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The Effect of Integrated Batak-angkola Culture on Open-ended Approach to Mathematical Creative Thinking Skills of Middle Secondary School Students

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Abstract The purpose of this study was to: (1) analyze the effect of Batak-Angkola culture integration on Open-ended approach (BAC-OE) towards mathematical creative thinking skills (MCTS) of the students, (2) analyze the effect of initial mathematical abilities (IMA) on mathematical creative thinking skills, (3) find out whether there is an interaction between BAC-OE and IMA towards MCTS. The instrument used is the test of MCTS. Data analysis was carried out by two-way ANOVA. The results of the research show: (1) there is an effect of BAC-OE towards MCTS of the students, (2) there is an effect of IMA on MCTS of the students, (3) no interaction between BAC-OE and IMA towards MCTS.

Keywords: *open-ended learning approach, Batak-Angola culture, mathematical creative thinking skills*

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1. Introduction

Education is very important and cannot be separated from human life. Education is a benchmark for the progress of a nation. An advanced nation is a nation that has quality human resources, both in terms of spiritual, intelligence and skills. With quality human resources a nation will be able and proactive in responding to the challenges of an ever-changing era. Education and teaching are always a no end problem and challenge for every country. Problems and challenges can come from various sources such as advances in science, technology, population growth, limited skills of teachers, limited funds and others.

In mathematics, most of the materials are closely related, so mastering mathematics from the bottom is very important for students to be easier to deal with the next material at a more complicated level. In other words, if the basic skills of students' mathematics is inadequate, then the student himself will feel overwhelmed to learn further material. So it's no wonder that many students think that mathematics is a difficult and tedious lesson due to inadequate students' mathematical prior abilities [1].

One of the abilities that students must possess in mathematics is the skills to think creatively. Students' creative thinking skills cannot develop well if in the learning process the teacher does not involve students actively in constructing the concepts, or if the learning method used in schools is still conventional, namely teacher-centered learning. This is in accordance with Fatah [2] who said that learning mathematics in schools is not only related to mastering mathematics material as much as possible, but also to achieve higher goals, such as building students' thinking skills. By thinking creatively one will have creativity as a product of thinking. Creative thinking is a process used when we get or want to bring up a new idea. This is certainly done by combining ideas that were previously done.

The causes of students' low creative thinking skills include learning that has not empowered students' to develop creative thinking skills, therefore it is needed a learning pattern that can improve students' creative thinking skills. Another factor that causes students 'low creative thinking abilities is because there is no variation in the learning process, and the lack of students' curiosity in learning.

In addition, the results of previous studies [3] finds that learning with an open ended approach can improve students' creative thinking skills. The skills to think creatively includes one of high-level thinking skills. Higher order thinking such as mathematical creative thinking occurs when a person takes new information and information stored in memory and correlates and or rearranges and extends this information to achieve a purpose or find possible answers in complex situations that creative thinking is one type of thinking that directs new insights, new approaches, new perspectives, or new ways of understanding things. Both of these opinions indicate that a high-level thinking skills will occur when a student can associate new information with the information

he already has in his memory and connect or rearrange and develop information to achieve a goal or find a solution to a difficult problems. Furthermore, according to Torrance, the results of creativity include original ideas, different perspectives, solving the chain of problems, recombining ideas or seeing new relationships between these ideas [4].

In addition, students' success in grasphing mathematical creative thinking skills is also strongly effected by their initial mathematical abilities (IMA). IMA is very decisive in learning a new mathematics subject matter because mathematics is hierarchical subject matter. The better the IMA of the students, the better the skills of students to learn mathematical topics. In addition, IMA of students is also useful as a foundation in the selection of optimal learning strategies. Because, by knowing each student's initial mathematical abilities, the teacher will be easier in determining the method or strategy that is suitable for use in the classroom so that the learning carried out will be more effective and efficient. Each student's initial skills varies in level (high, medium, and low).

One step that can be done by the teacher to improve the skills to think creatively is to choose the right and nuanced learning approach, that is, an approach is needed in conveying learning that can make students think positively, especially in mathematics learning. Such learning, including learning mathematics with Open-ended. The results the research stated that the skills to think creatively is a high-level thinking skills that requires students to develop ideas so as to produce something new and give new understanding of existing concepts [5]. Four components of creativity that can be assessed, namely: (1) fluency; the skills to produce a number of ideas, (2) flexibility; skills to generate diverse ideas, (3) details or elaboration; the skills to develop, complete, or eliciting an idea; and (4) Originality; the skills to produce unusual ideas among most or rarely [6].

In addition, depending on the learning approach, student achievement in the learning process is also effectd by the students' initial mathematical abilities, or what is called IMA. This skills is mathematical skills of the students before the learning process begins. In the process of teaching learning, students' initial mathematical abilities are grouped into three categories, namely high, medium, and low categories. The purpose of grouping students based on IMA is also to investigate whether there is a shared effect between learning and IMA on improving students' creative thinking skills. This is in line with the opinion of Tandililing [7] that students' initial skills to learn new ideas depends on their previous knowledge that existing in cognitive structures. In his research, Tandaliling investigated information about students' initial mathematical abilities and mathematical creative thinking through problem-based learning.

Another factor that effects learning is the culture in the local community. Culture is very decisive in how students view things, including in understanding mathematical topics. When the topics is so far from the cultural scheme they have, of course the topics will be difficult to understand. For this reason, an approach is needed in mathematics learning that is able to connect between mathematics and students culture. For this reason, efforts must be made to improve students' mathematical creative thinking skills based on culture. The culture chosen by researchers is Batak-Angkola culture. The reason for choosing Batak-Angkola culture is because the majority of students are in SMP N 2 public school Arse Subdistrict is has Batak-Angkola culture background. Integration of culture in learning pproach can be expected to show positive results, in accordance with the results of the study of [8] which states that learning based on Javanese and Madurese culture (etnomatematics) shows very positive results. Positive results is indicated by the results of good work of the students in doing mathematics work sheet and good result test on Comparative topic. This learning is also able to improve students' skills to present their work in front of the. Open-ended approach can also link mathematics material with local culture. So, indirectly, through learning mathematics students' appreciation to their culture does not fade and students can get to know and appreciate their own culture. This is important, because by incorporating culture into mathematics learning enable to motivate students to learn mathematics, it can also shape positive character of students that reflects cultural values. Then, question of the research is could integration of Batak-Angkola culture on Open-ended approach(BAC-OE) approach improve mathematical creative thinking skills, and is there any interaction between learning approach and IMA towards students mathematical creative thinking skills.

2. Theoretical Review

Creativity includes original ideas, different perspectives, solving chains of problems, recombining ideas or seeing new relationships between ideas. The skills to think creatively includes the objectives of mathematics learning in schools [9]. This is reasonable considering that creativity can produce something new. When students are trained to think creatively through mathematics, they are trained to think creatively in other areas of life. There are four aspects in the skills to think creatively that can be assessed, namely fluency, flexibility, authenticity and elaboration. These abilities can be increased through open-ended problems. Because open-ended problems provide opportunities for students to explore and develop their abilities freely. Learning by using Open-ended approach can improve students' mathematical creative thinking skills [10].

Like any other skills, creativity can improve through learning. According to Shimada& Becker [11] "Open-ended approach is a learning approach that presents a problem that has more than one answer or method for solving the problems". Open-ended approach promises an opportunity for students to explore various ways that they believe in accordance with the skills to elaborate on the problems given. In Open-ended approach, the problem is open. Through the Open-ended approach students are required to make observations, ask questions, determine relationships to show the reasons and draw conclusions. Therefore, Open-ended approach has a lot of compatibility with mathematical thinking components. Learning by using Open-ended approach is more meaningful if the students' activities to think about and their interests so that eventually it will form mathematical intelligence.

Inferred from Shimada that learning with an Open ended approach can improve students' creative thinking skills. Because Open-ended learning requires students to be creative in providing diverse answers to a problem. An integrated Open-Ended learning approach to culture can improve students' creative thinking skills. This can happened because of learning related to local culture can make students more easily understand the mathematical problems they face. The integration of culture in learning can be expected to show positive results, since learning through culture make the students familiar to the problem situation so that it helps students to understand the problems easier (Aufa, Saragih, Minarni, 2016).

3. Research Method

This research was categorized in quasi-experimental research, which was conducted in Middle Secondary School (MSS) 2 Arse Subdistrict with all of the students at 8 grade as a population. Class VIII-1 (as experiment class) and VIII-2 (control class) as a sample. The design used in this study is Non Equivalent Control Group Design as explained in Table 1 below:

Table 1. Experimental Design

Group	IMA	Treatment	Post Test
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

3.1. Subjects and Objects of Research

The population in this study was all of the students at 8 grade as a population. Students at Class VIII-1 (as experiment class) and VIII-2 (control class) as a sample.

3.2. Instrumentation and Data Analysis

Instrument used in this research consisted of MPSA test.

In Batak Angkola culture, salak fruit is sold in packaging units of measurement 'chopsticks'. Students will be very familiar if the theme 'chopsticks' are integrated in the mathematical problem scenarios. This study, designing a mathematical problem that is both realistic Angkola batak culture related. Another example, in batak Angkola culinary was known favorite food called ' sambal Taruma ' or ‘taruma chilli’ that tastes spicy and is often used as a complement to the fish at the time of eating rice. This kind of food is also integrated in the mathematical problems in this research. An example of math problem:

Problem

Adrian bought 3 chopsticks salak, and 2 packets of ‘trauma chilli’ and he had to pay Rp 72,000.00, while Gunawan buy 2 chopsticks salak, and 3 packs of ‘taruma chilli’ and he must pay Usd 58,000.00. Determine the price of 3 chopsticks salak fruit and 1 packet chili Taruma.

Along teaching learning activity, the students faced math problems such as the problem in the example above. Thus, it can be hoped that the students could master math topic in clear situation because the problem is familiar with them.

Data collection techniques in this study is tests to measure students' mathematical creative thinking skills (MCTS). Data processing begin with normality test and variance homogeneity test. After that, two-way ANOVA was carried out. All statistical calculations is done with the help of the SPSS 21 computer program and Microsoft Excel program packages. While, to improve students mathematical creative thinking skills, some problems are designed and presented in Student Activity Sheet (SAS). The students solved the problems in SAS at every mathematics lessons. The teacher act as a guide, facilitator, and as a helper whenever the students getting stucked in solving problems. Problems in SAS is designed based on aspect of creative thinking aspects and validated by three education experts.

4. Results

4.1. Description of Students' Initial Mathematical Ability

Mathematical initial skills (IMA) is a basic or backbone of the students formulation of new concepts in learning. The following table are the calculation results of the average and standard deviations of IMA from both classtoom (experimental and control class). Experiment class use integration of Batak-Angkola on Open-ended (BAC-OE) approach.

Table 2. Statistic of IMA of the Students

Class	IMA category	$\overline{x}$	s_d
BAC-OE	Low	33.33	3.27
	Medium	54.1	6.85
	High	76.57	4.86
Control	Low	33.14	1.95
	Medium	53.33	7.76
	High	76	4.62

Table 2 above shows that mean and standard deviation of the experimental class for students with IMA low category is 33.33 and 3.27, the medium category is 54.1 and 6.85 and the high category is 76.57 and 4.86. While the control class for students with IMA is low in the mean and standard deviation is 33.14 and 1.95, the medium category is 53.33 and 7.76 and the high category is 76 and 4.62. Figure 1 shows the diagrams of mean and standard deviations based on learning factors.

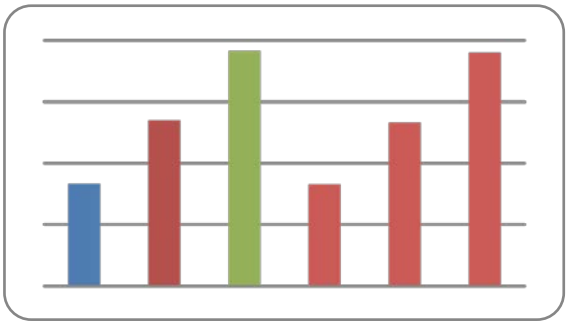

Figure 1. Average Score of IMA

In Figure 1 above, it appears that the average low IMA of the experimental class is 33.33 while the average low IMA of the control class is 33.14. The average medium IMA while the experimental class is 54.1 while the average IMA while the control class is 33.14. The average high IMA of the experimental class was 76.57 while the average high IMA of the control class was 76. So it can be concluded that the average IMA of experimental class is better than the average IMA of control class.

4.1.1. Test of Normality for IMA Data

The normality test used in this study is the Kolmogorov-Smirnov Test. The testing criteria are if D_0 is lesser than D_t then the sample from the population is normally distributed. Summary results are presented in Table 3 below:

Table 3. Normality Test of IMA

Class	N	D_0	D_{table}
Experiment	32	0.085	0,240
Control	32	0.093	0,240

It can be seen from Table 3 above that the successive D_0 values are 0.085 and 0.093 for the experimental class and control class. The second class D_0 value is less than D_t, so the data is normally distributed for the experimental class and control class. 2.

4.1.2. Test for Homogeneity of Students' Initial Mathematical Skills

After known that the two classes are normally distributed, then the process continued with testing homogeneity. Homogeneity test used in this study is the F-Test. The criteria for testing homogeneity using the F-test is if $Fcount<F_{table}$ then the variance of the two population is homogeneous, and if it has other prices then the variance of the two population is not homogeneous. The summary results are presented in Table 4 below:

Table 4. Homogeneity Test of IMA

Class	Varians (s^2)	F_0	F_{table}
Experiment	229.92	0.936	1.822
Control	245.66		

Based on Table 4 above it is obtained that the value of $Fcount<F_{table}$, that is 0.936<1.822, so the variance of the data group is declared homogeneous. This shows that both experimental class and control class data groups come from the population that has homogeneous variances. The testing criteria used are: if the significance value (sig.) is greater than 0.05, then H_0 is accepted. Meanwhile, the results of homogeneity calculation for the students' initial mathematical skills scores in the experimental class and in the control class using SPSS 21 are briefly described as follows:

Table 5. Homogeneity Test of IMA

Levene Statistic	df1	df2	Sig.
.148	1	62	.701

From the table, it can be seen that the significance score of students 'learning motivation questionnaire obtained p value 0.701>0.05, it can be concluded that the experimental class and control class for students' initial mathematical skills scores have homogeneous variance.

4.2. Description of Students' Mathematical Creative Thinking Skills

Summary results students' Mathematical Creative Thinking Skills is presented in Table 6.

Table 6. Statistic of MCTS

Statistic	Learning approach	
	Open-Ended	Conventional
N	32	32
Average	72.84	49.34
SD	16.32	16.01

In general, bar charts that describes the average score of mathematical creative thinking skills (MCTS) is presented in Figure 2.

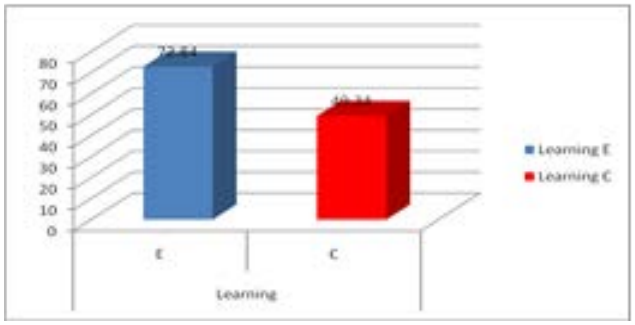

Figure 2. Average Score of MCTS

In Table 6 and Figure 2 above, it appears that the average mathematical creative thinking skills of the students who have an open-ended learning approach integrated Batak-Angkola culture is 72.84, while the average value of mathematical creative thinking skills of students who receive conventional learning is 49.34. So, the average of students' mathematical creative thinking skills in the experimental class are greater than the average of students' the mathematical creative thinking skills.

The overall results of the analysis of mathematical creative thinking skills based on IMA that students have is presented in Table 7.

Table 7. Average of MCTS based on Learning Approach

Group	IMA	MCTS			
		$\bar{X}$	s	Min	Max
Experiment	Low	62	8.04	52	70
	Medium	69.68	16.25	29	89
	High	90.71	6.94	81	100
Conventioal	Low	32.28	5.41	27	38
	Medium	48.66	12.91	27	70
	High	68.14	8.37	52	78

Table 7 shows that the mean and standard deviations of mathematical creative thinking abilities with low IMA are 62 and 8.04, while 69.68 and 16.25 and high are 90.71 and 6.94. Whereas for mathematical creative thinking skills of

the students with low IMA: mean and standard deviation are 32.28 and 5.41, while mathematical creative thinking skills of the students with high IMA: average score and standard deviation of experiment class and control class respectively are 48.66 and 12.91 and high are 68.14 and 8.37. A diagram of the average mathematical creative thinking skills of students based on the learning factors displayed in Figure 3.

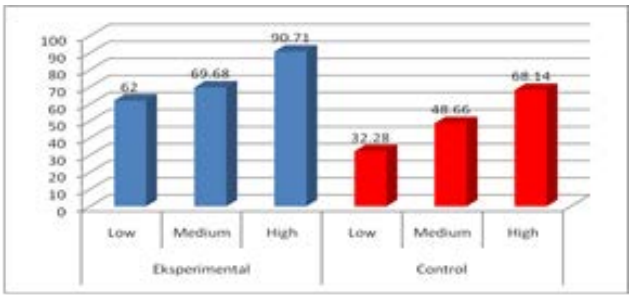

Figure 3. Average Score of MCTS at Each IMA Category

From Figure 3 above, it is known that overall the average mathematical creative skills of experimental class is better than the average skills at control class. Descriptively, there are several conclusions regarding the mathematical creative thinking skill a as expressed in Table 10 and Figure 3:

1. In low-skills, the average mathematical creative thinking skills of students who are given an open-ended learning approach integrated Batak-Angkola culture is62, higher than the average mathematical creative thinking skills of students who learn through conventional learning, that is only32.28.
2. For students with moderate abilities, the average mathematical creative thinking skills of the students who learn throug an Open-ended learning approach integrated Batak-Angkola culture is 69.68, higher than the average mathematical creative thinking skills of students who learn through conventional learning, that is only 48.66.
3. In high-skills IMA, the average mathematical creative thinking skills of the students who learn throug an Open-ended learning approach integrated Batak-Angkola culture is 90.71 looks higher than the average mathematical creative thinking skills of students given conventional learning, that is only 68.14.
4. Overall, the average mathematical creative thinking skills of the students at experiment class is 72.84, higher than the average skills of the students at control class, that is ontly49.34.
5. Standard deviation of math creative thinking skills of the students in experimental class is 16.32, higher than standard deviation of math creative thinking skills of the students in control class, 16.01.

4.2.1. Test of Normality of Mathematical Creative Thinking Skills Data

Table 8. Result of Normality Test for MCTS

Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
BAC-OE	.120	32	.200	.957	32	.229
Conventional	.148	32	.071	.922	32	.023

4.2.2. Homogeneity Test Data for Creative Thinking Skills

Based on the table above, it was found that MCTS data of the students who learn through integration of Batak-Angkola culture to Open-ended approach (experimental class) is normally distributed, so does MCTS of the students at conventional learning class (control class).

4.2.3. Homogeneity Test Data for Creative Thinking Skills

Table 9 shows that significance value (sig.) = 0.749 of the test is greater than 0.05, then H_0 is accepted. Thus, both samples come from populations that have homogeneous variance. So based on the hypothesis test that has been done, it is stated that the research sample group comes from a population with normal distribution and homogeneous variance.

Table 9. Result of Homogeinity test of MCTS

Levene Statistic	df1	df2	Sig.
.103	1	62	.749

Summary result of ANOVA is presented in the following Table 10.

Table 10. ANOVA Output for MCTS

Source	SS	Df	SSA	*F*	*Sig.*
IMA (α)	7690.509	2	3845.254	25.94699	0.4280
B	8906.641	1	8906.641	60.1002	0.4801
Aβ	-121.939	2	-60.9694	-0.41141	-0.0815
Within	8595.398	58	148.1965		
Total (T)	25070.61	63			

Based on Table 10 above, we obtained the value of F_0 is 60.1002 greater than F_{table}= 4.007. It was concluded that there was enough evidence to reject H_0. This means that there is an effect of the learning approach towards students' matheamatical creative thinking skills. For the existance of interaction, we obtained F_0 value is 25.94699 is greater than F_{table} = 3.156. It was concluded that there was enough evidence to reject H_0. This means that there is an effect of IMA on students' creative thinking skills. The summary results are presented in Table 11.

Table 11. ANOVA Test Result for MCTS

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	16485.618[a]	5	3297.124	22.341	.000
Intercept	196193.695	1	196193.695	1329.37	.000
IMA	7357.093	2	3678.547	24.925	.000
Learning	7638.861	1	7638.861	51.760	.000
IMA * Learning	182.400	2	91.200	.618	.543
Error	8559.820	58	147.583		
Total	263922.000	64			
Corrected Total	25045.438	63			

a. R Squared = .658 (Adjusted R Squared = .629).

4.3. Analysis of Learning Approach Effect

To investigate effect of learning approach, testing hypothesis is carried out as follow:

H_0: $\beta_1 = \beta_2$

$H_a : \beta_1 \neq \beta_2$.

Based on the ANOVA test results in Table 10, it can be seen that the calculated F value is 51.760 and the significance value $\alpha = 0.000$. Significant level of Open-ended learning approach integrated to cultural of Batak-Angkola is smaller than $\alpha = 0.05$. Thus, H_0 is rejected and Ha is accepted. So, it can be concluded that there is an effect of integration of Batak-Angkola culture on Open-ended approach (BAC-OE) towards the skills of mathematical creative thinking.

To see the percentage of the effect of BAC-OE towards mathematical creative thinking skills, look at Table 10. The percentage is 48.01%. With the aid of SPSS 21, the result of effect test is presented Table 12.

Table 12. Effect of Learning Approach to MCTS

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.798[a]	.636	.624	12.280

a. Predictors: (Constant), learning, model,

From Table 12, it can be seen that the coefficient of determination of R-Square is 0.624 (62.4%). Variation in dependent variable (students' mathematical creative thinking skills) can be explained by learning approach (BAC-OE and conventional learning), meaning that the percentage of the effect of the independent variable on changes in the dependent variable is 62.4%, while 37,6% is because of the effectd of other variables. Thus, integration of Batak-Angkola culture on Open-ended approach gives 62.4% contribution towards the improvement of mathematical creative thinking skills of the students.

4.4. Interaction Between Learning and Initial Mathematical Skills

The hypothesis proposed for the ANOVA test is formulated as there is no interaction between learning approach and students 'initial mathematical ability in influencing students' mathematical creative thinking skills. With an altenative hypothesis: there is an interaction between the learning approach and the students 'initial mathematical ability in influencing students' mathematical creative thinking skills. Statistically, it is presented as follows:

$H_0 : (\alpha\beta)_{ij} = 0$, i=1,2,3 ; j=1,2

H_a : at least one $(\alpha\beta)_{ij} \neq 0$.

From Table 10, information is obtained that the calculated F value is 0.618 and the significance value (sig.) for the IMA category is 0.543 greater than $\alpha = 0.05$, which means that H_0 is accepted and rejects alternative hypothesis, meaning that there is no interaction between the learning approach and the initial mathematical skills students in influencing students' mathematical creative thinking skills. So there is a shared effect learning approach and IMA on students' creative thinking skills. This means that the difference in the average score of mathematical creative thinking skills of students with IMA categories respectively low, medium and high between those taught with BAC-OE is not significantly different. More specifically, there is no interaction between student learning and IMA towards students' mathematical creative thinking skills. This finding is presented in Figure 4:

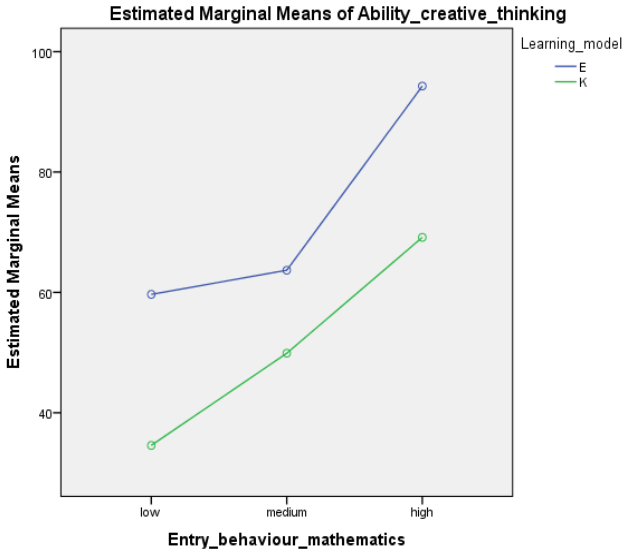

Figure 4. Interaction between Learning Approach and IMA to MCTS

5. Conclusions

Based on the results of data analysis the following conclusions are obtained:

1. There is the effect (effect) of integration of Batak-Angkola culture on Open-ended approach towards students' mathematical creative thinking skills.
2. There is a difference of mathematical creative thinking skills of the students who learn trough BAC-OE approach and their counterpart in conventional classroom.
3. There is no interaction between learning approaches and IMA towards students' mathematical creative thinking skills.

6. Suggestions

1. For Teachers: the teacher must create a learning atmosphere that provides opportunities for students to express mathematical ideas in their own language and ways, so that students become brave in arguing, confident and creative.
2. The teacher must provide various views and problems related to the material being taught and present various apperceptions to students. This will have an impact on each student to be able to know the application of material in their daily life.
3. The teacher must manage the time effectively. The learning step that spends a relatively large amount of time is occur when organizing group discussion. It is suggested that groups discussion should be formed first, so that the time usage can be concentrated on group investigations and to present the results of group investigations.
4. For related institutions: BAC-OE approach that has the purpose to improve students' creative thinking

skills is still very unfamiliar to teachers and students, therefore it needs to be socialized by schools or related institutions in hopes of improving mathematical creative thinking skills.

5. BAC-OE approach can be used as an alternative learning that is useful in improving students' mathematical creative thinking skills on the subject of the circle. Then it can be socialized to teachers so that it can be used as an effective learning approach for other mathematical subjects.
6. To Advanced Researchers: (a) BAC-OE can be tried to implement in other topics of mathermatics, (b) The implementation of BAC-OE can be collaborated with other factors, such as students' attitudes and interests, economic backgrounds, mathematical disposition, and so on, so that students mathematical creative thinking skills could be improved by more significant factor.

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