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Design of Literacy-Based Mathematics Learning Model by Utilizing Game Methods to Develop the Character and Creativity of Junior High School Students

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Abstract
The problem in this research is the low creativity of Junior High School students. The solution for this problem is the MB-LIPE model, which aims to develop students' character and creativity by utilizing the game method in learning. The type of research used is experimental research, namely implementing the MB-LIPE model in learning mathematics. The research design was carried out by a pre-experimental design with the type of One-Group Pretest-Posttest Design. The population in the study were students of Junior High School in Makassar, the sample in this study were students of class VII at Junior High School MTsN Makassar City. The results showed that students' creativity in the pre-test group obtained an average of 62, 75 (medium) with the results of the grouping categorization in the intermediate interval (60.50%). Furthermore, the implementation of the MB-LIPE Model learning treatment was given for 4 meetings. The creativity of the post-test group students showed an increase to 71.50 (medium), with the grouping categorization being in the medium interval (68.50%). The results of observing student activities in the MB-LIPE model learning are classified as active for discussion, and there is a change in character for the better. From the results of the study, it can be concluded that the MB-LIPE Model (1) can increase students' creativity, (2) can increase student activity in discussions, and (3) there is a change in character for the better. The creativity of the post-test group students showed an increase to 71.50 (medium), with the grouping categorization being in the medium interval (68.50%). The results of observing student activities in the MB-LIPE model learning are classified as active for discussion, and there is a change in character for the better.

Keywords*: Metacognition Skills; Problem Solving; Ethnomathematics.*

1. INTRODUCTION

Mathematics is a universal science that underlies the development of modern technology, has an important role in various disciplines, and advances human thinking. The rapid development in information and communication technology today is based on the development of mathematics in the fields of number theory, algebra, analysis, opportunity theory, and discrete mathematics. Therefore, mastering and utilizing technology in the future requires a strong mastery of mathematics from an early age.

Realizing the importance of mastering mathematics, then in the Law of the Republic of Indonesia No. 20 Th. 2003 regarding The National Education System (*Sisdiknas*) Article 37 emphasized that mathematics subjects are one compulsory subjects for students at the primary and secondary education levels. School mathematics is the form of mathematics subjects (R. Soedjadi, 2000) in primary and secondary education. School mathematics are elements or parts of mathematics selected

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based on or oriented to educational interests and interests to master and utilize technology in the future. Therefore, mathematics subjects in primary and secondary education are also intended to equip students with the ability to think logically, analytically, systematically, critically, creatively, and cooperate. These abilities (UNESCO, 1998) are competencies required by students to have the ability to obtain, manage, and utilize information to survive in ever-changing, uncertain, and competitive circumstances.

Students deal with personal, social, work, and scientific problems in everyday life. Many of these problems are related to the application of mathematics. Good mastery of mathematics can help students solve problems. Mathematical literacy also helps a person to understand the role or usefulness of mathematics in everyday life while using it to make the right decisions needed by society. Mathematical literacy skills (National Council of Teachers of Mathematics, 2003) are considered one of the important components required by students in analyzing, giving reasons, and conveying ideas effectively, formulating, solving, and interpreting mathematical problems in various forms and situations. This shows that mathematical literacy is very important for students to be able to understand mathematics not only in the mastery of the material but also in the use of reasoning, concepts, facts, and mathematical tools in solving daily problems and require students to communicate and explain the phenomena they face with mathematical concepts. The lack of mathematical literacy skills makes students' ability to create, reason, and argue undeveloped, so solving mathematical problems in everyday life is difficult.

It is undeniable that Mathematics is a difficult subject for some students. According to students, "Mathematics lessons only revolve around numbers. The subject matter is difficult to understand because the object of study is abstract." As a result of this view, students' learning motivation is reduced, Mathematics lessons become uninteresting, boring, and saturated, and many other complaints arise about Mathematics lessons. Therefore, we must immediately find a solution to turn these perceptions into exciting learning. The trick is to change the learning habits of Mathematics (Istarani, 2012) which is always in the classroom, combined with learning games by using game media, both in-person games and games in the form of applications, so that students can get a meaningful learning experience because students more activate learning activities.

The game method (Andang Ismail, 2018) is a way of presenting the subject matter through various forms of game activities to create a fun, serious, but relaxed atmosphere so that students will learn happily, which can support the implementation of instructional objectives in teaching both cognitive, affective, and psychomotor aspects. Through learning *games* (Andang Ismail, 2018), students are expected to be able to understand abstract mathematical objects because the formation of knowledge involves understanding and learning experiences of students in playing. Creating a game medium that matches the mathematical material allows learning with the game method. Therefore it is necessary to understand the rational game-based mathematical learning model, the theory supporting game-based learning, and the need to develop a learning model design with a game method approach.

In line with contextual learning, game learning has endeavored in such a way that it becomes more meaningful learning for students because the creativity of the students can be increased by using various ways such as observing, asking, proving something, solving a problem, and others.

Through game learning, students can develop their talents, creativity, and potential so that they are expected to develop a character of curiosity, love to read, the ability to think logically, analytically, systematically, critically, creatively, and the ability to work together, hard work, discipline, and responsibility.

In the 21st century, it is very important to develop the numeracy literacy of students. Numeracy literacy skills need to be possessed by every student because these abilities can prepare students to live life outside the classroom, both in the community environment and the world of work. Therefore, integrating numeracy literacy learning through a game learning approach is very

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important. The results of developing a literacy-based mathematics learning model with the game method are expected to foster the development of student character and creativity development.

Observing the description above, updates and innovations were carried out on developing learning models in schools. Therefore, the author seeks to develop a mathematical learning model to foster the character and creativity of students. Based on the description above, the researchers examined the development of the MB-LIFE learning model with the hope that a mathematical learning model would be found that could foster student character and creativity.

The results of the development of MB-LIFE are then implemented in learning in schools.

2. MATERIAL

Learning Model

Model learning (Joice et al, 1992) is planning or pattern used to guide learning in the classroom or to determine learning tools, including books, movies, computers, curriculum, etc. Each learning model leads to designing learning to help students in such a way that learning objectives are achieved. Furthermore, (Joice et al, 1992) put forward 5 (five) important elements of a learning model, namely: (1) Syntax, which is a sequence of activities commonly also called learning phases or steps; (2) The social system, which outlines the role of teachers and students, as well as the necessary rules in socio-cultural interaction; (3) The principle of management reaction, which gives the teacher an idea of how to perceive or respond to students' questions; (4) Support system, namely the conditions necessary for the model to be implemented effectively and efficiently; and (5) Instructional and accompaniment effects, namely, the direct and indirect influences that students experience when the application of the model is carried out.

Furthermore, the learning model (Paul Eggen and Don Kauchak, 2012) is a learning perspective strategy designed to achieve learning objectives. While the learning model (Arends Richard, 1997) refers to the learning approach to be applied. In addition, it also refers to the learning environment and classroom management. Furthermore, Arends states that there are four distinctive features of the learning model, namely: (1) Theoretical rationales of a logical nature derived from its design; (2) Rationale about the learning task to be achieved and how students learn to achieve these goals; (3) Teacher teaching activities necessary so that the learning model can be implemented effectively; and (4) The learning environment necessary to achieve the goals.

Mathematical Literacy

In PISA, mathematical literacy is defined as follows: *"Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged, and reflective citizens".*

Mathematical literacy is the capacity of individuals to formulate, use, and interpret mathematics in various contexts. This includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe, explain, and express phenomena. This leads the individual to recognize the role of mathematics in life and make good judgments and decision-making needed by the constructive and reflective population. This understanding hints at mathematical literacy in mastering the material and using reasoning, concepts, facts, and mathematical tools to solve daily problems. In addition, mathematical literacy also requires a person to communicate and explain the phenomena he faces with mathematical concepts. Before being introduced through PISA, the term mathematical literacy had been coined (National Council of Teachers of Mathematics, 2003) as one of the visions of mathematics education, namely to become literate in mathematics. In this vision,

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mathematical literacy is interpreted as *"an individual's ability to explore, to conjecture, and reason logically as well as to use a variety of mathematical methods effectively to solve problems. By becoming literate, their mathematical power should develop"*.

This understanding includes 4 main components of mathematical literacy in problem-solving: exploring, connecting, and logical reasoning and using various mathematical methods. This main component is used to facilitate the solving of everyday problems that can at the same time develop their mathematical abilities. More simply, mathematical literacy (Ojose B, 2011) is the knowledge of knowing and using the basics of mathematics in everyday life. In this sense, a person with good mathematical literacy abilities is sensitive to mathematical concepts relevant to the phenomenon or problem he is facing. From this sensitivity, it is then continued with problem-solving by using mathematical concepts. In line with this opinion, literacy (Stecey, K dan Tuner, R, 2015) in the context of mathematics is to have the power to use mathematical thinking in solving everyday problems to be better prepared to face the challenges of life. The intended mathematical thinking includes the mindset of problem-solving, reasoning logically, communicating, and explaining. This mindset is developed based on concepts, procedures, and mathematical facts relevant to the problem at hand. Complementing the previous opinion, (Stecey, K dan Tuner, R, 2015) adds the word effective in the sense of mathematical literacy. Mathematical literacy is interpreted as the ability to use mathematical knowledge and understanding effectively in facing the challenges of daily life. A person who is literate in mathematics cannot only use his knowledge and understanding but must also be able to use it effectively.

Games as Learning Interactive Media

Interactive Learning Media can be used as a tool to channel messages (learning materials) to make them more interesting so that students prefer them and are not boring. Interactive multimedia learning can change students' mindset that learning is just that; every material will be more accessible for students to understand.

Game Methods as Learning Design

The game method is a way of presenting the subject matter through various game activities to create a fun, serious, but relaxed atmosphere so that students will learn happily, which can support the achievement of instructional goals in teaching cognitive, affective, and psychomotor aspects.

Along with the development of technology, an educator must be able to quickly adapt and use technology for learning development, especially during a pandemic like today. Online technology allows us to still interact with students, whether one-way or two-way. We can use various applications, for example, Google Classroom, Edmodo, WhatsApp, email, video call, video conference, zoom, Kemdikbud learning house, youtube, candy cbt, moodle LMS, and others.

METHODS

Research Design

The type of research used is a pre-experimental *one-group pretest-postest* research setting which examines the value of Mathematical Literacy Ability.

Research Location, Population, and Sample

The research location was carried out in Junior High School MTsN Makassar. The population in the study were students of Junior High School in Makassar. The sample in this study were students of class IX at Junior High School MTsN Makassar.

Data Collection Technique

Instruments used to collect data were observations, interviews, and scales. Scales were used to measure the value of Mathematical Literacy Abilitybefore and after treatment. Meanwhile,

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observations were conducted during the research to record the students' and teachers' responses to the learning model that had been developed.

Research Procedures

The effectiveness of the Model MB-LIFE through pre-experimental research design by performing the following steps: (1) conducting pretest, having learning processes in the experiment groups, (2) conducting posttest, and (3) analyzing the results of the experiments. The independent variable of the research was the MB-LIFE learning model, while the dependent variables were the early Mathematical Literacy Ability.

Statistical Analysis

The pre-test and post-test data were analyzed using descriptive and inferential statistics on the *IBM SPSS statistic 23* application. Descriptive statistics were carried out to obtain information about the data's mean, mode, median, maximum value, and minimum value. Meanwhile, the inferential statistics were used in the T-test paired sample test to see the influence of the MB-LIFE model learning. However, the normality test was conducted on the data before the T-test was administered.

RESULT AND DISCUSSION

Result

Results of the Descriptive Statistic Analysis

The results of the descriptive statistical analysis on the pretest and posttest of Mathematical Literacy Ability Refer to Table 1 below.

Table 1. The Results of the Descriptive Statistic Analysis on the Pretest and Posttest of Mathematical Literacy Ability

No.	Statistics	Pretest	Posttest
1	Mean	62.75	71.50
2	Median	62.00	71.00
3	Mode	52.50	75.50
4	Standard Deviation	9.36	7.62
5	Variance	87.58	57.95
6	Skewness	-0.22	-0.01
7	Kurtosis	-0. 68	-0. 95
8	Range	36	27
9	Minimum	42.50	58.50
10	Maximum	78.50	85.50

Source: SPSS Data Analysis Results

The descriptive statistical analysis results on the pretest of Mathematical Literacy Ability showed that: (1) the mean score was 62.75, (2) the median score was 62, (3) the mode score was 52.50, (4) the standard deviation score was 9.36, and (5) the variance score was 87.58, (6) the skewness score was -0.22, (7) the kurtosis score was -0.68, (8) the range score was 36, (9) the minimum score was 42.50, and (10) the maximum score was 78.50.

The descriptive statistical analysis results on the post-test of Mathematical Literacy Ability showed that: (1) the mean score was 71.50, (2) the median score was 71, (3) the mode score was 75.50, (4) the standard deviation score was 7.61, and (5) the variance score was 57.95, (6) the skewness score was -0.006, (7), the kurtosis score was -0.95, (8) the range score was 27, (9) the minimum score was 58.50, and (10) the maximum score was 85.50.

If the Value of Mathematical Literacy Ability is made in the form of categorization, then the categories are presented in the following table:

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Table 2. The Results of the Pengkategorian on the Pre-test and Post-test of mathematical Literacy Ability

No.	Interval	Category	Pretest		Post	
			Frequency	Percent	Frequency	Percent
1	0-20	Very Low	0	0%	0	0%
2	21-40	Low	0	0%	0	0%
3	41-60	Keep	10	33%	3	10%
4	61-80	Tall	20	67%	23	77%
5	81-100	Very High	0	0%	4	13%
Sum			**30**	**100%**	**30**	**100%**

Further, the above table of categories is created in the form of a histogram as follows:

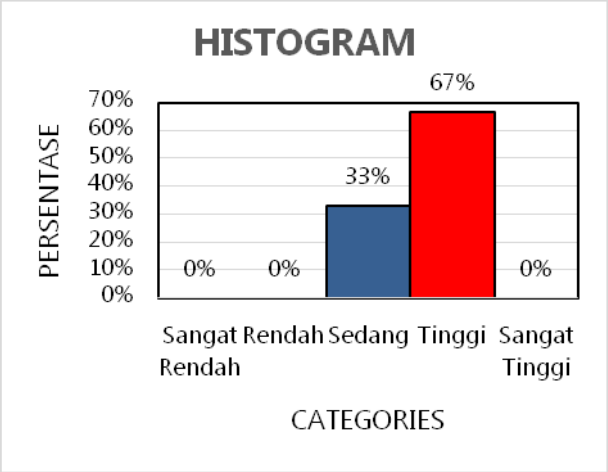

Figure 1. Histogram Pretest of Mathematical Literacy Ability

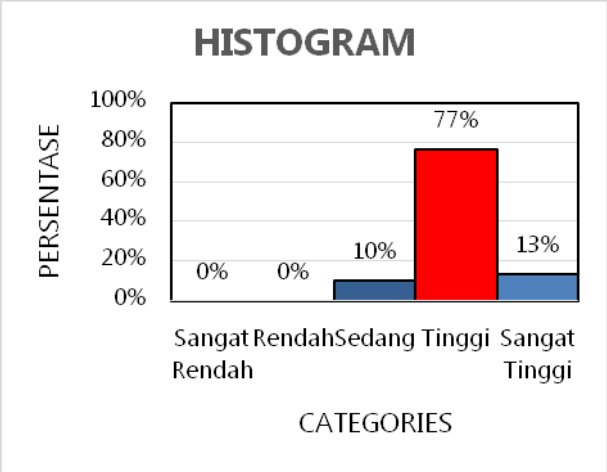

Figure 2. Histogram Posttest of Mathematical Literacy Ability

Results of the Inferential Statistic Analysis: T-Test

Result of the data analysis T-Test of value Mathematical Literacy Abilityas follows:

Table 3. The result of the Data Analysis T-Test of value Mathematical Literacy Ability

	Paired Samples Test		
	T Stat	df	Sig. (P-value)
Pair: Post-Pre	3.908	29	0.000

Source: SPSS Data Analysis Results

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Based on the results of data analysis, a calculated t value of 3.908 with an opportunity value (significance) of 0.000 is smaller than the alpha value of 0.05, which means that it is statistically necessary to accept the H1 hypothesis and reject the H0 hypothesis, namely, there is a significant difference in the average value of MathematicalLiteracy Ability between pre-test and post-test. When paying attention to the average value, the average value of pretest problem-solving ability was obtained by 62.75; then, there was an increase in the average value of post-test problem-solving ability by 71.50. This indicates that the MB-LIFE Model can effectively improve students' Mathematical Literacy Skills.

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