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Mathematical Literacy Reviewed from the Student's Cognitive Style in the Problem Based Learning Learning Model Assisted by the Learning Management System

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Abstract

This study aims to find out the PBL model assisted by LMS is effective in improving mathematical literacy skills, to determine the effect of mathematical literacy skills on the PBL learning model assisted by LMS in terms of students' cognitive styles, and to determine the description of mathematical literacy in terms of students' cognitive styles in the PBL-assisted learning model. LMS. This type of research is explanatory sequential mixed methods. Non-equivalent research design (Pretest-Posttest) Control Group Design. Data collection techniques using tests, questionnaires, observation, documentation, and interviews. The research was conducted in class XI SMA N 1 Semarang. The research sample is in class XI MIPA 4 and XI MIPA 5. Based on the results of the study it was found that (1) PBL Learning Model Assisted LMS Effectively Improves Mathematical Literacy. (2) The positive effect between students' cognitive style (visualizer-verbalizer) and mathematical literacy in the PBL learning model assisted LMS is 51.3%. (3) Visualizer subjects who have high literacy skills meet 6 aspects of 7 aspects of mathematical literacy indicators, visualizer subjects who have moderate mathematical literacy skills meet only 5 aspects and visualizer subjects who have low mathematical literacy skills meet 3 aspects. (4) Verbalizer subjects with high criteria in their mathematical literacy ability meet 5 aspects of 7 aspects of mathematical literacy indicators, verbalizer subjects who have moderate mathematical literacy skills meet 4, and verbalizer subjects who have low mathematical literacy skills meet only 3 aspects.

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INTRODUCTION

Formulation, use and interpretation of mathematics from various contexts including the ability to reason with mathematics and the use of concepts, procedures, facts as a means of describing, explaining, and predicting a phenomenon or event is a personal ability that PISA interprets as mathematical literacy ability (Sumirattana, 2017: 308). From this statement, mathematical literacy helps someone to understand the usefulness of mathematics in everyday life as well as to make the right decisions as constructive, caring, and reflective citizens (OECD, 2017). Indonesian students in mathematical literacy skills are still at a low level (OECD, 2017). Anwar, 2018: 153). This happens because mathematical literacy is not one of the subjects in Indonesia but can be taught to students through learning mathematics for several reasons (Lestari, 2019: 2). This is also the case by the international survey organization PISA (Programme for International Student Assessment) organized by the OECD (Organization for Economic Co-operation and Development) as evidenced by research on mathematical literacy skills which is held once every three years for 15-year-old students. Since 2000 Indonesia has been actively participating and then following every three years thereafter. the final grades of Indonesian students in 2015 were still at the lower level, although there was an increase in grades from the previous year, although not significantly. The average mathematical literacy score in 2015 was 386 (level 2) while the international average score was 496 at level 3 ("Indonesian PISA Ranks and Achievements Have Improved," 2016). Mahdiansyah and Rahmawati (2014) suggest that there are three factors that influence students' mathematical literacy skills, namely personal factors, instructional factors, and environmental factors. The following is Table 1. Which explains the three factors.

Table 1. Description of Mathematical Literacy Influence Factors

Aspect	In terms of:
Personal Factor	students' perception of mathematics students' confidence in mathematical abilities.
Environmental factor	teacher characteristics and the existence of learning media in schools. (Gusnidar (2017: 63)
Instructional Factor	intensity, quality, and teaching methods, which include learning strategies and approaches.

According to a survey conducted by Faiz (2019) with one of the class VIII teachers who teaches mathematics in junior high school, most students find it difficult to explain concepts or symbols. According to Sari & Budiarto, (2016) as an environmental response, to process and organize information students will choose the preferred way. The method of receiving and processing information acquisition by students is known as cognitive style. This includes personal factors (Mahdiansyah and Rahmawati, 2014). The cognitive style that is the focus of the researcher is the cognitive style proposed by Paivio in 1971, namely the verbal system (verbalizer) and the visual system (visualizer) (Mcewan & Reynolds, 2007: 4).

The next factor that dominates the mathematical literacy ability is the instructional factor. In the instructional factor regarding the seriousness in the delivery of learning by the teacher to his students which results in the quality of the information provided which includes models, strategies, methods, and approaches used during the learning process to manage activities in the classroom in a conducive manner. And another factor is from the environment. This environment means the characteristics of the teacher which can be viewed from the level of understanding of the cognitive style of each student. Not least that teachers do not know or understand what cognitive styles are in students, so it becomes an important focus for teachers to know what cognitive styles are and even know how many kinds of cognitive styles there are.

Problem Based Learningis a learning model based on problems. Based on the problem at the beginning of learning, it will be able to help students improve their mathematical literacy skills because

students are formed from the beginning to learn a concept to be able to solve related problems.Barrows, (Barrett, 2010) argues that the Problem Based Learning model is a learning process in the classroom through a work process that aims to understand the problems presented at the beginning of learning by the teacher who as a facilitator will thus demand active students.

The origin of the word "media" from the Latin medius which means "middle", "intermediary", or "introduction". "Intermediary" or "introduction" of messages from the sender to the recipient of the message is the meaning of "media" in Arabic (Arsyad: 2012). Hamalik argues that using learning media in the learning process can increase new desires and interests, generate motivation and stimulus for learning, and even influence students' psychology. Using learning media at the learning adjustment stage will greatly help the effectiveness of the learning process as well as in conveying the content of the lesson (Arsyad: 2012). Kemp and Dayton suggest the use of learning media is to increase the quality of student learning outcomes (Putra: 2015). Media can be hardware such as computers, televisions, projectors, and software used on the hardware. One of the online media used as e-learning media is Google Sites.

Based on the explanation above, cognitive style is one of the important variables that affect students' mathematical literacy and the selection of learning models, and the use of media can be more effective in learning. The limited research on mathematical literacy in terms of the visualizer and verbalizer cognitive styles with the LMS-assisted PBL learning model (google site) made researchers interested in conducting this research because the study of students' mathematical literacy based on cognitive styles (visualizer and verbalizer) on the PBL model assisted LMS is an innovation in the field of educational research, especially in the field of mathematics education. The formulation of the problem that will be discussed in this article is whether the PBL model assisted LMS is effective in improving students' mathematical literacy and Is there an effect of students' cognitive style (visualizer-verbalizer) on mathematical literacy in the LMS-assisted PBL learning model, and how is the description of mathematical literacy in terms of students' cognitive style in the LMS-assisted PBL learning model.

METHOD

This type of research is explanatory sequential mixed methods. Nonequivalent research design (pretest and posttest) control group design. The population in this study were students of class XI semester II SMA N 1 Semarang. The sampling technique used is the Simple Random Sampling technique, in this way the researcher determines 2 classes from class XI SMA N 1 Semarang as classes that will be used as research samples to apply the PBL learning model assisted by LMS (google sites) to be applied in class XI MIPA 5 as experimental class and LMS-assisted discovery learning learning model (google sites) in class XI MIPA 4 as the control class.

Quantitative data collection techniques are carried out by giving tests in the form of description questions. The test given is a test of mathematical literacy ability in which the items in the description each measure indicators of mathematical literacy ability. The test was given twice, namely the initial ability test (pretest) and the final ability test (posttest).

Data collection techniques in qualitative research are (1) VVQ, (2) interviews to determine students' mathematical literacy skills, interview guidelines used in this study are semi-structured forms (3) research documentation, (4) observations to determine teacher performance and activities student. The observation technique that will be carried out is direct observation. Provide an observation sheet on the implementation of learning to get data about teacher activities. Filling in the observation sheet is done by means of a check list. The activity of filling in the observation sheet is carried out after the learning process has been completed.

RESULTS AND DISCUSSIONS

Quantitative data analysis was assisted by SPSS 17 application. Posttest data analysis was carried out after the end of treatment. Quantitative data analysis was analyzed by two-party and one-party t-test. However, before conducting the pretest, the cognitive style of the experimental class and

control class students was classified to determine the cognitive style of each student.

Table 1 Cognitive Style Classification Recapitulation

No	Cognitive Style	Amount	Percentage
1	Visualizer	16	43.32%
2	Verbalizer	11	29.73%
3	Negligible	10	27.03%

Based on the table above, there are 16 students who have Visualizer cognitive style and 11 students who have verbalizer cognitive style. And 10 other children have other cognitive styles that are ignored.

After grouping the cognitive styles, the next step is to carry out a pretest to determine the initial ability of the two samples, namely the experimental class and the control class, of course the prerequisites have been tested first. Here are the resultsanalysis of the similarity test of the two initial data averages in Table 2.

Table 2 Test the Similarity of Two Means of Initial Data

Data	Sig.	Information
Pretest Score (2 classes)	0.185	H_0 accepted

Based on Table 2above obtained the value of Sig. 0.185 were based on the test criteria, namely the value of sig. greater than 0.05 thenH0 is accepted and Ha is rejected, which means thatthe two classes, namely the experimental class and the control classhave the same initial ability. Furthermore, to test the effectiveness of the LMS-assisted PBL model to improve mathematical literacy skills, it is carried out with a proportion completeness test with the z test and the one sample t test. In this study, Problem Based Learning (PBL) assisted by the Learning Management System is effective for improving mathematical literacy if (1) the achievement of mastery in learning by students is the proportion of mathematical literacy mastery with Problem Based Learning (PBL) assisted by the Learning Management System is higher than the classical KKM is 70%. (2) The average mathematical literacy of students with Problem Based Learning (PBL) assisted by the Learning Management System is better than the average mathematical literacy of students with conventional learning.

The z test is used uto test individual mastery where with that aim is obtained $z_{hitung} = 0{,}7594$. because $z_{hitung} = 0{,}7594 \geq z_{tabel} = 0{,}1736\ then\ H_0\ was\ rejected$, which means that The proportion of mathematical literacy completeness in the Problem Based Learning (PBL) learning model assisted by the Learning Management System is more than 70 which has reached 70%. Then for test the completeness of the proportion/classical was tested using SPSS 17.0, namely the One Sample T Test.

Table 3 Output test One Sample T Test

Sig	description
0.000	H_o rejected

Based on the output Table 3Output One Sample T Test test above obtained a sig value of 0.000 where the test criteria reads if sig (2-tailed) value is less than (<) 0.05 then H0 is rejected and Ha is accepted, which means thatthe proportion of mathematical literacy completeness in the Problem Based Learning (PBL) learning model assisted by the Learning Management System is more than 70 has reached 70% .The classical learning completeness obtained by the experimental class was 81.1%, which means that there were 30 students who completed the KKM (70) out of a total of 37 students. Based on the results completeness test proportion, it can be concluded that students achieve mastery in learning. Then proceed with the two-mean difference testto find out whether the average mathematical literacy ability in Problem Based Learning (PBL) learning assisted by the Learning Management System is better than the average conventional mathematical literacy ability. The two-average difference test is assisted by SPSS 17.0, namely the. test Independent Sample T Test. Following Table 4 Output test Independent Sample T Test SPSS 17.0 processing results.

Table 4 Output test Independent Sample T Test

Sig	Information
0.000	H_o rejected

Based on Table 4 Output test Independent Sample T Test the output results above that the sig value is obtained 0.000 where the value is less than 0.05 (0.000 <0.05) then based on the test criteria it can be concluded that it is rejected, which means the averageH_o students' mathematical literacy in the Problem Based Learning (PBL) learning model assisted by the Learning Management System is more than the average mathematical literacy of students in conventional learning. Based on the results completeness test proportions, and the test of the difference between two proportions, it can be concluded that Problem Based Learning (PBL) learning assisted by the Learning Management System is effective for improving mathematical literacy.

To test whether there is an effect between cognitive style and students' mathematical literacy skills, a simple linear regression test is used where this test is certainly assisted by the SPSS 17.0 application. The following are the results of a simple linear regression test.

Table 5. Output *Coefficients*

Model		Unstandardized Coefficients
		B
1	(Constant)	0.278
	Value_GK	0.871

In Table 5 Coefficients to see the regression coefficients and form a model of the regression equation, the regression equation is obtained from the table as follows: Y = 0.278 + 0.871X.

Table 6. Output Model Summary

Model	R	R Square
1	.716a	.513

Table 6 Output Model Summary above is based on the R value, the magnitude of the regression coefficient between students' cognitive styles and students' mathematical literacy is 0.716 (strong enough). R Square to see the magnitude of the influence of the independent variable on the dependent variable that is equal to 0.513 which indicates that the effect of cognitive style (x) on students' mathematical literacy (y) is 51.3% while the other 48.7% is influenced by other variables/factors.

Mathematical Literacy Viewed from the Visualizer's Cognitive Style

Based on the research results, subject Vs (E-12) has high mathematical literacy ability, subject Vs (E-27) has moderate mathematical literacy ability, and Subject Vs (E-2) has low mathematical literacy ability. Subjects Vs E-12 who have high literacy skills, in the aspect of Communication / communication tend not to write down what is known, do not write down what is asked but are able to explain clearly what is known and what is asked in the question, not only that about this visualizer write and explain answers and conclusions correctly, clearly and correctly. In the Mathematising aspect, this subject can transform what is defined in the real or realistic world into mathematical form, not only in the form of being able to model into mathematical form but having strong assumptions/concepts and being able to explain the conclusions made clearly. In the Representation aspect, this subject can explain what is needed to draw a table. In the aspect of Reasoning and Argument, this subject can explore or explain and connect the elements of the problem so that they can draw conclusions from the problem or provide solutions to the problem. In the aspect of Division Strategies for Solving Problems, the subject of this visualizer can write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of Using Symbolic, Formal and Technical Language and Operations, this visualizer subject can write symbols and operate the formulas used correctly and can explain them clearly.

Subjects Vs E-27 who have moderate literacy skills, in the aspect of Communication / communication, subjects tend todo not write down what is known, and do not write down what is asked, and it is answered immediately. And the subject of this visualizer explains briefly that what is seen is not a matter of writing text, but what is seen to work on question number 1 is a picture of the pyramid arrangement of the bridge card so that from a little information on the image the subject immediately answers so that this subject is less able to explain the answer clearly. In the Mathematising aspect, the visualizer subject can transform what is defined in the

real or realistic world into mathematical form, but this subject also assumes or has a working concept that it is easier to work on problem number 1 directly by looking at the level arrangement image on the bridge card. Also, able to explain the answer briefly. In the aspect of representation, the subject of this visualizer can explain what is needed to draw a table and is able to explain how he draws. In the aspect of Reasoning and argument, the subject of this visualizer can explore or explain and connect the elements of the problem so that it can draw conclusions from the problem or provide a solution to the problem, namely by counting manually from the pictures of triangles or bridge cards arranged in a triangular shape so that he explains one by one. difference between each tribe. In the aspect of Division Strategies for Solving Problems, the subject of this visualizer is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems. In the aspect of using Mathematical Tools, this subject can use mathematical tools, which can be physical objects, measuring instruments or calculators where the measuring instrument is a ruler.

Subjects Vs E-2 who have low literacy skills, in the aspect of Communication / communication, the subject tends todid not write down what was known, and did not write down what was asked, and answered immediately but was unable to explain the conclusion or answer to the solution. In the Mathematising aspect, the visualizer subject can transform what is defined in the real or realistic world into mathematical form, but this subject also assumes or has a working concept that the number one question to find out the difference between each term in the sequence must read it at least 2 times on the question. However, this subject is not able to explain the answer well. In the Representation aspect, the subject of this visualizer can explain what is needed to draw a table and is able to explain how he draws. In the aspect of Reasoning and argument, the subject of this visualizer is less able to explore or explain and relate the elements of the problem and is less able to draw conclusions from the problem correctly. In the aspect of Division Strategies for Solving Problems, the subject of this visualizer is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems correctly. In the aspect of using Mathematical Tools, this subject can use mathematical tools in the form of physical objects, measuring instruments or calculators. In the aspect of Division Strategies for Solving Problems, the subject of this visualizer is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject is able to explain what symbols are used but cannot explain how to operate the formulas used in solving problems correctly. In the aspect of using Mathematical Tools, this subject can use mathematical tools in the form of physical objects, measuring instruments or calculators. In the aspect of Division Strategies for Solving Problems, the subject of this visualizer is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used to solve problems correctly. In the aspect of using Mathematical Tools, this subject can use mathematical tools in the form of physical objects, measuring instruments or calculators. This subject can explain what symbols are used but is unable to explain how to operate the formulas used to solve problems correctly. In the aspect of using Mathematical Tools, this subject can use mathematical tools in the form of physical objects, measuring instruments or calculators. This subject can explain what symbols are used but cannot explain how to operate the formulas used to solve problems correctly. In the aspect of using Mathematical Tools, this subject can use mathematical tools in the form of physical objects, measuring instruments or calculators.

Mathematical Literacy in terms of Verbalizer's Cognitive Style

Based on the research results, subject Vs (E-22) has high mathematical literacy ability, subject Vs (E-33) has moderate mathematical literacy ability, and Subject Vs (E-1) has low mathematical literacy ability. Subjects Vs E-22 who have high literacy skills, in the aspect of Communication / communication tend not to write down what is known, do not write down what is asked but are able to explain clearly what is known and what is being asked in the question, not only that about this verbalizer write and explain answers with less precise, clear, and correct. However, it also does not include conclusions in the answer paper but can explain them through interviews. In the Mathematising aspect, this subject can transform what is defined in the real or realistic world into mathematical form, not only in the form of being able to model into mathematical form but having strong assumptions/concepts and being able to explain the conclusions made clearly. In the Representation aspect, this subject can explain what is needed to draw a table. In the aspect of Reasoning and Argument, this subject can explore or explain and connect the elements of the problem so that they can draw conclusions from the problem or provide solutions to the problem. In the aspect of Division Strategies for Solving Problems, the verbalizer subject can write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of Using Symbolic, Formal and Technical Language and Operations, the subject of this verbalizer can write symbols and is less precise in operating the formula used and can explain it clearly. In the aspect of using Mathematical Tools, the verbalizer subject can use mathematical tools such as physical objects, measuring instruments or calculators.

Subjects Vs E-33 who have moderate literacy skills, in the aspect of Communication / communication, the subject tends towrite down what is known, and do not write down what is asked, but the subject of this verbalizer is able to explain clearly and correctly from the answer to the solution. In the Mathematising aspect, the verbalizer subject can transform what is defined in the real or realistic world into mathematical form. In the Representation aspect, the subject of this visualizer can explain what is needed to draw a table and is able to explain how he draws. In the aspect of Reasoning and argument, the verbalizer subject can explore or explain and connect the elements of the problem so that it can draw conclusions from the problem or provide solutions to the problem. and can draw the conclusion that to work on the number one problem for him, it must be done simultaneously between understanding the problem and working on the problem. In the aspect of Division Strategies for Solving Problems, the verbalizer subject is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems. In the aspect of using Mathematical Tools, this subject can use mathematical tools, which can be physical objects, measuring instruments or calculators, where the measuring tools are rulers and calculators. the subject of this verbalizer is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems. In the aspect of using Mathematical Tools, this subject can use mathematical tools, which can be physical objects, measuring instruments or calculators, where the measuring tools are rulers and calculators. the subject of this verbalizer is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems. In the aspect of using Mathematical Tools, this subject can use mathematical tools, which can be physical objects, measuring instruments or calculators, where the measuring tools are rulers and calculators. This subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems. In the aspect of using Mathematical Tools, this subject can use mathematical tools, which can be physical objects, measuring instruments or

calculators, where the measuring tools are rulers and calculators. This subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems. In the aspect of using Mathematical Tools, this subject can use mathematical tools, which can be physical objects, measuring instruments or calculators, where the measuring tools are rulers and calculators.

Subjects Vs E-1 who have low literacy skills, in the aspect of Communication / communication, subjects tend not towrite down what is known, and do not write down what is asked, write the conclusion on paper that the bridge card used to make n levels is 27 where this answer is not correct. In the Mathematising aspect, the verbalizer subject can transform what is defined in the real or realistic world into mathematical form, but this subject also assumes that to work on a number one kind of problem, you must read it repeatedly before doing it and be able to explain how to draw conclusions from the results of their work. However, this subject is not able to explain the answer well. In the Representation aspect, the verbalizer subject can explain what is needed to draw tables and be able to explain how he draws. In the aspect of Reasoning and argument, this verbalizer subject is less able to explore or explain and relate the elements of the problem and is less able to draw conclusions from the problem correctly. In the aspect of Division Strategies for Solving Problems, the verbalizer subject is less able to write strategies in the form of applying formulas and problem-solving steps in sequence and correctly. In the aspect of using Symbolic, Formal and Technical Language and Operations, this subject can explain what symbols are used but cannot explain how to operate the formulas used in solving problems correctly. In the aspect of using Mathematical Tools, this subject can use mathematical tools in the form of physical objects, measuring instruments or calculators.

CONCLUSION

PBL Learning Model Assisted LMS Effectively Improves Mathematical Literacy and closes pthe positive influence between students' cognitive style (visualizer-verbalizer) and mathematical literacy in the PBL Learning Model Assisted LMS is 51.3%.

Visualizer subject who has high literacy skills, this subject fulfills 6 aspects of 7 aspects of the mathematical literacy indicator, except for the Communication aspect. Visualizer subjects who have moderate mathematical literacy skills, only fulfill 5 aspects except in the Communication aspect and in the Division Strategies for Solving Problem aspect. Visualizer subjects who have low-criteria mathematical literacy skills, only fulfill 3 aspects, namely except for the Communication aspect, Reasoning, and argument aspects; aspects of Divisional Strategies for Solving Problems; and on aspects of using Symbolic, Formal and Technical Language and Operations.

Verbalizer subject has high criteria in his mathematical literacy ability, this subject fulfills 5 aspects of 7 aspects of mathematical literacy indicators, namely except for the Division Strategies for Solving Problems aspect and the using Symbolic, Formal and Technical Language and Operations aspect. Verbalizer subjects who have moderate mathematical literacy skills meet only 4 aspects except for the Communication aspect; aspects of Divisional Strategies for Solving Problems; and on aspects of using Symbolic, Formal and Technical Language and Operations. Verbalizer subjects who have low-criteria mathematical literacy skills meet only 3 aspects except for Communication, Reasoning and argument aspects; aspects of Divisional Strategies for Solving Problems; and on aspects of using Symbolic, Formal and Technical Language and Operations.

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