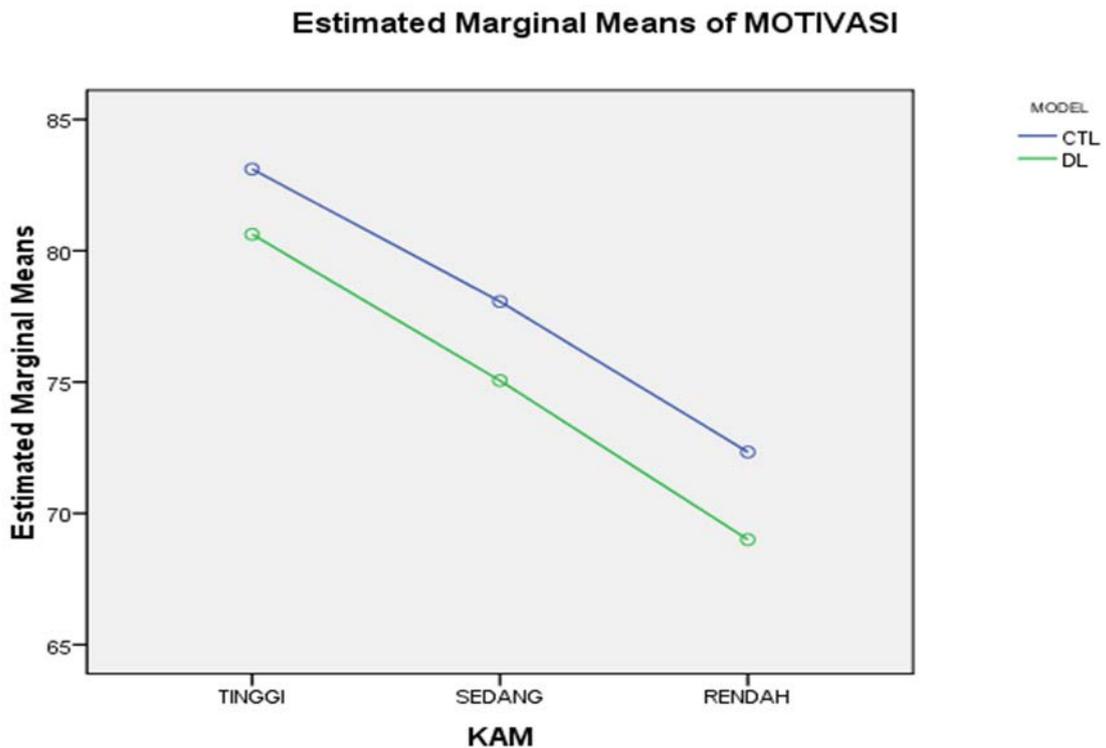


Figure 2. Interaction between Learning Model and KAM Against Student Learning Motivation

From Figure 2 above shows that contextual learning is more influential in achieving student learning motivation because the average score obtained by students in this class is higher than the average score obtained in the guided discovery learning class. So there is no interaction between learning and students' initial mathematical abilities on students' motivation to learn mathematics. This means that there is no joint influence contributed by the learning model and KAM of students on student motivation.

4. Conclusion

Based on the results of the analysis of research data on spatial abilities and learning motivation of students who learn through contextual learning models and learning models of guided learning oriented Mandailing Batak culture, then some conclusions are obtained:

1. There are differences in the spatial abilities of students who get contextual learning with students who get guided discovery learning oriented in Mandailing Batak culture
2. There is a difference in students' mathematical learning motivation that gets contextual learning from students who get guided discovery learning oriented towards Mandailing Batak culture.
3. There is no interaction between the learning model with students' initial ability to differences in students' spatial ability.
4. There is no interaction between the learning model with students' initial ability to differences in student motivation.

5. Suggestion

Based on the conclusions that have been described above, the writer conveys the following suggestions:

1. A rather noisy classroom atmosphere when the group discussion process disrupts other student learning activities. It is recommended that teachers be more active around the class and give a warning or warning to students who do not take the learning process seriously.
2. The lack of variety of questions given to students during the learning process. It is recommended that the teacher give a variety of questions to each group, then each group presents the questions in front of the class, so that the whole group can understand the different forms of questions.
3. This research is only limited to three-dimensional material, namely the material distance points, lines and fields in space. It is hoped that other studies

will develop contextual learning and guided discovery of Mandailing Batak-oriented culture in other three-dimensional material

4. For further researchers to be able to examine the weaknesses or weaknesses of this learning and examine how it influences for other mathematical abilities.

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