

Effectiveness of Hand-Out Based on a Scientific Approach in Improving the Numeracy Literacy Skill of Class V Elementary School Students

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ABSTRACT

Numeracy literacy skill need to be equipped by students to solve mathematical problem. To achieve this goal, teaching materials such as hand-out based on a scientific approach are needed in learning mathematics. Therefore, this research aims to develop students' numeracy literacy skill by using hand-out based on a scientific approach. This research involved 24 elementary school fifth grade students. The research design used in this study was a one group pre-test post-test design. Data was collected through a numeracy literacy skill test and analyzed using descriptive statistics taking into account aspects of the n-gain index calculation. The results showed that the pre-test average score of students' numeracy literacy skill is 66.33 in the medium category. While the average post-test score of 88 students is in the very high category. The results of calculating the average n-gain index in individual, group and field trials each obtained a value of 0.7 or in the medium category. This indicates that there is an increase in the score of students' numeracy literacy skill. Thus, there is an increase in the average value of students' literacy skill before using and after using scientific approach-based hand-out. Thus, it can be concluded that using hand-out based on a scientific approach is effective in improving students' numeracy literacy skill.

Keywords: hand-out, numeracy literacy skill, scientific approach

INTRODUCTION

Children's education is a stepping stone for someone to achieve the habituation process in daily life both in the family and school environment and is an interconnected element that can realize the achievement of educational goals in general (Molla & Nolan, 2020). This goal can be achieved as shown by satisfactory learning results to form student characters who are able to think at a high level, are logical, systematic and have an objective nature. Apart from that, from the character aspect, they are expected to have honesty, discipline, tolerance and cooperation in solving problems both in the field of mathematics education and in other areas of everyday life. Solving mathematical problems requires literacy skill (Manfreda Kolar & Hodnik, 2021)

One of the basic literacies that is important for students according to the World Economic Forum in 2015 is numeracy literacy (World Economic Forum, 2015). To develop this literacy culture, it is necessary to provide reading materials that can attract students' interest in reading. Students' interest in reading needs to be fostered from an early age because it is an important part that influences the development of students' character. Therefore, the availability of quality and affordable reading materials and students' high interest in reading can encourage students' reading and writing

habits both at school and in society (Duckworth & Brzeski, 2015).

A different thing is happening in the field, where based on the results of rankings related to literacy, mathematics and science abilities carried out by the Programme for International Student Assessment (PISA) in 2015, the performance of Indonesian students is still relatively low. Respectively, the average achievement scores of Indonesian students for science, reading and mathematics are ranked 62nd, 61st and 63rd out of 65 countries evaluated. Indonesia's ranking and average score is not much different from the results of the previous PISA test and survey in 2012, which was also in the low material mastery group. Furthermore, the 2018 PISA data shows that Indonesia's reading score is ranked 72nd out of 77 countries, then the mathematics score is ranked 72nd out of 78 countries, and the science score is ranked 70th out of 78 countries where the three literacy skills (reading, mathematics and science) are in the low category. From the description above, it appears that there is a low literacy culture in Indonesian society.

The results of the PISA assessment and several other studies have prompted the government to carry out evaluations in order to improve the quality of education in Indonesia, especially in terms of classroom teaching practices and the formulation of educational policies. Therefore, improvements are needed in terms of learning practices that can increase students' interest in numeracy literacy. To achieve this goal, it takes teachers who are creative in training students' numeracy literacy skill. This skill is important for students because it is a fundamental skill that equips students with the ability to choose, analyze information critically and use it to make decisions in students' daily lives (Genc & Erbas, 2019). In addition, it is a skill in applying number concepts, arithmetic operations and interpreting quantitative information in everyday life that surrounds students (Szabo et al., 2020)

Ozkale and Ozdemir Erdogan (2022) further explained that mathematical literacy skills are an individual's capacity to formulate, use and interpret mathematics so that this skill is the knowledge to know and apply basic mathematics in students' daily lives. According to the Organization for Economic Co-operation and Development (OECD) mathematical literacy is students' capacity to formulate, apply and interpret mathematics in various contexts including reasoning and using mathematical concepts. The basic ability of mathematical literacy according to the OECD (OECD, 2016) is communication. Mathematical literacy helps someone understand the use of mathematics in everyday life while making the right decisions as a constructive, caring and thinking citizen. The reality that happens to students is that students are often unable to apply their mathematical knowledge in other areas directly, indicating a need that all teachers need to facilitate this process (Jesionkowska, Wild, & Deval, 2020).

Therefore, teachers should improve the learning process by offering teaching materials using an approach that can help students improve their numeracy literacy skills. Grimaldi et al. (2019) suggest that teaching materials are part of learning resources that make learning more meaningful in helping students to no longer be fixated on the teacher's explanation but they free to explore their own knowledge and develop the knowledge they already have. So that teachers innovate in developing teaching materials in this era of globalization through mathematical literacy. According to Rafiepour Gatab (2012) stated that mathematical literacy is needed in the world of education. This is needed because mathematical literacy does not only involve the use of procedures, but demands basic knowledge and competence as well as self-confidence to apply knowledge in everyday life (Kavkler, Magajna, & Babuder, 2014). Thus, teacher creativity is needed in compiling teaching materials that can help students understand and master the material discussed in the learning process.

Based on the results of the observations made, it was obtained an illustration that the textbooks in mathematics lessons at school that were used by teachers still relied more on textbooks and electronic books, so that students felt bored in learning. Apart from that, when working on questions students are passive because the teacher has not used a scientific approach in the learning process. In addition, students' mathematical literacy skills are still low, marked by the difficulty of understanding the meaning of questions that are different from the examples given so that students are not effective in solving problems presented in class.

Thus, it can be stated that the problem often faced by teachers in learning activities is choosing the right teaching materials in order to help students achieve the desired competencies. Konnova et al. (2019) stated that teaching materials are materials that systematically display the complete figure of the competencies mastered by students in the learning process with the aim of planning and reviewing learning implementation. The same thing is stated by Stoeger, Fleischmann, and Obergruesser (2015) that teaching materials are a set of learning that contains materials, methods and evaluation methods that are designed systematically to achieve the expected goals (Mamolo, 2019). Wahyuni, Erman, and Jatmiko (2020) explains that teaching materials are all forms used by teachers in carrying out teaching and learning activities in the classroom in the form of written or unwritten materials. Alwa'id (2021) defines teaching materials as broadly consisting of knowledge, skills and attitudes that students must learn in order to achieve predetermined competency standards. Yaniawati et al. (2021) argues that the purpose of teaching materials is structured to provide teaching materials for teachers that help students obtain alternative information. Thus, it makes it easier for teachers to carry out learning. One of the teaching materials developed is in the form of handouts that summarize a topic, student worksheets, practical instructions,

assignments and tests that are given to students separately.

Hand out teaching materials that can be used in learning mathematics are by compiling concise materials equipped with practice questions using a scientific approach. This hand out provides brief material and practice questions with a learning process where students actively construct mathematical concepts, laws or principles through the stages of observing, asking, classifying, measuring, explaining and being able to conclude the mathematical material discussed in the classroom.

By using a scientific approach in handouts, it is hoped that it will help students be more active in finding out about various sources through observing mathematics learning, not just relying on information from the teacher. Apart from that, hand-out using a scientific approach makes the learning process in the classroom more meaningful because the scientific approach is a form of developing patterns of discovery and developing students' attitudes, skills and knowledge which does not only focus on how to develop students' competence in carrying out observations or experiments, but how to develop knowledge and thinking skills so that they can support creative activities in innovation so as to provide students with the understanding to recognize and understand the material presented in the hand out. Thus, through hand-out with a scientific approach it is expected to be effective in improving students' numeracy literacy skills.

MATERIALS & METHODS

The research design applied in this study was a pre-experimental study by selecting a one group pretest-posttest design. This research design was chosen considering that there was one class involved to get an overview of students' numeracy literacy skills. This description of numeracy literacy skills is obtained after applying the mathematics learning process using hand-out with a scientific approach to geometric material. The hand out used in this study is a

hand out that has been developed and validated through expert judgment both from the material, construct and language

aspects and meets the valid aspects. The results of the hand out validation developed are presented as follows.

Table 1. Hand out validity test results based on a scientific approach

No	Valued aspect	Validator				Average	Category
		V ₁	V ₂	V ₃	V ₄		
1	Material	3.1	3.3	3.2	3.2	3.2	Valid
2	Design	3	3	3.4	3	3.1	Valid
3	Numeracy literacy	4	3.7	3.6	3.7	3.8	Valid
Overall average						3.37	Valid

The data collection process begins with pre-test activities before treatment is given and post-test after treatment is given. The treatment intended in this research is the use of hand-out based on a scientific approach in learning mathematics on geometric material. The research design intended in this research is a research design adapted from the experimental research design developed by Fraenkel, Hyun and Wallen (2012) which is described as follows.

Table 2. Research design

O ₁	X	O ₂
Pre-test	Treatment	Post-test

Information:

O₁: student numeracy literacy skills test results before being taught using a scientific approach-based handout (pre-test).

X: teaching spatial construction material using handouts based on a scientific approach.

O₂: students' numeracy literacy skills test results after being taught using a scientific approach-based handout (post-test).

This study involved 24 elementary school fifth grade students as the research sample. The sample was selected using random sampling technique. The tool used to collect data as a research instrument is a test of students' numeracy literacy skills which consists of 10 numbers in the form of an essay. Instruments in the form of tests can be used to measure the validity and effectiveness of hand-out based on a scientific approach. This test is carried out after the implementation phase. The score interval for determining the level of student mastery is stated in the following table.

Table 3. Student numeracy literacy skill level score interval

Score	Category
$0 \leq \text{value} \leq 40$	Very Low
$41 \leq \text{value} \leq 60$	Low
$61 \leq \text{value} \leq 75$	Medium
$76 \leq \text{value} \leq 85$	High
$86 \leq \text{value} \leq 100$	Very High

Furthermore, data from the results of students' numeracy literacy skills tests that have been collected from this study were processed using descriptive statistical analysis. Descriptive analysis was used to analyze data to get an overview of students' numeracy literacy skills descriptively. To find out the increase in pre-test and post-test scores related to students' numeracy literacy

skill, a gain index is calculated. In this study, the gain index will be used if the average value before and after treatment is different. The formula used to see the increase in score is as follows.

$$\text{gain } (d) = \frac{o_2 - o_1}{\text{max score} - o_1}$$

Information:

O_2 = score of post-tests

O_1 = score of pre-tests

The criteria for increasing pretest and posttest scores related to students' numeracy literacy skills are described in Table 4 below which was adapted from Hake (1999).

Table 4. Gain index interpretation criteria

The amount of "d" Gain	Interpretations
$d > 0,7$	high
$0,3 \leq d < 0,7$	medium
$d < 0,3$	low

RESULT

An indicator of the effectiveness of hand out teaching materials based on a scientific approach in improving numeracy literacy is a test of the results of literacy skills in using hand out teaching materials with the average post-test result being at least in the moderate category. The purpose of analyzing the results of numeracy literacy skills is to find out students' ability to work on math problems based on numeracy literacy. As for the results of numeracy literacy skills that are analyzed are cognitive learning outcomes according to the basic competencies achieved. The results of the pre-test and post-test of numeracy literacy skills are described as follows.

Individual Trials

The pre-test results of students' numeracy literacy abilities before using handouts in the learning process were stated in the low category with the overall average score of students being 56 or in the interval $41 \leq \text{value} \leq 60$. Meanwhile, the post-test results of students' numeracy literacy abilities after Using handouts in the learning process, the overall average score was 84 and was in the interval $76 \leq \text{value} \leq 85$ in the high category. Based on the results of the pre-test and post-test results in individual trials in improving students' numeracy literacy skills, the n-gain value was obtained in the table as follows.

Table 5. Normalized n-gain average results of numeracy literacy skill

Experimental Stage	Average	Category
Individual trials	0.7	Medium

Based on the data presented in Table 5, the pre-test and post-test results in improving students' numeracy literacy skills using hand-out in the learning process is 0.7 in the medium category.

Group Trials

The results of the pre-test on students' numeracy literacy skills before using handouts in the learning process showed that the overall average student score was 69 and was in the interval $61 \leq \text{value} \leq 75$ in the medium category. The post-test results of students' numeracy literacy skills after using handouts in the learning process were stated in the very high category with the overall average score of students being 87 or in the interval $86 \leq \text{value} \leq 100$. Based on the results of the pre-test and post-test results in the group trial in improving students' numeracy literacy skills, the n-gain value was obtained in the table as follows.

Table 6. Normalized n-gain average results of numeracy literacy skill

Experimental Stage	Average	Category
Group trials	0.7	Medium

Based on the data presented in Table 6, it is known that the results of the pre-test and post-test in improving students' numeracy literacy skills using hand outs in the mathematics learning process obtained an average value of 0.7 in the medium category.

Field Trials

The results of the pre-test of students' numeracy literacy skills before using the hand out in the learning process obtained the average value of the entire student score is 74 and is at intervals of $61 \leq \text{value} \leq 75$ in the medium category. The results of the post-test of students' numeracy literacy skills after using hand outs in the learning process obtained an overall average value of 93 and was at an interval of $86 \leq \text{value} \leq 100$ in the high category. Based on the

results of the pre-test and post-test in field trials in improving students' numeracy literacy skills, the n-gain value is obtained in the following table.

Table 7. Normalized n-gain average results of numeracy literacy skill

Experimental Stage	Average	Category
Field trials	0.7	Medium

Based on the data presented in Table 7, it is known that the pre-test and post-test results in improving students' numeracy literacy skills using hand out in the learning process are stated in the medium category, namely at an average of 0.7. To identify numeracy literacy skills in pre-test activities, the explanation is described as follows.

Table 8. Results of pre-test analysis of numeracy literacy skill

Numeracy literacy skill	Result	Category
Individual trials	56	Low
Group trials	69	Medium
Field trials	74	Medium
The overall average	66.33	Medium

Based on the data presented in Table 8, it is known that the results of the pre-test of students' numeracy literacy skills before using hand out in the mathematics learning process obtained an overall average value of 66.33 and it is at interval of $61 \leq \text{value} \leq 75$ in the medium category. Meanwhile, to identify numeracy literacy skill in the post-test activities, the description is described as follows.

Table 9. Results of post-test analysis of numeracy literacy skill

Numeracy literacy skill	Result	Category
Individual trials	84	High
Group trials	87	Very High
Field trials	93	Very High
The overall average	88	Very High

Based on the data presented in Table 9, it is known that the post-test results of students' numeracy literacy skills after using handouts in the learning process obtained an overall average score of 88 and were in the interval $85 \leq \text{value} \leq 100$ with a very high score category. The results of the analysis of the numeracy literacy skills test can be concluded that the level of effectiveness of scientific approach-based teaching materials in increasing numeracy literacy is declared

effective. To support this data, it is necessary to compare the aspect of obtaining n-gain values from each trial stage in the pre-test and post-test activities of numeracy literacy skills. The calculation results are described as follows.

Table 10. Recapitulation of the normalized n-gain mean results of numeracy literacy skill

Experimental Stage	Average	Category
Individual trials	0.7	Medium
Group trials	0.7	Medium
Field trials	0.7	Medium

Based on the data presented in Table 10, it is known that the average n-gain results in individual trials obtained a value of 0.7 or were in the medium category, group trials obtained a value of 0.7 or were in the medium category, and field trials obtained The value is 0.7 or is in the medium category so it can be said that the use of hand out teaching materials based on a scientific approach can improve numeracy literacy skills where at each trial stage there is an increase in the average n-gain value which is in the medium category.

DISCUSSION

The description of the research results suggests that students' numeracy literacy skills can be grown or improved by using handout based on a scientific approach. This is in line with the research results of Hasmawati, Syamsuddin, and Akib (2020) that the use of handout based on a valid scientific approach can be used as an alternative teaching material which is expected to improve students' numeracy literacy skills in learning mathematics. Therefore, utilizing this teaching material can provide space for students to maximize their literacy skills. By using a hand out based on a scientific approach, students will easily understand or investigate the questions or problems presented because in the handout material and practice questions are presented which are designed where each stage in problem solving has been provided which guides students to make maximum use of previous learning experiences. relating to the daily life of

students in solving numeracy literacy problems. Thus, students are motivated to solve non-routine questions contained in the handout which are closely related to the students' daily environment (Ergen, 2020).

By using hand-out based on a scientific approach, students are trained in solving questions or complex mathematical problems that require students' daily experiences. Starting from identifying problems to planning solutions, carrying out settlements and checking the solutions that have been carried out so that students will analyze further related to the completion process they are carrying out. Thus, learning with a scientific approach is not only based on the results but also a problem-solving process that emphasizes understanding to students in knowing, understanding various concepts used by using scientific methods. Therefore, with learning assisted by teaching materials based on a scientific approach student are more challenged in finding the information needed in solving problems, being able to answer each problem well, being able to develop their reasoning power, being able to communicate well and fostering independent learning (Gormally, Brickman & Lutz, 2012).

This is in line with the results of Kundu, Bej and Rice's research (2021) which states that with numeracy literacy skills students will be better prepared to face the times in the 21st century which are relatively fast and dynamic. In addition, students will be able to think rationally, systematically and critically in solving existing problems so that students are confident in the solutions students are doing. Therefore, to be able to maximize students' problem-solving process, the ability to understand the problem correctly is needed.

The same thing was stated by Jiang et al. (2021) that students should be able to develop effective ways of understanding problems so that the goal of solving problems can be achieved. Thus, a teacher's skills are needed in assisting students to understand the questions or problems they

present to their students. One of them is by using numeracy literacy skills, which are important skills for teachers and students as part of higher-level thinking that needs to be developed at elementary school level (Xiao et al., 2019).

Thus, the expectations and goals of the importance of teaching mathematics, namely having the ability to think, such as the ability to think logically, analytically, systematically, critically, reflectively and creatively can be achieved. This indicates that mathematics can be used as a medium to develop students' numeracy literacy skills. Therefore, teachers must be creative in connecting the concept of numeracy literacy with other literacies. Teachers are also required to be able to read, sort and bring material into an appropriate application form. If this can be applied properly, of course the basic numeracy competency scores will be maximized, students will have good numeracy skills and understand the concepts and applications of mathematics in other subject matter and in everyday life.

Therefore, to develop numeracy literacy skills, this can be done by giving students the opportunity to understand mathematical concepts and complete practice questions related to daily life through the use of scientific-based handouts so that an overview of students' numeracy literacy skills can be identified and described. well. Furthermore, a way to improve numeracy skills in classroom learning is by analyzing information displayed in various forms such as tables, graphs, charts and others and then interpreting the results of the analysis to predict something, make decisions or solve problems.

CONCLUSION

One alternative teaching material that can be used by teachers in order to develop students' numeracy literacy skills in mathematics learning is using handouts based on a scientific approach which involves students' abilities in understanding and investigating problems, planning and

carrying out solutions as well as checking or re-checking each stage of the solution. what students do. Thus, students can carefully make decisions in various contexts. Through these numeracy literacy skills, students will have the skills to use various kinds of numbers and symbols related to basic mathematics to solve practical problems in various contexts of daily life. In addition, students can analyze information displayed in various forms (graphs, tables, charts) and then use the interpretation of the analysis results to predict and make decisions. Thus, teachers can develop their own or use handouts based on a scientific approach in order to train students' numeracy literacy skill in learning mathematics in class through scientific activities, namely observing, asking, collecting information (trying), reasoning (associating), and communicating. Therefore, a teacher's creativity is needed in developing and creating a learning atmosphere that can stimulate students to be involved in learning in the classroom in order to develop students' high-level thinking skill, namely students' numeracy literacy skill in learning and solving mathematical problem.

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