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Can the MM Learning Model Improve Results of Students' Mathematical Cognitive Learning?

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ABSTRACT

The learning model of michelson morlay has a significant effect on the improvement of students' mathematical cognitive learning outcomes. This quasi-experimental research aimed to reveal differences in students' cognitive learning outcomes between experimental and conventional classes. Limited information related to the MM model and playing cards in integer matter mathematics learning encouraged this research to be conducted. MM model is one of the latest models or inventions that have not been developed. MM research instrument developed in the form of a description and validated by a mathematician before the research done. The results revealed that, there was no difference in pretest score between students who experienced conventional learning and MM. The T-test results were also revealed that the posttest of students studying with MM equipped with higher playing cards when compared with conventional class. The findings of this study suggest that it is important for teachers to empower students' cognitive abilities through MM and games in order to make learning more meaningful and contextual. Thus the MM learning model can be recommended in developing and improving students' cognitive learning outcome mathematics. Future research will explore the effect of MM on emotional intelligence, critical thinking of students and other variables related to mathematics learning.

Keywords: michelson morlay (MM), playing cards, conventional, cognitive learning outcomes

INTRODUCTION

The 21st century has been running for a decade in a pluralistic society, but the development of the education world has been felt to be a very rapid shift, even fundamental changes in learning (Saavedra & Opfer, 2012; Voronina et al, 2017). The progress of the 21st century differs from the 20th century especially the emergence of the development of information and communication as well as cutting-edge technology (Kim et al., 2012). It is no exaggeration to say that the advancement of science forces teachers to be challenged more creatively in preparing the gold generation of the nation ready to compete globally (Kenderov, 2006). In support of all that exists then the student must have good knowledge. Globally Indonesia is still lagging behind in mathematics learning compared to China which now also outperforms the western countries (Wang & Lin, 2009). These results can be seen from 100 participants of international mathematics competition from several countries in the world, it can be seen that Indonesia is not included in the top 100 awarded (IMO, 2017). The existing data proves that Indonesia should do a lot of breakthrough and evaluation in the learning system. In this regard, the Indonesian government has sought to improve the quality of human resources in the field of education, which revises the curriculum regularly to meet student needs (Leasa et al, 2016).

Not only the curriculum but also the planting of the concept or knowledge from the teacher to the students to overcome the problems ahead. Understanding the concept of mathematics became an important indicator in continuing studies on higher education (Duncan et al, 2007). Therefore it is necessary to change the conceptual

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Contribution of this paper to the literature

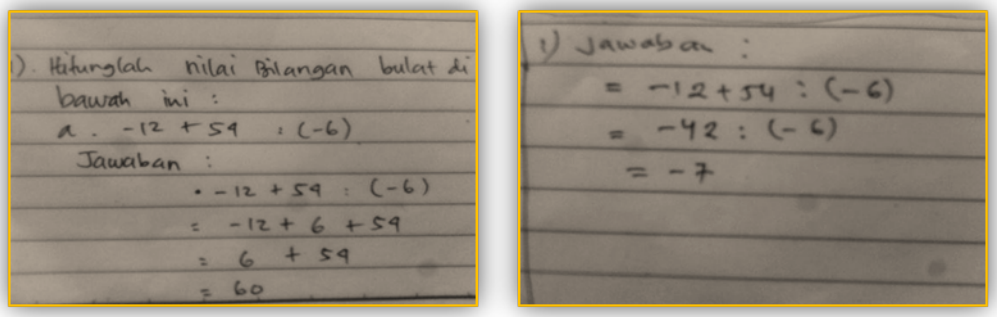
- A variety of learning media that are often used by students in everyday life that can be utilized to improve the quality of learning. Through teacher innovation, playing cards can be utilized in mathematics learning of integer topics.
- The MM model through playing cards on integer materials can improve students' academic pretensions, as students are empowered to solve real-life problems and reduce students' misconceptions.
- The MM model is one of the most effective models for encouraging self-confidence, intellectual skills and scientific reasoning that impact on improved cognitive learning outcomes.

students to actualize themselves in solving problems in everyday life (Cai and Howson, 2013; Ozturk & Guven, 2016). Many things are still a problem in learning, among students still make the classroom as a playground not as a place to serve in developing science (Gallenstein, 2005). Math learning is the main icon of several disciplines (Wasike, 2006) which is considered the most complicated student when compared with other lessons (Tambychik & Meerah, 2010) this is influenced by the teacher in explaining to his students. If the teacher's ability is low and has a poor concept of presenting mathematical material in the learning process, then it is certain that students will tend to assume that mathematics learning is difficult, complicated, boring, and frightening. If this continues to be left constantly, the student's cognitive math results will always be low.

Mathematics as the creation of the human mind (Awofala & Nneji, 2012) which is the language of precision (Awofala, 2011) and the encouragement in creativity, thought and problem solving required essentially to develop science, technology, and engineering knowledge. The purpose of mathematics learning is to develop individual ability and self-control ability and self-control (Milli, 2004). Therefore, mathematics should be taught in a new way (Charles & Chamel, 2005), in helping develop intellectual skills (Slavich & Zimbardo, 2012).

An integer is a material that is taught in grade 7 of a junior high school in Ambon city. An integer consists of an original number or a positive integer, a zero number, and an opposite of a natural number or a negative integer and the set is usually denoted by the letter B. Based on the question and answer with the mathematics teacher and the student observation result, then there are some problems that arise in the learning process, such as students who are less active, students who are still afraid to ask teachers, and students who are less interacting with other friends that affect their learning outcomes. One example problem is "specify the result of the following integer count operation: -12 + 54: (-6)." In this case, there are 19 students from 30 students of class VII who answered almost the same namely:

In **Figure 1(a)**, students work on the problem with a reference to a negative number, but in a positive share of results. This causes the student work is not appropriate. While in **Figure 1(b)**, students do the problem without seeing the negative sign of the number that will be summed, so that the student work is not correct. From the answer, students should do the problem by observing the sign of what operation should be done first, which must be done first is the sign of division operation after the results can be summed with the existing numbers, so the correct answer is (-21).



(a) "Count the integer value below :" (b) "Answer :"

Figure 1. Picture of Student's Work Results

The low learning outcomes of students due to the use of models that are still teachers -centered. Teachers are still using conventional learning model with the implementation phase starting from explaining the material, giving examples, and continued with practice questions. Until now student learning outcomes in the city of Ambon are still relatively low (Leasa & Corebima, 2017), this is due to limited information and communication when compared to other regions in Indonesia. Another factor that causes learning in Ambon is still low is the proverb which is

always implanted in descendants with the phrase "at the end of rattan there is gold" this sentence is the basis that learning must use rattan so it can make students more afraid (Leasa et al, 2017) . But what is expected from the learning is the humanist pattern that should be used by teachers in improving students' cognitive learning outcomes, not the pattern that should be used by teachers to snap children.

Based on existing problems then used one of the learning model that is considered effective and humanist to improve student learning outcomes on the matter of integers that is michelson morlay learning model that contains elements of meekness combined with playing cards game. A playing card combined with MM can contribute to student learning outcomes. It can be seen that students who are still elementary-junior high school is still in different categories to play with high school students or college students. Therefore, teachers design learning with a meaningful game so that students do not get bored in learning mathematics. Ambon city as an icon of the province of Maluku is still limited with ICT technology so the teacher must design the learning pattern by utilizing the materials that can be obtained in the surrounding environment by using playing cards as learning media.

MM learning model combined with playing cards is the latest learning model or principle and has never been developed by others. This model is inspired by the world physicist who came from the United States named "Michelson and Morley". They say that the ether exists and becomes the medium for sunlight to the earth. Based on this philosophy, the MM model is developed with the idea that teachers are "ether", all activities for students can understand and understand there must be teacher intervention. Teachers will use all of their abilities to design all learning so that students can understand and understand math well. With regard to the MM model developed under the name "Michelson Morlay" aims to have different characteristics with American physicists. MM model in this learning combined with playing cards, the goal is for students more eager in learning. The learning patterns using playing cards in this lesson are very different from the actual playing cards. The playing cards in this lesson are used as media and where the integer issues are embedded.

As for the steps of the MM learning model, 1) before the learning process begins the teacher will divide the students into 5 groups with the heterogeneous students, 2) the group representatives will move forward to hear the teacher's direction, the group members remain in the group, 3) When the representative of the advanced group of teachers will give instructions by showing the playing cards in the upside position, furthermore the teacher will instruct each representative from group 1-5 to take the card held by the teacher, 4) the teacher will give the pointer with the sentence, in this card there are some (5) fellow group members collaborate on resolving existing problems or problems, 6) group members will be appointed by the teacher to present their work, 7) the language used in the discussion must contain the elements of the meekness with the aim of humanist, organized and mutual learning appreciate, 8) the teacher will respond and evaluate the results of the presentation of the students, 9) the teacher re-show three playing cards in reverse position and one of the appointed students will take one of the three katu held by the teacher, the card is used teachers to re-reflect on learning that has been done to understand their mathematical concepts. Thus this study aims to reveal how the influence of MM learning model on integer matter.

METHOD

Type of Research

This research includes quasi experimental research that aims to reveal how the effect of cognitive learning result of mathematics of students with MM model of learning to students on integer material. MM and conventional learning model is independent variable, while cognitive learning result is dependent variable.

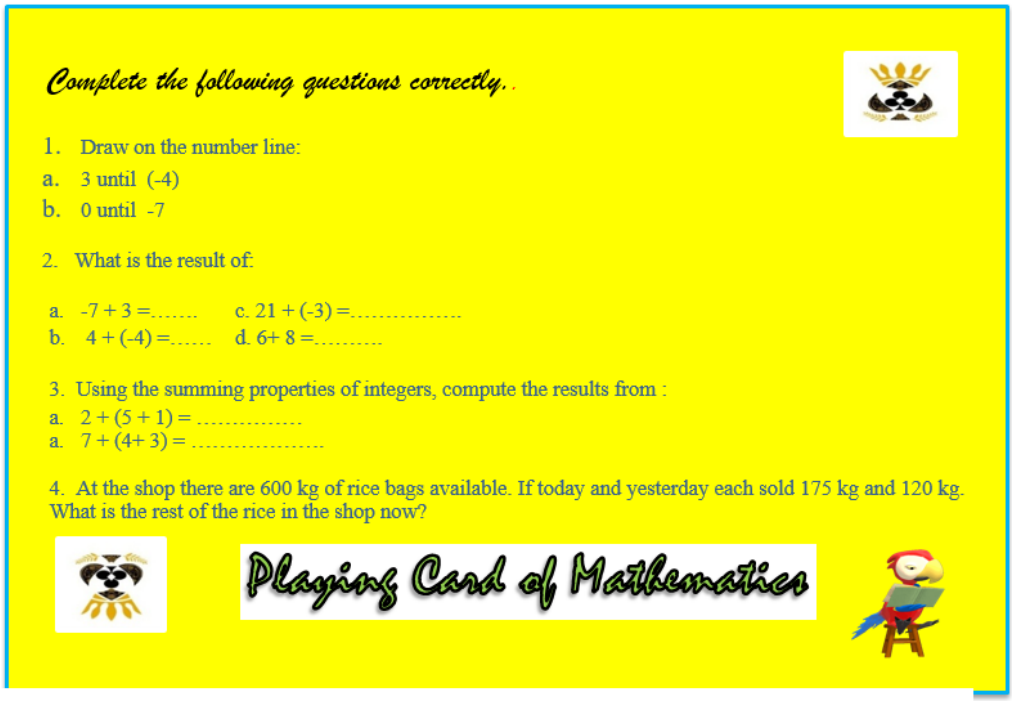
Population and Sample

The population in this research is the seventh grade students of SMP. The sample in this study amounted to 60 students determined randomly. The study sample focuses on junior high school 1 in Ambon City with low school status. Classes used in the study in the form of experimental class (n = 30) while the control group (n = 30). Students in the experimental group used MM, while students in the control group received conventional learning. Mathematics learning is done 2 hours per week for all students. The topic to be learned is an integer.

Instrument of Research

The research instrument used is a test question as much as 10 items. The instrument was developed by researchers after it was validated by a learning expert and mathematician and the test instrument of cognitive learning outcomes has been empirically tested.

Problem developed to measure student learning outcomes are:



Analysis of Data

The data of the research were analyzed by T independent samples test to reveal differences of students' creative thinking skill in control and experiment group. Data analysis is assisted with SPSS version 20 for Windows. Before the data is analyzed, the prerequisite test is tested normality and homogeneity. The results of both prerequisite tests indicate that the distribution of data in the control and experimental groups is normal and homogeneous.

RESULTS

The results of the study started from looking at students' early ability in pretest activities. The average value achieved can be seen in **Table 1** below.

Table 1. Average Pretest Value

Class	Average
Experiment	60.35
Control	61.89

The pretest values of both classes have almost the same average value. The pretest of the experimental class obtains an average of 60.35 pretest control classes obtaining an average value of 61.89. Furthermore for the average student learning outcomes can be seen in **Table 2** below.

Table 2. Average Results of Student Cognitive Learning

Class	Average
Experiment	66.21
Control	61.57

Table 2 shows that the average learning outcomes of the experimental class is greater than the control class. Next will be described successively about: (1) test prerequisite analysis and (2) hypothesis testing.

Test Prerequisite Analysis

Test data normality

To find out whether or not the data distribution is normal, calculations are made using the Kai-Square test (*chi-square test*) for both classes and the results are obtained in **Table 3** below.

Table 3. Normality Test Result (α = 0.05)

Class	χ^2_{count}	χ^2_{table}	*Sig.*	A	Conclusion
Experiment	8	23.68	0.89	0,05	*H_0 is Accepted*
Control	6.67	18.31	0.76	0,05	*H_0 is Accepted*

Table 3 shows that in the experimental class, the value χ^2_{count} = 8 is smaller than χ^2_{table}= 23.68 and the Sig value is greater than the value of α = 0.05, it is 0.89. It is similar also seen in the control class, the value of χ^2_{count} = 6.67 is smaller than χ^2_{table} = 18.31 and the Sig value is greater than the value of α = 0.05, it is 0.76. This means that H_1 is rejected and H_0 is accepted. Thus it can be concluded that the research data taken is the data that is normally distributed.

Homogeneity test

In order to know the students' ability of both homogeneous classes or not, the two variance equations tested using the Fishers test to compare the variance of the two classes. The test results are shown in the following table.

Table 4. Homogeneity Test Result (α = 0.05)

Class	F_{Count}	F_{table}	*Sig.*	α	Conclusion
Experiment and Control	1.14	1,88	0,087	0,05	*H_0 is Accepted*

Table 4 shows that the value of F_{count}= 1.14 is smaller than the value F_{tablel} = 1.88 and the value of Sig. Greater than the value of α = 0.05, it is 0.087. This means that H_0 is accepted so that it can be said that the variance of both classes is homogeneous, meaning that the students' ability of both classes before being given treatment is homogeneous. Thus the data analysis can use the t-test.

Hypothesis Testing

Once it is known through the prerequisite test that the samples taken are normal and homogeneous, then the hypothesis test is done by using the t-test and the test results are shown in **Table 5** below.

Table 5. Results of Hypothesis Testing by Using t-Test (α = 0.05)

Class	t_{count}	t_{table}	*Sig. (2-tailed)*	*α*	Conclusion
Experiment and Control	1.68	1.67	0.002	0,05	*H_1* is Accepted

From **Table 5** can be seen that the value of t_{count}= 1.68 is greater than the value of t_{table}= 1.67 and Sig value. (2-tailed) is smaller than the value α = 0.05, it is 0.002. This shows that at the level of significance α = 5% H_1 accepted and H_0 rejected. These results indicate that H_1 is accepted and H_0 is rejected which states there is a difference in student learning outcomes taught by using MM learning model and conventional learning model on integer material.

DISCUSSION

The learning process at the pretest stage found that between the experimental and control classes retained their learning outcomes. This is evidenced by students having almost the same ability at the same level or level. Thus the school as an education institution has performed its duties and responsibilities well, where the process of admission of new students and the division of classrooms is determined based on the value of entrance tests in junior high.

In the posttest process there is a very big change in the experimental class with good learning outcomes, thus the MM learning model has a good reward stage when compared with conventional learning. At this stage students are given a verbal appreciation (praise) in the form of applause from the teacher to the student who has presented the work correctly and the unacceptable answer is given by telling the students your answer is extraordinary. By this award that creates student self-confidence so as not to be afraid in doing the problem and not feel ashamed of

the wrong answer. In the MM model students in groups exchange ideas in solving the problems faced. The MM model is still based on a cooperative learning pattern, which is an interesting topic for researchers for decades. CL is achieved by dividing the class into small groups that work together to achieve good results by helping each other among friends in a group (Aziz & Hossain, 2012; Buchs et al, 2015). CL can improve students' mathematics learning outcomes (Kolawole, 2007).

In the control class, students learn with conventional learning in the form of a mirror and question and answer. Dongsong (2004) argues that conventional learning is characterized by a speech which is accompanied by explanations and assignments and exercises. After giving the teacher materials then give examples of problems and do it. In this research, it can be seen that the students only record the material presented by the teacher in front of the class without any reciprocity, the students feel bored and very passive in the learning process, so that the students' learning outcomes have excellent value qualification in the control class (the class taught by using conventional learning model) does not exist, and there are still three students who have very less value qualification.

The existence of significant differences between the two classes is due to the experimental class taught by using the MM learning model. The teacher acts as a facilitator who is ready to provide assistance to groups or individuals who need help. In the first stage students will be divided into several groups by applying heterogeneous patterns. The purpose of this is to have a good social relationship between fellow members of the group. Shiva who have more knowledge will be mutually exclusive with low-knowledge students (van der Smith & Spindle, 2007). The next stage representatives of the group will come forward to take the cards they choose after which they will return to their respective groups to discuss resolving what is on the mathematical playing cards. The learning process with the help of playing cards in which there are problems provides opportunities for students to work together with their groups (Baghaei et al, 2007), and overcome individual student learning difficulties, this strategy is developed to increase student participation in the classroom so that it is superior to conventional learning which uses the basic rote method (Effendi, 2017). A group learning pattern teaches students to work together, if group members' issues have not been resolved then fellow members of the group will help to succeed their group work (Jolliffe, 2014). In relation to that, then, teachers play an important role to guide students to discuss, so that the creation of a more active learning atmosphere and fun through the stages that exist. Group learning has several advantages such as maximizing social life, improving learning motivation and improving students' cognition (Johnson & Johnson, 2009; Slavin, 2011)

The next stage the teacher will appoint group representatives to present the work to other groups. Each of the groups will ask questions so that the process of moving information will work. The purpose of this communication or presentation stage is to practice students' individualized communication skills (Prichard et al, 2006, 2011). At the end of this stage the teacher will straighten out the student's answers and provide direction for the student's erroneous answers. The final stage of the teacher will evaluate the individual by lifting three shirts, the representative of the designated group will go forward and select one of the three playing cards so that the card becomes the teacher's reference to ask questions in the form of questions to the students to re-examine the checks of their math concept. MM gives very different colors with other learning.

CONCLUSION

Based on the results of research and discussion concluded that the learning model michelson morlay able to improve the score of posttest result of cognitive learning outcomes of students on the matter of integers. Thus MM can be recommended in developing and improving students' mathematical cognitive learning outcomes. Related to that fact, MM can be collaborated with other mathematics material. Further research is expected to explore the effect of MM on emotional intelligence, critical thinking of students and other variables related to mathematics learning.

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