



Mathematical Literacy Ability Viewed From Student's Learning Style Based on Gender Differences on PBL Assistance Project Assessment

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Abstract

This research was aimed to know the effectiveness of PBL assistance project assessments on mathematical literacy ability and to describe student's mathematical literacy ability based on their learning style and gender. The type of research is the mixed method concurrent embedded design. The sample of this study were students of class VII A as the experimental class and VII E as control class. This research was conducted in SMP Negeri 6 Semarang in the academic year of 2017/2018. The result of this study showed that PBL assistance project assessments is effective on mathematical literacy ability. Male students with visual learning styles is able to master communication well, female students with visual learning styles are able to master communication, mathematising, and representation, male students with auditory learning styles are able to master communication, mathematising, reasoning and argument well, female students with auditory learning styles are able to master communication and mathematising, male and female students with kinesthetic learning styles each are able to master communication and mathematising well.

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INTRODUCTION

Mathematical learning not only convey information, show formulas, and demand problem processing procedures, but teachers act as mediators and facilitators and creating conducive learning so that students actively build their own knowledge (Kusmaryono et al., 2016). The purpose of mathematics learning 2013 curriculum following: 1) understanding of mathematical concepts (2) using the pattern as a guess in solving the problem (3) using reasoning to solve problems (4) communicating ideas (5) having an attitude of respecting the usefulness of mathematics in life (6) having attitude and behavior that are appropriate with mathematical values (7) doing motoric activities use mathematical knowledge dan and (8) use simple props and technology results. This goal is in line with the ability of mathematical literacy which has recently been discussed in the world of education. Mathematical literacy is the ability of individuals to formulate, use and guide mathematics in various contexts, including the ability to reason and use concepts, procedures, functions as tools to describe, explain and demonstrate phenomena or events OECD (2010). Asmara et al., (2017), Fathani (2016), Sari & Wijaya (2015) said that students need to be equipped with mathematical literacy ability to recognize the role of mathematics in life, able to use it in solving everyday problems and making the right decisions various problems.

The importance of mathematical literacy is not in line with the achievements of Indonesian students in the eyes of the international community. Based on the 2015 *Programme for International Student Assessment* (PISA) results the average score of the mathematics aspects of Indonesian students reached 396 ranked 63rd out of 72 OECD participating countries. This score is far below the International average score of

490. PISA assessment of the mathematics literacy ability of Indonesian students is relatively low. Diyarko & Waluya (2016) revealed that there was no habituation from teachers regarding math literacy problems causing students to experience difficulties so that the learning achievement achieved was not maximal. One of the learning factors thought to have an effect on learning achievement is learning style. This is based on research conducted by Widyawati (2016) which results in the tendency of learning styles to affect learning achievement. DePotter & Hernacki (2004) explained that learning style is a combination of how one absorbs, manages and processes information. Learning styles are classified into 3 types, namely visual, auditory and kinesthetic. Visual learning styles use their sense of sight to help learning, auditory learning styles utilize auditory ability to facilitate learning, and kinesthetic learning styles use their physical as optimal learning tools. Students who learn according to their learning style will more easily understand a subject matter so as to enable learning achievement to improve.

Based on OECD (2016) it is explained that on average in all OECD countries, there is a gender gap in reading ability This is in line with the opinion of Zhu (2007) that female and male students have different preferences in problem solving strategies. This gender difference is also likely to affect students' mathematical literacy ability, especially with the diversity of learning styles. This is in line with the research of Bhatti & Bart (2013) which states that learning styles and gender affect students' learning achievement. The quality of learning in the classroom must also be considered, one of the factors that influence it is the accuracy of the learning model (Rian & Junaedi, 2016). Therefore, a cooperative

learning model is needed that can support the achievement of the 2013 curriculum vision. One alternative to cooperative learning is the PBL model. The learning model presents contextual problems that stimulate students to learn to solve real-world problems (Kemendikbud, 2013). Solving mathematical problems is one part of mathematical literacy ability (OECD, 2013). In addition to innovation in learning development, it is also necessary to develop assessments or assessments to improve students' mathematical literacy ability (Wardono & Kurniasih, 2015). Authentic assessment is used to measure abilities that represent real-world problems. One of the authentic assessments is project assessment.

The application of pleasant project appraisal makes students enjoy their activities and is motivated by learning (Andreea & Stancuna, 2014). Project assessments can focus on processes that are used as a means of developing and monitoring students ability or products used as a means of assessing students' ability to communicate something through written reports Asikin et al., (2017). Based on the previous description, question in this study are: (1) is PBL assisted project assessment effective to mathematical literacy ability?; (2) how is the mathematical literacy ability of male students with visual learning style; (3) how is the mathematical literacy ability of female students with visual learning style.; (4) how is the mathematical literacy ability of male students with auditory learning style; (5) how is the mathematical literacy ability of female students with auditory learning style; (6) how is the mathematical literacy ability of male students with kinesthetic learning style; and (7) how is the mathematical literacy ability of male students with kinesthetic learning style. The description of mathematical literacy carried out is related to the learning carried out, namely using PBL

assisted with project assessment. Gender in this study is used as a tool to classify differences in abilities and individual characteristics. This is in line with what was expressed by Stewart & McDermott (2004) which states that gender is used to compare differences between women and men, both in terms of their personality, behavior, and abilities.

METHOD

This research is a mixed method concurrent embedded design. The study was conducted at SMP Negeri 6 Semarang, Central Java using rectangular building materials. The population of this study was all seventh grade. The sample was chosen by purposive and it was obtained the class of VII A as a control class with PBL and VII E as an experiment class with PBL assisted with project assessment. In the learning process, grade VII A students as an experimental class are taught by PBL assistance project assessments, while class VII E as a control class is taught PBL.

Data collection techniques consist of questionnaires, tests of mathematical literacy ability, and interviews. The research instrument consisted of interview guidelines, test instruments in the form of tests of mathematics and non-test literacy ability in the form of learning style questionnaires, the instruments used were validated by experts, and for the literacy ability test questions were tested first to find out the quality of the questions used. There are two data analyzes in this study, namely the prerequisite analysis in the form of normality, homogeneity, and average two-equality test as well as hypothesis test analysis, namely in the form of a thorough test of averages, proportion test, and average difference test. Whereas for qualitative data analysis passes the stages of data reduction, data presentation, and conclusion. Before analysing

qualitative data, for the first, students are classified by the categories of learning style from each gender. Then the description of mathematical literacy abilities is based on the classification that has been carried out, there are men students with visual learning styles, women students with visual learning styles, men students with auditory learning styles, women students with auditory learning styles, men students

with kinesthetic learning styles, and women students with kinesthetic learning styles.

RESULTS AND DISCUSSION

The test results of mathematical literacy abilities on space and shape content based on learning are presented in Table 1.

Table 1. Recapitulation of Mathematics Literacy Ability Results

Number	Description	Experiment Class	Control Class
1	Average	74.31	70.97
2	The highest score	91	80
3	The lowest score	56	52
4	Standard Deviation	8.03	5.42
	Students who complete	32	22
	Students who didn't complete	3	12

First, the analysis carried out to determine the effectiveness of PBL assistance project assessments on mathematical literacy ability. Average due diligence based on individual minimum completeness criteria (KKM) was analyzed using one sample t test with the help of SPSS 17.0. As for the acceptance criteria if the

significant value $> 5\%$, the average mathematics literacy ability of students does not reach the KKM. The following is presented the data of the average test results of mathematical literacy abilities based on individual KKM presented in Table 2.

Table 2. Test Results of Average Mathematical Literacy Ability Based on Individual KKM

	Test Value = 67			Average different	95% trust interval difference	
	<i>t</i>	<i>df</i>	<i>Sig.</i>		Under	Upper
Class_experiment	5.39	34	0.000	7.314	4.56	10.07

Based on Table 2, a significant value of $0.000 < 5\%$ is obtained, so the average value of experimental class mathematical literacy abilities reaches KKM. Furthermore, the classical completeness test is a test to see how many complete students reach 80% in one class, in this case the experimental class. Based on the results of the calculation of the proportion test obtained the value $z_{value} = 2.298$ and the value of $z_{table} = z_{\frac{1}{2}(1-\alpha)} = 1.96$. The testing criteria accept H_0 if $-z_{\frac{1}{2}(1-\alpha)} < z < z_{\frac{1}{2}(1-\alpha)}$ for $\alpha = 5\%$, because value z_{value} not located between -1,96 dan 1,96. This

means that the proportion of students' completeness with PBL assistance project assessments has reached 80%. Finally, the mean difference test aims to find out the differences in the average mathematics literacy ability of students in the class with PBL assistance project and class assessment with PBL, the analysis using independent sample t-test with the help of SPSS 17.0. As for the criteria for admission if value $\alpha > 5\%$ then the average mathematics literacy ability of students with PBL assistance project assessment is less than or equal to the average mathematics literacy ability of students with PBL. The following is

presented the results of different test data on average mathematical literacy abilities presented in Table 3.

Table 3. Test Results Differences in Average Mathematical Literacy Ability

		T test results for average similarity						
		<i>t</i>	<i>df</i>	<i>Sig.</i>	Average difference	Standard error	95% trust difference Under	Upper
Variance is assumed to be the same n	is	2.022	67	0.047	3.344	1.654	0.043	6.645
Variance is assumed to be n not the same	is	2.003	59.813	0.047	3.344	1.645	0.053	6.634

Based on Table 3, obtained significant values of $0.047 < 5\%$, the average mathematics literacy ability of class students with PBL assisted by project assessment is more than the average mathematics literacy ability of students with PBL. The results of the analysis above, can be concluded that PBL is assisted with effective project assessment of mathematical literacy ability. These results are in line with the results of the research by Firdaus et al., (2017) there are significant differences between the improvement of students' mathematical literacy ability with problem-based learning models (PBL) and direct instruction (DI); PBL models are more effective in improving mathematical literacy ability than DI. The same study was conducted Istiandaru et al., (2014) said that PBL with a realistic-scientific approach with PISA-oriented assessment is effective in improving students' mathematical literacy ability.

The discussion about PBL mathematics literacy ability assistance project assessment in terms of learning styles and gender in the form of descriptions of students' answers and interviews. Data on students' mathematical literacy ability is data about the ability of students to solve mathematical literacy problems which include 7 components namely communication, using mathematical tools, devising strategies for solving problems, representation, reasoning and argument,

mathematising and using symbolic, formal and technical language and operation. The results obtained for male students with visual learning styles are able to master communication indicators well. Students tend to complete the information that is known and asked. While the indicators of literacy ability for reasoning and argument need to be improved because in the answer sheet students have not made conclusions which is the right answer.

The results obtained by female students with visual learning styles are able to master both indicators of communication, mathematising, and representation. Students are able to express ideas in accordance with problems, change problems into mathematical form with complete and provide information through the images created. While the indicators of mathematical literacy ability for devising strategies for solving problems need to be improved because the students' answer sheets have not precisely determined the strategy to solve the problem. This is in line with what was revealed by Zhu (2007) that female and male students had different preference in problem solving strategies.

The auditorial learning style category of male students is able to master indicators of communication, mathematising, and reasoning and arguments. In the answer sheet, students are able to mention what information is known and asked in the

complete question, write a mathematical model according to the problem, and provide a complete conclusion. For indicator representation and using symbolic, formal, technical language and operation needs to be improved because students do not use images to clarify problem solving, are less clear in the use of mathematical symbols and improper number operations.

For female students with auditory learning styles are able to master communication and mathematising indicators. Students in modeling real problems into a form of mathematics is quite detailed so that students understand the purpose of the problem and have no difficulty understanding the problem. While the indicators of mathematical literacy ability for reasoning and argument need to be improved because in the answer sheet students have not made conclusions which is the right answer.

The last learning style category is the kinesthetic learning style of male students. Indicators of mathematical literacy abilities that students can master are communication and mathematising. Learners in modeling real problems become a fairly detailed form of mathematics so that students have no difficulty understanding the problem. The representation indicator needs to be improved because it does not use images to clarify the resolution of the given problem.

The next indicator of literacy ability is for female students in the kinesthetic learning style category. Students are able to master communication and mathematising well. In the aspect of communication that is built by female students with complete kinesthetic learning styles and does not experience difficulties in understanding problems and can model real problems into mathematical forms. While the indicator of mathematical literacy ability using symbolic, formal, technical language and

operation needs to be improved because in the answer sheet students tend not to work optimally in dealing with the use of mathematical symbols. This is similar Bhatti & Bart (2013) which states that learning styles and gender influence student learning achievement.

CONCLUSIONS AND SUGGESTIONS

Based on the analysis and discussion, it can be concluded that PBL assistance project assessment is effective on mathematical literacy ability and in the indicator of mathematical literacy abilities, male students with visual learning styles are able to master one indicator, while female students with the same learning style are able to master three indicator well. The next category is the auditory learning style of male students who are able to master three indicators of mathematical literacy ability well, as is the case with female students with auditory learning styles who only master two indicators. The last category is the kinesthetic learning style of male and female students mastering two indicators of the same mathematical literacy abilities. Teachers need to pay attention to the learning style of students so that it is easier to understand a subject matter that enables achievement of mathematical literacy ability to increase. In addition, teachers also need to cultivate teaching related to students' mathematical literacy ability by involving many learning styles simultaneously by providing problems about story problems presented in writing, pictures, videos and direct practice to improve their academic achievement.

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