

## STUDENTS NUMERICAL LITERACY ABILITY IN PROBLEM BASED LEARNING WITH ETHNOMATEMATICS NUANCES

FAKHRIZAL UTAMA<sup>1</sup>, ZAENURI<sup>2</sup>, YULI KURNIAWATI SUGIYO PRANOTO<sup>3</sup>

<sup>1,2,3</sup>Universitas Negeri Semarang /Jl.Kelud Utara III Semarang, Indonesia

[fakhri2408@gmail.com](mailto:fakhri2408@gmail.com)

### Abstract

One of the approaches/methods used in learning to improve students' numeracy literacy skills is using Problem Based Learning (PBL). The use of PBL in learning is used for various purposes, starting from increasing mathematical abilities, mathematical communication, and students' numeracy literacy skills. In order for learning to be more meaningful, learning is associated with the culture in the surrounding environment. Ethnomathematics is the term that refers to the combination of culture and mathematics. However, in reality learning mathematics is still centered on the teacher. Innovative learning models are not used by teachers. The purpose of this study was to assess the efficacy of the PBL model with ethnomathematics nuances in improving students' numeracy literacy skills. A quasi-experimental research method was utilized in this study, with one experimental group. As a result, the design employed by the researchers was a one group pretest posttest design. The research sample consisted of 37 students, class IV with saturated sample technique. The type of instrument is a description test. The study's findings demonstrate an improvement and development in the average numeracy literacy skills. Therefore, the application of the PBL model with ethnomathematics nuances can improve students' numeracy literacy skills.

**Keywords:**Numeracy literacy, Ethnomathematics, Problem based learning

### Abstrak

Salah satu pendekatan/metode yang digunakan dalam pembelajaran untuk meningkatkan kemampuan literasi berhitung siswa adalah dengan menggunakan Problem Based Learning (PBL). Penggunaan PBL dalam pembelajaran digunakan untuk berbagai tujuan, mulai dari peningkatan kemampuan matematis, komunikasi matematis, dan kemampuan literasi berhitung siswa. Agar pembelajaran menjadi lebih bermakna, pembelajaran dikaitkan dengan budaya yang ada di lingkungan sekitar. Etnomatematika adalah istilah yang mengacu pada kombinasi budaya dan matematika. Namun, pada kenyataannya pembelajaran matematika masih berpusat pada guru. Model pembelajaran inovatif tidak digunakan oleh guru. Tujuan dari penelitian ini adalah untuk menilai keampuhan model PBL bernuansa etnomatematika dalam meningkatkan kemampuan literasi berhitung siswa. Metode penelitian eksperimen semu digunakan dalam penelitian ini, dengan satu kelompok eksperimen. Hasilnya, desain yang digunakan oleh peneliti adalah one group pretest posttest design. Sampel penelitian terdiri dari 37 siswa kelas IV dengan teknik sampel jenuh. Jenis instrumennya adalah tes uraian. Temuan penelitian ini menunjukkan adanya peningkatan dan perkembangan kemampuan literasi berhitung rata-rata. Oleh karena itu, penerapan model PBL bernuansa etnomatematika dapat meningkatkan kemampuan literasi berhitung siswa.

**Katakunci:**Literasi numerasi, Etnomatematika, Problem based learning

### INTRODUCTION

To achieve the educational goals above, what the government is doing is looking at the results of international numeracy literacy competency measurements such as the Program for International Student Assessment (PISA). In PISA, numeracy literacy is one of the important points in the assessment of mathematical competence. Numeracy literacy

skills encompass the knowledge and abilities necessary to utilize different numerical and symbolic representations of fundamental mathematical concepts in order to solve real-world problems, as well as to analyze information presented in a variety of formats, interpret the results of said analysis, and subsequently make predictions and informed decisions. (Han et al., 2017).

Currently, students' numeracy literacy skills have in fact not been optimally developed. This is in accordance with the latest results of the Program for International Student Assessment (PISA) test in 2021 showing that Indonesia has a mathematics score below the average score of OECD members.

Efforts are needed by teachers and researchers to enhance students' mathematical literacy skills by devising learning models, strategies, methods, and techniques that facilitate the development of solutions. This opinion is in line with the opinion of Ashri & Pujiastuti (2021) which states that numeracy literacy needs to be improved in learning at the basic education level because practicing numeracy literacy from a young age will be very useful for students in the future. In life activities, humans will never be separated from mathematics, because mathematical concepts are frequently employed as a means of solving problems in numerous human activities. (Nahdi & Suciawati, 2020).

One of the approaches/methods used in learning to improve students' numeracy literacy skills is using Problem Based Learning (PBL). The use of PBL in learning is used for various purposes, starting from increasing mathematical abilities, mathematical communication, and students' numeracy literacy abilities (Ambarwati & Kurniasih, 2021).

The PBL (Problem Based Learning) model is founded upon numerous authentic problems that necessitate genuine solutions to actual issues through investigative means (Trianto, 2007). Here students not only understand the concepts they learn in the abstract, but can also use them in real problems that exist in the classroom around them, so learning will be more meaningful.

In order for learning to be more meaningful, learning is associated with the culture in the surrounding environment. Ethnomathematics is the term used to refer to the combination of culture and mathematics (J. B. Darmayasa, Wahyudin, & Mulyana, 2018).

According to Gerdes (2017) mathematics is employed in a specific manner by various cultural groups, professional and occupational clusters, children from particular socioeconomic strata, as well as indigenous ethnic groups, among others. This mathematical application is referred to as ethnomathematics. The study of mathematical techniques used and identified by cultural groups to comprehend, clarify, and address problems and activities within their own societies is known as ethnomathematics (Yusuf et al., 2010).

The ethnomathematics in this study was taken from the geometric shapes of batik patterns found in Pekalongan City. The addition of local cultural forms is expected to increase students' sense of cultural love, because directly the sense of cultural love will affect the character education possessed by students. The various Jlamprang batik motifs may serve as a tool to introduce geometric concepts in mathematics, thereby aiding in the comprehension of abstract mathematical concepts encompassed are straight and curved lines, symmetry, points, angles, rectangles, squares, triangles, circles, parallelograms, and the notion of congruence.. The following is an example of the Jlamprang Batik Motif in Pekalongan City:



Figure 1. Jlamprang Batik Motifs

This batik with the name Jlamprang motif originates from the Pekalongan area. The Jlamprang motif is one of the most popular batiks produced in the Krapyak Pekalongan area. This batik is a development of the Potola cloth motif from India the geometric ones are sometimes in the form of stars or compass points and use branches with rectangular ends. This Jlamprang motif is enshrined as one of the streets in Pekalongan. When traders from Gujarat (India) arrived on the north coast of Java Island, they brought woven fabrics and silk materials typical of Gujarat in their wares.

There has been a lot of research conducted regarding the effectiveness of PBL on students' numeracy literacy skills, but not much has been done on students in elementary schools. In addition, in this study PBL has an ethnomatematics nuance which is applied using quiz which is adapted to the characteristics of students in elementary schools. From the aforementioned description, the research aims to determine significant differences in the numeracy literacy abilities of students in classes that get problem-based learning with ethnomathematics nuances compared to students in classes with expository learning.

## METHODS

The research design used in quantitative research is as if they were experimenting (quasi-experimental), specifically, a research design that involves two groups - an experimental group and a control group. This quasi-experimental research uses nonequivalent control group design (Suharsaputra, 2014:163) which can be described in the following table.

**Table 1. Research Design**

Group	Pretest	Treatment	Posttest
Experiment	O1	X1	O2
Control	O1	X2	O2

Information:

O1 : Initial test of the experimental group and the control group

O2 : Final test of the experimental group and the control group

X<sub>1</sub> : Giving models *PBL* ethnomathematics nuances for the experimental group

X<sub>2</sub> : Providing an expository learning model for the control group

Researchers carried out this research at Panjang Wetan 04 Public Elementary School and Panjang Wetan 03 Public Elementary School, North Pekalongan District, Pekalongan City. The research lasted for 2 months, February to March 2023.

The sample of this study were fourth grade students at SDN Panjang Wetan 04 and SDN Panjang Wetan 03, North Pekalongan District, Pekalongan City, totaling 74 students. This sample was selected based on an initial analysis related to the results of semester 1 UAS scores owned by each student so that these considerations made 2 elementary schools selected. Quantitative sampling technique used is cluster random sampling. This research

required 1 experimental class 1 control class and 1 research instrument trial class. Technique use cluster random sampling with the first stage is to do statistical testing.

In this study, the data is in the form of learning outcomes scores given by the experimental and control classes. The technique used for data collection is uses a numeracy literacy ability test, namely using description questions which consist of 5 questions. The researcher analyzed the data statistically starting from the normality of the data, the homogeneity of the data and the independent sample T-test.

## RESULTS AND DISCUSSION

The results of the research discussed in this section consist of the results of the data description test, data normality, and independent sample t-test. The three results are described by the researcher and interpreted so that they can be understood.

**Table 2. Normality Test Pretest Numerical Literacy Ability**

Kolmogorov-Smirnov <sup>a</sup>			
	Statistic	Df	Say.
AND	.121	74	.191

Based on Test Kolomogrov-Smirnov with a significant level of 5% using SPSS it is known that a significance value of  $0.191 > 0.05$  then the null hypothesis ( $H_0$ ) is accepted, indicating that the sample is derived from a population with normal distribution. After testing the normality and normal distribution, the subsequent step involves conducting the homogeneity test.

**Table 3. Homogeneity Test Pretest Numerical Literacy Ability**

Levene	df1	df2	Say.
Statistic			
2.375	1	74	.128

The homogeneity test results from the output indicate that table Test of Homogeneity of Variances with a significance level of 5% it is obtained that the value is  $0.128 > 0.05$ , one can

conclude that  $H_0$  is accepted, indicating that the variance between the two groups is identical or homogeneous.

**Table 4. Independent Sample T-Test Results**

Sig. 2 tailed	$\alpha$	Mean		Information
		Experiment	Control	
0.00	0.05	86.02	80.10	There exists a difference in the average numeracy literacy abilities of the students.

Upon examining the t-test table for the posttest, it can be observed that the significance value is 0.00, which is less than 0.05. Thus, it can be concluded that there exists a significant difference in the average numeracy literacy skills of students in the experimental and control groups following the learning proces. The boxplot indicates that the experimental group has a higher mean compared to the control group showed a result of 86.02, whereas in the control class it showed a result of 80.10. The experimental class has a higher average numeracy literacy ability compared to the control class, as indicated by the box mean.

Students' numeracy literacy skills are carried out in three stages including using numbers and symbols to solve problems, analyzing information, interpreting the results of analysis and making decisions. Numerical literacy skills are at the heart of mathematics (Holmes, 2017). Mathematical numeracy literacy activities are needed for knowledge of mathematical material, numeracy literacy strategies, and effective self-monitoring, as well as a productive attitude in addressing and solving a problem. Students' ability to solve real problems learned at school and based on experiences outside of school is based on mathematical processes (Fajriyah et al., 2019).

The PBL learning process with ethnomathematics nuances is important because students learn with problems encountered in everyday life. Selcuk (2013), said in his research that learning using the PBL model can have a positive influence on improving numeracy literacy, critical thinking, and creative abilities. Meanwhile, in the opinion of Purnamaningrum et al, (2012) the statement explains that PBL is a learning method where

students are presented with real-life problems, allowing them to construct their own knowledge while solving them.

Research from Sugimanet al., (2010) argued that numeracy literacy skills are needed by society, given the importance of the role of numeracy literacy and being the focus of learning mathematics in several countries. This is in line with Santoso's opinion et al., (2013) which says that numeracy literacy is a basic skill that a person must have in order to lead a better life. Students must have the ability to solve problems in order to be able to overcome problems related to school material (Hidayat et al., 2018)

Based on the opinion above, it can be seen that numeracy literacy skills involve complex processes, so they need to be trained from an early age so that students can find the main way and alternative ways to solve various problems. The control class experienced different conditions. The teacher's role in providing a stimulus to explore student knowledge is significant, therefore the teacher needs to employ appropriate techniques in exploring student knowledge. This is because the PBL used in the control class is not collaborated with ethnomathematics.

The use of learning models that are easy to apply and in accordance with the concepts being taught will help students more easily understand the material presented by the teacher. Apart from that, as a math problem, it can introduce students to local cultures in their environment, and make it easier for students to solve various problems encountered in their environment so that students can find the right way to solve each problem. Research by Heryan (2018) says by learning mathematics based on ethnomathematics, students can be encouraged to become more active in the teaching and learning process of mathematics.

Several things make learning using the PBL model with ethnomathematics nuances effective for increasing students' numeracy literacy skills including; 1) In learning using PBL with ethnomathematics nuances, students are provided with more questions and LKPD questions related to the calculation of the perimeter and area of local cultural shapes such as squares, rectangles, and triangles in Pekalongan City; 2) compared to classes that apply Expository models, students who learn using PBL with ethnomathematics nuances are more active in asking questions about material that they have not understood, namely the circumference and area of square, rectangular, and triangular flat shapes presented with the

local culture of batik cloth, either by asking group mates or the teacher; 3) students in learning using PBL with ethnomathematics nuances are more active in discussions than students by applying the Expository model so that students really can directly relate the mathematical concepts of perimeter and area of flat shapes such as squares, rectangles, and triangles to batik cloth in the City of Pekalongan and understand them better when learning through the PBL model with ethnomathematics nuances. The results of this study are in line with the results of Agriat et al., (2019) who say that learning with ethnomathematics nuances is better than ordinary learning. The average value of class mathematics using ethnomathematics based learning is better than classes using conventional learning (Kaselin et al., 2013).

Based on the results above, can be concluded learning using the PBL model with ethnomathematics nuances is effective in increasing students' numeracy literacy skills. The effectiveness of the PBL model with ethnomathematics nuances in improving students' numeracy literacy skills in solving problems does not only lie in students' answers about problems. But when students check back the answers that have been found so that they get the right answer based on the correct concept.

Several studies are in line with this research namely by Abdullah et al., (2015) stated that the numeracy literacy ability of students who learned the ethnomathematical nuanced PBL model was higher than the numeracy literacy ability of students with the conventional model. The research conducted by Hendriana et al., (2018) shows that students who receive treatment with nuanced ethnomathematics learning achieve better quality than the quality achieved by students who receive regular learning. Research from Geni et al., (2017) states that the project based learning model with ethnomathematic nuances is effective for numeracy literacy skills. Research conducted by Hendriana et al., (2018) shows that students who receive treatment with ethnomathematics nuanced learning achieve better quality than the quality achieved by students who receive ordinary learning, and there is a high association between mathematical numeracy literacy skills and self-confidence . From several other studies, it is stated that the PBL model with ethnomathematics nuances can support the learning components and achieve learning goals so that the learning process becomes effective



## CONCLUSION

Based on the data obtained and analysis of data in the previous chapter on students' numeracy literacy skills in problem based learning with ethnomathematic nuances, it shows that the application of the problem based learning model with ethnomathematic nuances is effective for students' numeracy literacy skills and is very effective in use, this can be seen from the PBL model influencing literacy skills student numeracy indicated by a sig value  $<0.05$  and there is an average difference in students' numeracy literacy skills in elementary mathematics learning using the Problem Based Learning (PBL) model compared to expository learning. The results showed that the mean of the experimental class was 86.02, while the control class was 80.10.

## ACKNOWLEDGMENTS

This journal article was written by Fakhrizal Utama based on the results of research which was funded by the the Beasiswa Pendidikan Indonesia, the KEMENDIKBUD and LPDP collaboration program in 2021. The contents are fully the responsibility of the author.

## REFERENCES

- Abdullah, D. I., Mastur, Z., & Sutarto, H. 2015. "The Effectiveness of Learning Models Problem Based Learning Ethnomatematic Nuances on Students' Problem Solving Ability." *Unnes Journal Of Mathematics Education*, 4(3): 285–91. <https://journal.unnes.ac.id/sju/index.php/ujme/article/view/9056>.
- Ambarwati, D., & Kurniasih, M. D. 2021. "Influence Problem Based Learning Helped by Youtube Media for Students' Numerical Literacy Ability." *Scholar's Journal: Journal of Mathematics Education*, 5(3): 2857–2868. <https://doi.org/10.31004/cendekia.v5i3.829>.
- Ashri, D. N., & Pujiastuti, H. 2021. "Numerative Literacy in Integrated Thematic Learning in Elementary School Grades." *Journal of Mathematics Education Works* 8(2): 1–7.
- Darmayasa, J. B., Wahyudin, W., Mulyana, T., & Noto, M. S. (2018). Remembering the Hindu festivities mathematically by the Balinese using integer operations and the least common multiple. *Journal of Physics: Conference Series*, 1008(1). <https://doi.org/10.1088/1742-6596/1008/1/012057>

- Dwi, I. M., Arif, H. & Sentot, K. 2013. "The Influence of ICT-Based Prolem Based Learning Strategies on Understanding Concepts and Ability to Solve Physics Problems ."Journal of Indonesian Physics Education9(1). <https://journal.unnes.ac.id/nju/index.php/JPMFI/article/view/2575>.
- Fajriyah, Euis, Mulyono, and M Asikin. 2020. "Mathematical Literacy Ability Reviewed from Cognitive Style of Students on Mind Mapping Learning Model with Constructivism Approach." Unnes Journal of Mathematics Education Research 8(1): 57–64. <https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/30452>.
- Geni, P. R. L., Hidayah, I., & Zaenuri. 2017. "Student Problem Solving Ability in LearningProblem Based Learning Ethnomatematics Nuances Viewed From Cognitive Style."Journal of Mathematics Education Research. 6(1): 11–17. <https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/17232>.
- Hendriana, H., Johanto, T., & Sumarno, U. 2018. "The Role Of Problem-Based Learning To Improve Students' Mathematical Problem-Solving Ability And Self Confidence." Journal on Mathematics Education 9(2): 291–300. <https://ejournal.unsri.ac.id/index.php/jme/article/view/5394>.
- Ministry of Education and Culture. 2017. "Numeration Literacy Support Material."Ministry of Education and Culture8(9): 1–58.
- Nahdi, D. S., Jatisunda, M. G., Cahyaningsih, U., & Suciawati, V. 2020. "Pre-Service Teacher's Ability in Solving Mathematics Problem Viewed from Numeracy Literacy Skills." Elementary Education Online. <https://doi.org/10.17051/ilkonline.2020.762541>.
- Prabawati, N, M. 2016. "Ethnomathematics of the Rajapolah Weaving Craftsmen Society, Tasikmalaya Regency."Scientific Journal of Mathematics Study Program STKIP Siliwangi Bandung5(1): 25–31.
- Santoso, Ni., Waluya, B., & Sukestiyarno. 2013. "Problem Solving Ability in Mathematics Learning with Master Strategy and Application of Scaffolding."Unnes Journal of Mathematics Education Research 2(2): 69–75. <https://journal.unnes.ac.id/sju/index.php/ujmer/article/view/2683>.
- Sugiyono. 2010.Educational Research Methods. London: ALPHABETA.
- Suharsaputra, U. (2014).Quantitative, Qualitative, and Action Research Methods.Bandung: PT Refika Aditama.

- Trianto. 2007. *Constructivist Oriented Innovative Learning Models*. Jakarta: Library Achievement.
- Widiastuti, E. R., & Kurniasih, M. D. 2021. "Influence of Models Problem Based Learning Using Cabri 3D V2 Software on Students' Numerical Literacy Ability." *Scholar's Journal: Journal of Mathematics Education*, 5(2): 1687–1699. <https://doi.org/10.31004/cendekia.v5i2.690>.
- Yusuf, M, W. , Saidu, I. , & Halliru, A. 2010. *Internasional Journal Of Mathematical Science Education* 3(1):36–42. <https://www.researchgate.net/publication/265710203>  
Ethnomathematics a% 0A mathematical\_game\_in\_Hausa\_culture.