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Abilities of Mathematical Literacy Based on Self-Confidence in Problem Based Learning with DAPIC Problem-Solving Process

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Abstract

This study aimed to 1) explaine the quality of problem-based learning with DAPIC problem-solving process and 2) describe about students' mathematical literacy abilities after being subjected to problem-based learning with DAPIC problem-solving process based on self-confidence. This study used the mixed method with concurrent embedded models. The results of this study indicated that the learning planning obtained quite valid, the implementation of learning with good category, and the average value of mathematical literacy abilities of experimental class students reached the KKM and the proportion of students who complete the KKM reached to 75%. Furthermore, the average mathematical literacy abilities of the experimental class students was better than the control class and the proportion of student's mastery learning in the experimental class was higher than the control class. Students with low self-confidence still got difficulties in solving problems with the correct resolution steps. Students with self-confidence were already good enough in solving problems based on the correct steps. While students with high self-confidence were very good in solving the given questions so that the steps were quite complete and correct.

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INTRODUCTION

Mathematics is one of the basic sciences that has an important role both in the development of science and in everyday life. This is expressed by Purwosusilo (2014: 31), who states that mathematics is a science that is needed in various fields, both in mathematics itself and in other fields. Mathematics not only for the needs of the present, but also the future. In line with this, Baki et.al (2009: 1402) states that mathematics is a part of real life that is not only used in daily activities but also for various work situations. It is necessary to transfers the knowledge and skills of mathematics acquired in schools to real life which require an individual to consider, calculate, estimate or apply mathematical knowledge to solve real life problems and also to communicate mathematically. The demand for mathematical abilities is not just the ability to count. According to Fathani (2016: 137) mathematical abilities also include logical reasoning abilities and are critical in problem solving. The solution to this problem is not merely a problem in the form of routine questions but rather to the problems faced everyday. According to Sari (2015: 713), such mathematical abilities are known as mathematical literacy abilities.

OECD (Asmara, et.al, 2017: 136) interpreted mathematical literacy as the ability to formulate, use knowledge and mathematical understanding effectively in everyday life or it can also mean that mathematical literacy is the ability of an individual to formulate, use and interpret mathematics in various contexts. This includes concepts, procedures, facts and mathematical tools to describe, explain and predict phenomena. Literacy emphasizes the use of basic mathematics in everyday life, in line with Ojose's (2011: 90) opinion. Ojose argued that literacy is the knowledge to understand and apply the basics of mathematics in everyday life. As for Yore, et al. (2007: 562) suggested that understanding, application, communication, and problem solving are important aspects that must be owned by an individual to successfully apply the basic mathematics in everyday life. Using basic mathematics in other words, an individual must have the power to use their minds. Stacey & Turner (2012: 13) revealed that the use of functional knowledge or applying knowledge to solve problems requires individual strength. The strength in question is focusing on students' ability to analyze, reason, present ideas, formulate, solve, and interpret mathematical problems in various forms and situations. According to Stacy (Fitriyani, 2017: 140), mathematical literacy refers to these abilities that can help individuals solve problems in everyday life effectively.

The mathematical literacy abilities of Indonesian students are still relatively low. This can be seen in the results of a survey conducted by the Program for International Student Assessment (PISA). The results of the 2015 PISA study (Wicaksana, et.al, 2017: 168), showed that mathematics literacy ranked Indonesia 61st with a score of 386 from 86 PISA participating countries. Previously, the results of the 2012 PISA study (Mena, et.al, 2016: 188) ranked Indonesia in 64th out of 65 countries with an average Indonesian score of 375. These results indicate that students' mathematical literacy in Indonesia based on international studies is still not satisfactory although ranking increase. According to (Diyarko & Waluya, 2016: 71), there are many factors that cause low student difficulties in solving mathematical literacy problems in other words, a number of variables can be a determinant of students' literacy abilities. In general these factors can be grouped into two categories: factors in students (internal) and factors outside of students (external). According to Mahdiansyah & Rahmawati (2014: 456), internal factors are related to cognitive and non-cognitive aspects. Parsons (2009) stated that one of the students' internal non-cognitive factors which is important in learning mathematics is self confidence and according to The Report of the Expert Panel on Student Success in Ontario (2004: 9), self-confidence is the key to success of an individual's learning and success in mathematics. This is in line with what was conveyed by Hannula et.al. (2004: 23) that self-confidence is a variable that is an important predictor for the future development of students such as the development of orientation and the success of mathematics achievement.

Based on the previous description, the problems that occur can be overcome by applying a lot of learning to train students to achieve the highest ability in the field of mathematics. This is explained in the Minister of National Education Regulation No. 16 of 2007 concerning the Standards of Qualification

and Competency of Teachers, requiring teachers to have 4 competencies, one of which is pedagogic competence, namely the ability of teachers to understand students, design and implement good learning, evaluate participants' learning outcomes students, and develop and guide students to find various potentials they have. Pedagogic competencies include: a) being able to understand students in depth, b) being able to design learning, c) being able to carry out learning, d) being able to design and carry out learning evaluations, and e) able to help students to explore and develop their potential. Thus, teachers should be able to design and carry out learning activities in schools that direct students to be able to apply mathematics to problems relate in daylife that are often called mathematical literacy and direct students to be trained in the work to solve these problems, Linuhung (2014: 37). Mathematics learning in this case does not only focus on students' mathematical literacy abilities, mathematics learning should also facilitate students' self-confidence. One of the appropriate models of mathematics learning is problem-based learning.

According to Pecore (Major, et.al, 2018: 2), problem-based learning is a learning model that can develop students' knowledge and problem solving skills of everyday life. This is needed in developing mathematical literacy abilities. Furthermore, to supporting these capabilities, steps or process of problem solving are needed. One process that can be used is DAPIC problem-solving process. Learning based on this problem solving has the steps needed to facilitate students' literacy abilities. DAPIC which stands for define, assess, plan, implement and communicate relate to the components in literacy, namely understanding concepts, solving problems, implementing procedures, and communication. Problem-based learning with DAPIC problem-solving process will be able to facilitate students' self-confidence so as to improve students' mathematical literacy abilities. Based on the previous background description, research on learning that can facilitates mathematical literacy and self-confidence is needed. The learning in question is problem-based learning with DAPIC problem-solving process. This study aims to explain the quality of problem-based learning with DAPIC problem-solving process and describe students' mathematical literacy abilities in terms of self-confidence after applying problem-based learning with DAPIC problem-solving process.

METHODS

Mixed method was used in this research with concurrent embedded models. This study used quantitative methods as the primary method and qualitative methods as secondary methods. Concurrent model research embedded in this study began with the discovery of problems that have been explained in the background of the problem and then formulated the problem formulation. After formulating the problem, the researcher choosed theories that can explain the problem and formulate the research hypothesis. After that, the researcher conducted quantitative data collection followed by qualitative data, but before that was carried out pre-field stage which consisted of, 1) compiling the research design, 2) choosing the research field, 3) arranging permits, 4) field observations, 5) preparing equipment research. Further analysis of quantitative and qualitative data was then presented data of research results and concludes and compiles suggestions related to research.

RESULT AND DISCUSSION

The results of the study related to the description of the quality of learning and students' mathematical literacy abilities after being subjected to problem-based learning with DAPIC problem-solving process. Description of the quality of learning included the planning stage, implementation phase, and evaluation stage. Description of students' mathematical literacy abilities after being subjected to problem-based learning with DAPIC problem-solving process in terms of the self-confidence category.

The first stage was the description of the quality of learning, namely the planning stage. This stage was carried out the device validity test. Validity testing conducted in this study was validated by experts and empirical validation. Devices validated by experts include syllabus, lesson plan, student's worksheets, self-confidence questionnaires, students' mathematical literacy test questions, and interview guidelines. Recapitulation of validation results by experts can be seen in Table 1.

Tabel 1. Recapitulation of Validation Results by Experts

No.	Devices	Average Percentage of Validation Score	Category
1	Syllabus	79	Quite Valid
2	Lesson Plan	80	Quite Valid
3	Student's Worksheet	74	Quite Valid
4	Pretest	80	Quite Valid
5	Posttest	80	Quite Valid
6	Questionnaires	80	Quite Valid
7	Interview Guidelines	80	Quite Valid

Table 1 above shows that the device obtaining results is quite valid. The question of the students' mathematical literacy test was not only validated by experts but also empirical tests. Empirical tests were carried out in two classes, namely class VII C and class VII D where class VII C was used to test pretest and class VII D was used to test posttest. The test included item validity, reliability, and level of difficulty. The results showed that out of the 14 questions tested, there were 9 questions that fall into the valid category. Questions number 1a, 4b, 6a, 6b, and 7 were invalid because $r \leq r_{table} = 0{,}361$. Reliability in the pretest included in the high category with $r_{hitung} = 0{,}750$. In the difficulty level, the questions tested for difficulty level are only valid questions, namely questions 1b, 2a, 4a, and 8, including the difficult category and the questions 1c, 3a, 3b, 5a, and 5b including the medium category. Whereas in posttest showed that of the 14 questions tested, there were 7 questions which were included in the valid category. Questions number 1b, 1c, 4, 5b, 7, 8a and 8b were invalid because $r \leq r_{table} = 0{,}3494$. Reliability in the posttest included in the high category with $r = 0{,}734$. In the difficulty level, the problem that was tested for the difficulty level was only a valid problem, those were questions number 2, 3a, 5a and 5b were included in the difficult category and questions 1 and 3b were included in the medium category.

The second stage of the description of the quality of learning was implementation stage. The implementation stage was done by looking at the learning effectiveness using the learning implementation sheet. Learning sheets were filled by observers by assessing the learning process and the result must in the good category. Assessment took place in four meetings. A summary of learning assessment result can be seen in Table 2.

Tabel 2. A Summary of Learning Assessment Result

Meetings	Average of Scores	Category
1	3.42	Good
2	3.42	Good
3	3.5	Good
4	3.57	Very Good

Table 2 above shows the average of scores obtained during learning for each meeting. Based on the results of these observations, the implementation of learning at the first meeting includes in the good category with an average score of 3,42. At the second meeting, they still gets the same average score with the first meeting, which is 3,42 so that it is include in the good category. After that, at the third meeting, improvements are made so that learning is carried out more optimally so that the average score increases to 3.5 but was still in the good category. At the fourth meeting, achievement is increase so that it reaches an average score of 3.57 to reach a very good category.

The third stage was the description of the quality of learning, namely assessment. The assessment phase was carried out by testing the hypothesis. Hypothesis testing in this study consisted of hypothesis testing I and II. Hypothesis I testing included testing the achievement of minimum completeness criteria and classical completeness test. Before the test was carried out, the conditions that must be met, namely the data obtained must be normally distributed. The test results can be seen in the following explanation. Data normality testing was

carried out using the Kolmogorov-Smirnov. The summary of the test results can be seen in Table 3.

Tabel 3. The Summary of Posttest Data Normality Test in Experiment Class

	Kolmogorov-Smirnov
	Posttest of Experiment Class
Df	32
Significance	0.077
Result	Data is normally distributed

Table 3 above shows the significance value obtained is $0{,}077 > \alpha = 0.05$, so H_0 is accepted, which means that the value of posttest data is normally distributed. After it was known that the data was normally distributed. Test the minimum completeness achievement aimed to find out whether the statistically, posttest has reached the minimum completeness criteria of 70. The summary of the test results can be seen in Table 4.

Tabel 4. The Summary of Minimum Completeness Achievement Test Results

	T-Test
	Posttest of experiment Class
t_{table}	1.698
t	7.14
Result	reject H_0 and accept H_1

Table 4 above shows that the t value obtained is $7{,}14 > t_{table} = 1{,}698$ then reject H_0 and accept H_1. This means that the average mathematical literacy ability of students has reached the minimum completeness criteria of 70. The classical completeness test aimed to test whether the proportion of students achieving the minimum completeness criteria in the experimental class reach 75%. The test used in this test is the Z test. The summary of the test results can be seen in Table 5.

Tabel 5. The Summary of Classical Completeness Result

	Z-Test
	Posttest of Experiment Class
z_{table}	1.64
z	2.45
Result	reject H_0 and accept H_1

Table 5 above shows that $z = 2{,}45 > z = 1{,}64$. Thus reject H_0 and accept H_1, this means that the proportion of completeness of the experimental class students who were subjected to problem-based learning with DAPIC problem-solving process reaches 75%. Hypothesis II test included comparative test of average mathematical literacy ability and classical comparative test. This test was carried out after the normality and homogeneity test requirements are met. The following was an explanation of testing the hypothesis II test. Normality test on the average comparative test of mathematical literacy abilities and classical comparative tests using the data of the posttest scores of the mathematical literacy abilities of the two classes. The test used was the Kolmogorov-Smirnov test. The summary of the normality testing in Table 6.

Tabel 6. The Summary of Posttest Data Normality Test in Experiment And Control Class

	Kolmogorov-Smirnov
	Posttest
Df	60
Significance	0.059
Result	Data is normally distributed

Based on Table 6 above, the significance value obtained is $0{,}059 > \alpha = 0.05$ so that it accepts H_0. This means that the experimental test and control class posttest data values were normally distributed. The homogeneity test in this test aimed to test whether the data on the final test scores of students'

mathematical literacy abilities of both classes were homogeneous or not. The homogeneity test summary is presented in Table 7.

Tabel 7. The Summary of Posttest Data Homogenity Test in Experiment And Control Class

	Levene's test for Equality of Variances
	Posttest
F	0.302
Significance	0.585
Result	Data is homogen

Based on Table 7, the significance value is obtained at $0.585 > \alpha = 0.05$ so that it accepts H_0. This means that the data of the final experimental class and homogeneous control class data. The average comparative test of mathematical literacy ability was done to test statistically which class has a higher average. The summary of the results of the calculation can be seen in Table 8.

Tabel 8. The Summary of Comparative Posttest of Experiment and Control Class Average

	T-Test
	Posttest
t_{table}	0.79
t	5.79
Result	reject H_0 and accept H_1

Based on Table 8 above, the $t = 5{,}79 > t_{table} = 0{,}79$. Thus reject H_0 and accept H_1. This means that the average mathematical literacy abilities of students who were subjected to problem-based learning with DAPIC problem-solving processes were more than students who were subjected to conventional learning. Classical appeal test was a test that compares the proportion of the experimental class to the control class. A comparable proportion was the proportion of the completeness of each class. The summary of the results of the calculation of the classical comparative test can be seen in Table 9.

Tabel 9. The Summary of ComparativeProportion of Experiment and Control Class Average

	Uji z
	Posttest
z_{table}	3.72
z	1.64
Result	reject H_0 and accept H_1

Based on Table 9 above, $z = 3.72 > z_{table} = 1{,}64$. Thus reject H_0 and accept H_1. This means that the proportion of students with mathematical literacy abilities reached 70 in the classroom that were applied to problem-based learning with DAPIC problem-solving process more than the class applied by conventional learning.

This study also measured students' self-confidence using questionnaires. The self-confidence questionnaire contained 40 statements consisting of 20 positive statements and 20 negative statements. This questionnaire helped researchers classify students' self-confidence into high, medium, or low categories. Each statement item consisted of four answer choices with different score weights. The four answer choiced are very agree, agree, disagree, and strongly disagree. The summary of the classification of students' self-confidence in the experimental class can be seen in the following Table 10.

Tabel 10. The Summary of The Classification of Experimnet Students' Self-Confidence

Self-Confidence Category	Number of Student	Percentage
High	2	6.25
Medium	28	87.5
Low	2	6.25
Total	32	100

Table 10 above shows the most common category achieved by students, reaching 28 students with a percentage of 87%. Whereas in the high and low categories only achieved by two students for each category with a percentage of 6.25%. This classification aims to select research subjects that represent each of the categories that will be further investigate in relation to mathematical literacy abilities. The selected research subjects are respondents E-31 and E-32 to represent high categories, respondents E-20 and E-05 to represent the medium category, and respondents E-27 and E-19 to represent low categories.

Students' mathematical literacy ability with each category of self-confidence was different. This was seen from the level of errors made by each category. Students with low self-confidence often still made mistakes when solving problems related to mathematical literacy abilities. Students have been able to understand the problem by completing it based on the right steps, but there are still errors that students have not been able to understand the basic concept of the square that is understanding the characteristics of the square. The same thing happened to students with moderate self-confidence category. The error was caused by not understanding the characteristics of flat build. Students with high self-confidence solved problems related to the first indicator properly and correctly. These errors related to the level of mastery of the material and learning readiness. This was based on the research of Nadjib (2014) which revealed that the mistakes made by students in solving math problems are caused by their abilities, such as students' understanding of definitions, theorems, properties, formulas and work processes. Other causes that influenced were lack of level of mastery of material, carelessness, and also the condition of students' readiness in learning. According to research by Kurniasih, et. al., (2016) self-confidence was related to learning readiness. This was in line with the opinion of Dini et. al., (2018: 6) which stated that the attitude of self-confidence in the unfavorable category makes students feel difficult and ultimately gives up with incorrect answers from the problems given. The student was not careful and not confident which results in fighting power in dealing with very weak problems resulting in suboptimal results. This inaccuracy also occured in students with low self-confidence when working on questions related to other question indicators. Students with medium and high self-confidence solved mathematical literacy abilities better than low self-confidence students. Students with self-confidence were solving problems well but still often make misuse of formulas, calculation processes, and use of count operations. Whereas students with high self-confidence solved the problem well and used the right formula even though they still made a mistake in the calculation process.

CONCLUSION

Problem-based learning quality with DAPIC problem-solving process is divided into three, namely planning, implementation, and assessment. The quality of the planning stage can be seen from the results of expert validation and empirical trials that obtained results are quite valid. The quality of the implementation stage was seen from the observers' observations with the help of the learning implementation sheet, which was obtained with good categories. The quality of the assessment phase is seen from the achievement of KKM by the average results of the experimental mathematical literacy ability of students and classically 75% of students complete the KKM. In addition, it was also shown that the average results of experimental class students' mathematical literacy abilities were higher than those of the control class. Classically it also shows that the proportion of students who complete the KKM in the experimental class is greater than the control class. Students' mathematical literacy abilities based on the self-confidence category showed different results. Students with low self-confidence still have difficulties in solving problems with the correct resolution steps and also often experience miscalculation. Students with self-confidence are already good enough in solving problems based on the correct steps but still experience miscalculation. Whereas students with high self-confidence were very good at solving the given questions so that the steps to complete them were quite complete and correct even though there were still errors made in the calculations.

Problem-based learning with DAPIC problem-solving process is assessed as quality therefore it can

be used in mathematics learning to improve students' mathematical literacy abilities. Students with low self-confidence can be helped to familiarize themselves by applying learning with syntax that requires students to socialize and communicate so that students are more active in the classroom and more easily express difficulties experienced during mathematics learning. Students with medium and high self-confidence should be directed to join and learn together with low self-confidence students in order to help these students overcome difficulties by discussing. This study analyzes mathematical literacy abilities based on self-confidence. This research can be used as material for conducting further research, like as analyzing aspects of other literacy abilities are aspects of content and context and changes in students' self-confidence.

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