



Implementation of PBL Model on Strengthening Students' Numerical Literacy and Digital Literacy Skills

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Abstract

This study aims to look at the effectiveness of project-based learning on literacy skills and digital literacy of students in elementary schools. This study used a quantitative approach with the control group research method and the pretest-posttest research design. The students used in this study were grade II elementary school students with a selected population of 5 classes consisting of 120 students, randomly selected to meet the control class consisting of 20 students and 1 experimental class in each class who realized that the ability to understand numerical concepts and arithmetic operational skills in everyday life is not in accordance with numerical literacy indicators. The overall results described in the Manova test (Multivariate Analysis of Variance) show that the project-based learning model has proven effective in increasing students' digital literacy and numerical literacy skills. This can be seen from the results of the experimental class using the Project Based Learning model which is superior to the control class using the traditional learning model. Based on the results of the analysis and discussion, it can be concluded that the Project Based Learning model is effectively used to improve the numerical literacy skills and digital literacy of second grade elementary school students. So that through this research students can achieve the expected indicators in the application of numeracy and digital literacy.

Keywords: *project-based learning; numerical literacy; digital literacy*

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Introduction

Literacy and numeracy competencies are fundamental competencies in the industrial era 5.0. This competence is closely related to human activities in daily life Flores et al., (2020); Doyle-Kent & Kopacek, (2020). To understand today's world full of numbers and data, numeracy skills are indispensable. Numerical skills are also required in activities such as trade, health, and education. Furthermore, to face global challenges, solve problems, make appropriate decisions and understand natural and social phenomena, good literacy skills are needed. So that literacy and numeracy skills are important skills and become the basis in education Howard et al., (2017); Zhang et al., (2017).

In the 21st century, education is an important component of ensuring students' ability to learn and innovate as well as their ability to use technology and information media van Laar et al., (2017). Preparing quality students to compete globally is a challenge for educational institutions to adapt to the times of the 21st century. Students not only need to master language skills, science, math, and art, but are also expected to work with life skills and survive Widya et al., (2019); Al Kandari & Al Qattan, (2020). This is in line with the Partnership Declaration for 21st Century Learning, which seeks to develop a number of 21st century skills, including critical thinking and problem solving, communication skills, creativity and innovation skills and collaborative skills González-Salamanca et al., (2020); Corbett & Spinello, (2020). Students' literacy is a prerequisite for achieving 21st century skills.

Based on the 2019 PISA (Program for International Student Assessment) survey, Indonesian literacy is ranked 62nd out of 70 countries. These data show that Indonesian literacy is very low. Bruce & Hogan, (2019) a simple definition of literacy is the ability of a person to read and write. The National Institute for Literacy states that literacy skills are the ability to solve problems in activities such as reading, writing, speaking, computing, and the scope of work and society. UNESCO (United Nations Educational, Scientific and Cultural Organization) defines literacy as the ability to read and write, regardless of the skill acquired or who acquires it. Literacy can be understood as the ability to read, comprehend, re-read, write and solve problems in a variety of phenomena. Indonesia's statistical ability is also relatively low, based on the 2019 PISA survey, which ranked Indonesia 73rd out of 80 countries. Defining numerical ability according to PISA focuses on students' proficiency in solving, interpreting, and reasoning, analyzing, and effectively articulating various mathematical problems. Literacy can be simply defined as the ability to read and write García & Kleifgen, (2020) Over time, literacy today has been defined not only as the ability to read and write but has a somewhat broader meaning (multiple literacy) (Han & Xu, 2020). According to the Pocket Book of the School Literacy Movement, literacy is the ability to access, understand and use information intelligently Hannam et al., (2020); Lestari et al., (2020). There are different types of literacy skills that students need to master, some of which are numerical literacy and digital literacy.

Numerical literacy is the knowledge and ability to analyze, interpret, and interpret the results of analysis, using different numbers and symbols related to basic mathematics to solve practical problems in everyday life (Van den Heuvel-Panhuizen & Drijvers, 2020). In line with this statement, Susperreguy et al., (2020) defines numerical literacy as the ability to analyze and comprehend a statement packaged through the activities of sign or language manipulation found in everyday life, and to express or express these statements in writing. Numerical literacy skills are at the forefront of providing early protection against unemployment, low income and poor health. As Vanbinst et al., (2020) explain in their book, counting skills are required in various aspects of home, work and society. As information about the economy and politics is inevitable, as happens in the life of society and the state, information presented numerically or graphically must be understood and interpreted. Numerical literacy is defined as the ability to use mathematical skills in practice to meet the comforts of life and the needs of life. This ability is also meant to evaluate and comprehend information such as mathematically expressed charts, charts and tables (Sayekti et al., 2021).

In addition to the digital age of the 21st century, it would be even more interesting if numerical literacy skills were balanced with digital literacy skills to strengthen students' ability to compete globally. Growing generations with unlimited access to digital technology have a different way of thinking than previous generations. In terminology, UNESCO says digital literacy is not only the ability to use technology, information and communication tools, but also life skills that include social skills, learning skills and attitudes, critical thinking, creative and inspiring skills. Digital Skills (Spiteri & Chang Rundgren, 2020). Therefore, digital literacy will shape the order of students with critical and creative mindsets and ideas, and if students do not develop digital literacy skills, they will be at risk for job competition and social interaction (Tomczyk, 2020).

Several organizations and educational institutions are collaborating to find learning activities that help improve students' numerical literacy and digital literacy skills. Demand media use, learning strategies, and learning models play an important role in increasingly complex learning outcomes. Research by Tejedor et al., (2020) shows that efforts to assist students' numerical and digital literacy skills through the use of learning videos are yielding results that can enhance numerical literacy skills through the use of mathematical learning video media. It can be seen that the results of the statistical literacy test of the students in the research class and the control class differ significantly with the detailed condition that the test class test results are higher. Research by Widiastuti & Kurniasih, (2021) also found that the problem-based learning model supported by the Cabri 3D V2 software had an impact on the numerical literacy of students at Grade 8 State Junior High School. Copper Selathan. Referring to the research done, it can be concluded that the use of appropriate media and learning models affects the level of literacy of students, especially numerical literacy and digital literacy. What is different from what this research has done is that multiple literacy, that is, literacy and digital literacy, as well as the use of learning models in the selection of research subjects.

Based on observations, it is known the fact that one of the educational institutions in North Sumatra, namely SD Negeri 035935, has low ability in number concepts and arithmetic operational skills in daily life. In addition, the ability to access information and manage information digitally still needs to be improved. Several efforts were made, one of which was learning with a teacher-center approach in the form of lectures, numerical and digital literacy skills have not been able to develop and develop well in students. Therefore, why are researchers interested in and have a foundation in using the Project Based Learning model as an effort to support and grow numeric literacy and digital literacy skills in students.

The Project Based Learning model is based on the concept of creative learning, which enables students to build their knowledge on their own experience. The Project Based Learning model is designed so that students can solve a problem through project activities so that with this project work students will have real experience in project design (Jalinus et al., 2017). The benefits of using the project-based learning model are that it enhances student motivation, improves problem-solving skills, enhances collaboration and coexistence, and enhances resource management skills (Anazifa & Djukri, 2017). Supporting and strengthening research results on Pedersen et al., (2021) entitled "Changes in Students' Ability to Understand Mathematical Concepts Using Problem-Based Learning Models with 3D Cabri Auxiliary Discovery Learning Models". The conceptual comprehension ability of the experimental class 1 with the problem-based learning model with the help of the 3D cabriolet averaged 76.95 higher than that of the class 2 of the experimental class, with an average of only 68,175 for the three-dimensional cabri-assisted learning model. In line with research conducted Pitriani, (2017) with the title "Development of PBL-Based LKS Assisted by 3D Cabri Three Dimensional Materials for Class X SMA" the results show that student learning can be improved by developing LKS 5 products based on 3D cabri 3D. liquid for class X high school. The result of the proof that the percentage of students who work in LKS is 83.3%.

Referring to the above explanation, the researcher aims to delve deeper into the level of productivity that results from using the Project Based Learning model on student literacy and digital literacy skills in North Sumatra, State Primary School 035935 Pancuran Dairi Regency, so this study aims to see the effectiveness of the Project Based Learning model. Basic learning Student numbers are used in the learning process for literacy and digital literacy skills.

Methodology

This study uses a quantitative approach with research methods and control group research pretest-posttest design Peat et al., (2020);Mohajan, (2020). The students used in this study were second grade students of SD Negeri 035935 Pancuran Dairi Regency who realized that their ability to understand numerical concepts and arithmetic operational skills in everyday life was not in accordance with numerical literacy indicators. In addition, the ability to access and manage information digitally is not yet fully functional.

Sample techniques uses random sampling, where each student is given the same opportunity to become a research sample (Schmidt et al., 2018). In the selected population, there are 5 class groups of 120 students, randomly selected to meet a control class of 20 students and 1 experimental class in each class. As a control class, they will receive lectures in the form of lectures using a teacher-center approach, and as a research class, they will be treated as learners using the Project-based learning model.



Figure 1. Quantitative approach procedure

The following is an explanation of Figure 1 Quantitative Approach Procedure: **Identifies the research problem** -- as with any academic study, you must state clearly and concisely the research problem being investigated. **Data collection** -- describe the tools and methods used to collect information and identify the variables being measured; describe the methods used to obtain the data; and, note if the data was pre-existing [i.e., government data] or you gathered it yourself. If you gathered it yourself, describe what type of instrument you used and why. Note that no data set is perfect--describe any limitations in methods of gathering data. **Data analysis** -- describe the procedures for processing and analyzing the data. If appropriate, describe the specific instruments of analysis used to study each research objective, including mathematical techniques and the type of computer software used to manipulate the data. **Statistical analysis** -- how did you analyze the data? What were the key findings from the data? The findings should be present in a logical, sequential order. Describe but do not interpret these trends or negative results; save that for the discussion section. The results should be presented in the past tense. **Interpretation of results** -- reiterate the research

problem being investigated and compare and contrast the findings with the research questions underlying the study. Did they affirm predicted outcomes or did the data refute it? **Summary of findings** – synthesize the answers to your research questions. Do not report any statistical data here; just provide a narrative summary of the key findings and describe what was learned that you did not know before conducting the study (Bloomfield & Fisher, 2019).

The research tools used were interview equipment, observation equipment, test equipment and a quiz for digital literacy skills and digital literacy. Interview tools were used to obtain information from teachers and students about the characteristics of students before and after using the Project Based Learning model, and the conditions of the learning process. The monitoring tool is used as a guide to monitor student status and the suitability of Project Based Learning model implementation steps. The test instrument consists of 3 multiple choice questions and 9 true and 9 false questions as a tool used to measure students' numerical literacy and digital literacy skills. And the Statistics Literacy Questionnaire and Digital Literacy presented on a Likert scale and strongly agree with 5 alternative answers (5), agree (4), do not hesitate (3), disagree (2), strongly disagree (1) were used. Strengthening the testing apparatus for measuring the increase in students' numerical literacy and digital literacy skills after completing the learning process in the control class and research class.

Data collection techniques used in the study were interviews, observation and tests. Before conducting the research, the researcher validated the contents of the instruments used in the study to 1 lecturer and 2 classroom teachers to examine the accuracy of the content of the variables to be studied so that the expected research objectives could be achieved. Next, the researcher observed and followed the learning process carried out by the teacher in the control and experimental classes. After learning has been completed, test instruments and research questionnaires are given through a google form which is filled out by individual students.

Table 1. Variable Questionnaire Grid Strengthening Students' Numerical Literacy and Digital Literacy Skills through Project Based Learning Models

No	Aspect asked	indicator	No. Items/questions	Number of questions
1	Strengthening Students' Numerical Literacy and Digital Literacy Skills through Project Based Learning Models	1. variety of learning resources	1-3	15 questions
		2. variety of learning methods	4-6	
		3. nurturing or mentoring	7-9 10-12	
		4. assessment variation	13-15	
		5. Integration and combination of other platforms		
2.	Strengthening Students' Numerical Literacy and Digital Literacy Skills Number of Questions	characteristics of students, conditions in the learning process	1-15	15 questions
				30 questions

Analysis of Data on Effectiveness of Project Based Learning Model on Numerical and Digital Literacy Skills Using Psychoanalysis (Multiple Analysis of Variables) Scheiner, (2020); Shimizu & Kaneko, (2020). The data test steps include 1) basic testing to determine the

validity and reliability of the device, 2) data collection and 3) basic data analysis, general testing and seamless testing using SPSS version 25 applications. Classes are generally distributed and homogeneous. Determining data distribution as well as hypotheses (Moulder et al., 2018) 4) Project Based Learning on Numerical Literacy and Digital Literacy Skills of Students Ability to See Effectiveness of Using Model.

The following are tables 1 and 2 alternative score answers and questionnaires for Strengthening Student Numerical Literacy and Digital Literacy.

Table 2. Questionnaire Statement Score

No.	Information	Positive Score	Negative Score
1	Strongly agree	5	1
2	Agree	4	2
3	Doubtful	3	3
4	Do not agree	2	4
5	Strongly Disagree	1	5

Result and Discussion

The results of the analysis of the data obtained related to the effectiveness of Project-Based Learning Model on enhancing literacy and digital literacy skills of 20 students of State Primary School 035935 Pancuran were analyzed using psychoanalysis technique (Multivariate Analysis of Variations). To find out what effect an independent variable (X) has on the first dependent variable (Y1) and the second dependent variable (Y2).

The results of the calculation of the validity of the questionnaire to increase the literacy rate revealed that out of the 8 statement items declared valid, 7 items and 1 item were declared invalid, so that the questionnaire was used to increase the number literacy. Study 7 was the statement item, and the results of the reliability test were declared reliable with a value of alpha 1.11. According to the results of the calculation of validity of digital literacy questionnaire, as many as 7 items were declared valid with reliability test results with an alpha value of 1.10. Table 3 shows the results of the questionnaire test to increase the number of students literacy and digital literacy.

Table 3. Result of Questionnaire Validity Test for Enhancing Numerical Literacy and Digital Literacy of Students

r _{tabel}	Numerical Literacy		Digital Literacy	
	r _{hitung}	Conclusion	r _{hitung}	Conclusion
0,423	0,510	If Works	0,600	If Works
0,423	0,563	If Works	0,405	If Works
0,423	0,523	If Works	0,618	If Works
0,423	0,508	If Works	0,572	If Works
0,423	0,500	If Works	0,575	If Works
0,423	0,741	If Works	0,640	If Works
0,423	0,262	Invalid	0,431	If Works
0,423	0,429	Valid		

This research tool is certified by 1 person working as an expert lecturer and 2 people working as a class teacher. So that the tool can be used according to the research objectives. In general, the results of the use of the research questionnaire tested using the Multivariate Analysis of Variations are described below.

Furthermore, descriptive statistical analysis was performed to see the effectiveness of the PjBL learning model on enhancing numerical literacy skills and digital literacy. Based on the descriptive table in Table 4, it can be seen that the average number of control class literacy

and digital literacy capacity is less than the average number of experimental class literacy capacity and digital literacy. With eligibility, the average score for the control class is lower than the average qualification for the questionnaire score for the experimental class.

Table 4. Statistical Description of Numerical Literacy and Digital Literacy

	Class	Mean	Std. Deviation	N
Literacy Numeracy	Experiment	29.60	2.850	20
	Control	27.85	2.651	20
	Total	28.72	2.860	40
Digital Literacy	Experiment	28.45	3.265	20
	Control	27.05	3.060	20
	Total	27.75	3.208	40

Then perform a generality test and a homogeneity test to see if the data obtained is normally distributed and homogeneous. This is a prerequisite for the implementation of a multivariate analysis of variance. The results obtained in the generality test can be seen in Table 5 and the consistency test in Table 6

Table 5. Kolmogorov Smirnov One Sample Normality Test

	Model PjBL	Kolmogorov-Smirnov ^a			Shapiro-Wilk	
		Statistic	df	Sig.	Statistic	df
Literacy Numeracy	1	.170	22	.098	.939	20
Digital Literacy	1	.141	22	.200*	.932	20

Table 6. Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Literacy Numeracy	.000	1	42	.986
Digital Literacy	.121	1	42	.730

Table 7. Multivariate Test Results

	Effect	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.993	2731.546 ^b	2.000	41.000	.000
	Wilks' Lambda	.007	2731.546 ^b	2.000	41.000	.000
	Hotelling's Trace	133.246	2731.546 ^b	2.000	41.000	.000
	Roy's Largest Root	133.246	2731.546 ^b	2.000	41.000	.000
Class	Pillai's Trace	103	2.362 ^b	2.000	41.000	.107
	Wilks' Lambda	.897	2.362 ^b	2.000	41.000	.107
	Hotelling's Trace	.115	2.362 ^b	2.000	41.000	.107
					41.000	.107

Based on the results in Table 6 regarding the generality test using a sample kolmogorovskirnov, the significance value obtained for the digital literacy variable is $0.098 > 0.05$ and the significance value of the digital literacy variable is $0.200 > 0.05$ so the data is said to be normal. Delivered. Meanwhile, the results of the homogeneity test are shown in the table 5, indicates a significance > 0.05 so that the data will be declared homogeneous. After the generality test and homogeneity test are said to be normal and homogeneous, go for psychosis test (multivariate analysis of variance). To see the effectiveness of using PjBL (project-based learning) learning model to increase student literacy and digital literacy skills.

Based on the above multivariate analysis table 7, a significance value of $0.107 < 0.05$ was obtained. Therefore, the results of multivariate statistical analysis suggest that the independent variable (X) has a significant effect on all dependent variables (Y1 and Y2). This means that the use of the Project-based learning model can improve students' numerical literacy skills and digital literacy skills.

Discussion

The overall results described in the Manova test (*Multivariate Analysis of Variance*) show that the PjBL (project-based learning) model is proven to be effective in improving students' digital literacy and numerical literacy skills. This can be seen from the results of the experimental class that treats the Project-based learning model as superior to the control class that uses the traditional learning model. The use of the Project-Based Learning model makes students able to communicate with the results of numbers and digital literacy content from structures related to their experiences, more proactive in giving ideas, able to represent mathematics. Circumstances in the form of graphs, tables, diagrams and equations increase the power of creative thinking and critical thinking. Not only that, students can filter information obtained from the internet without remembering it and maintain ethics when using the internet properly.

Syamsu, (2018);Tabroni et al., (2022) states that in the context of the School Literacy Movement (GLS), literacy is the ability to access, understand, and use things intelligently through a variety of activities, including reading, watching, listening, writing, or speaking. Literacy is an important skill in life. Much of the educational process depends on literacy skills and awareness. The culture of literacy embedded in students affects the level of success in school and social life. Based on the above explanation, it can be concluded that the school literacy movement program in primary schools is a participatory business or activity involving all school members with the aim of promoting a culture of literacy in the school environment and creating a literate school ecosystem.

The development of literacy and numeracy are interrelated (Waters et al., 2018). Children who try in one area have difficulty in another. Developing literacy and numeracy skills at the same time is one way that can be done in formal schools (Cheung et al., 2018). The development of literacy and numeracy can be seen in the context of experiential learning of all subjects. Teachers are not required to formally evaluate and report progress separately from academic results. The development of literacy and numeracy is not the goal formal diagnostic tool. Numerical literacy can be used to inform teachers about the appropriate assessment strategies, activities and tools for their students.

Numerical literacy has three aspects, namely, counting, arithmetic relations and arithmetic operations (Reder et al., 2020). Counting is the ability to verbally count an object and to recognize the number of objects. Numerical relationships are related to the ability to distinguish between quantities such as high, low, high, or small. Meanwhile, arithmetic operations are the ability to perform basic mathematical operations in the form of addition and subtraction. The three aspects of numerical literacy described are the basic aspects of mathematics learning that are important to introduce from an early age until children enter the lower grades (Steffe & Ulrich, 2020). Numerical abilities of children can be identified by the stages of development, namely informal numbers, knowledge of statistics and formal numbers. In the informal phase of numbers, children are able to count in a coherent manner and identify the quality of objects. Informal arithmetic was from childhood to elementary school. Upon entering the early age of elementary school, the number of students skills changes to the number knowledge stage. Numerical skills develop towards abstract concepts (Soylu et al., 2018). In formal education students learn to use mathematical symbols and language. At the formal numbers stage, students learn more complex mathematical operations because the use of arithmetic operations presents mathematical problems that simply do not apply in everyday life. Children will learn to do basic arithmetic like addition, subtraction,

multiplication and division. In order for students to better understand the concept of using arithmetic operations, teachers combine basic arithmetic operations in the form of story questions.

The results of this study are based on research conducted by Yustina et al., (2020) which shows that the use of the Project-based learning model affects students' creative thinking, because they are trained to improve their creative thinking in the learning process. The work process also has almost the same problems so that students can correct each other during the presentation. In addition, the research of Yudha et al., (2020) also supports the findings of this study that the use of the Project-based learning model can increase cognitive curiosity and affect mathematical literacy skills. The abilities that achieve this include communicating, mathematics, representing, reasoning, using formal and technical symbolic operations, and using mathematical tools. Research by Abidin et al., (2021) also shows that project-based literacy education is a good and effective learning model for students to improve their mathematical reasoning abilities.

Based on this description, the learning process should be carefully designed so that it becomes more effective and efficient which of course will affect school literacy and student number literacy. Teachers also have an important role to play in instilling positive emotions in students, guiding them and instilling in them a desire to continue learning. The project-based learning model enables students to accomplish what they need as long as teachers try to design meaningful learning to awaken students' positive emotions and improve school literacy and student literacy.

Conclusion

Based on the results of the analysis and discussion, it can be concluded that the Project-Based Learning model is effectively used to improve numeric literacy and digital literacy skills in second grade students of SD Negeri 035935 Pancuran, Dairi Regency, North Sumatra. By obtaining a critical value of $0.107 < 0.05$, these results indicate that the independent variable (X) has a significant effect on all dependent variables (Y_1 and Y_2). This can be seen from the results of the project-based learning model which is superior to the control class using the traditional learning model. So that through this research students can achieve the expected indicators in the application of numeracy and digital literacy. Using the Project-Based Learning Model, the students also agreed that the process in the Project-Based Learning model could help them improve their numeracy and digital literacy skills.

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