Literatur Review: Strengthening Science Numeracy Literacy to Improve Student Understanding in Science Learning

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Abstract

Improving numeracy literacy in science learning is an important effort to deepen students' understanding of science concepts. Numeracy literacy not only includes the ability to count, but also involves data analysis, understanding of quantitative concepts and interpretation of numerical information. In the digital era, these skills are indispensable for developing critical thinking and data-based problem solving. This study aims to examine the effectiveness of innovative learning methods, such as problem-based learning (PBL) and interactive e-comics, in improving students' numeracy literacy and science understanding. The results showed that PBL was able to improve students' science literacy with moderate to high N-Gain categories, while interactive e-comics proved effective in facilitating the understanding of science concepts through interesting visuals. However, challenges such as limited facilities, low interest in reading, and differences in students' literacy levels are still an obstacle. Therefore, collaboration between teachers, schools, parents and the government is needed to create a supportive learning environment, provide adequate facilities and train teachers in teaching science numerically. With a holistic approach, students' numeracy literacy can be improved, preparing them for global challenges and technological advancements.

Keywords: Numeracy Literacy, Science Learning, Problem-Based Learning, Interactive E-Comics, Science Understanding.

INTRODUCTION

High levels of literacy and numeracy are required in the education system in the 21st century due to global developments. Reading, writing, speaking and listening are components of literacy, which are fundamental language skills that enable people to communicate successfully and efficiently (Nurlaili *et al*., 2023). To develop students' skills, literacy activities include reading books, paying attention to teachers, thinking critically, discussing and processing knowledge about current or future circumstances. Students can discover their strengths in current and future social knowledge through literacy activities (Komarudin *et al*., 2023). In terms of making judgments based on scientific considerations, science literacy is the capacity to understand science, communicate science orally or in writing, and apply science knowledge to solve problems while maintaining a positive attitude and awareness of oneself and the environment. Presenting science teaching materials is one strategy to improve the literacy level of Indonesian students (Filjinan *et al*., 2022). In Latin, literacy comes from literatus, which means one who learns. Literacy generally refers to an individual's ability to read, write, speak, calculate, and solve problems at the skill level required in everyday life. Literacy is not only limited to the ability to read and write, but also includes understanding, analyzing and using information to make decisions. The ability to read can be the first step in understanding other basic literacies, such as scientific literacy, numeracy literacy, digital literacy, cultural and civic literacy and financial literacy (Khakima *et al*., 2021). In the context of Education, Literacy is an important foundation for accessing and understanding various disciplines, including Natural Sciences (IPA).

Literacy is a complex process that includes the development of prior knowledge, culture, and experience to create new understandings and knowledge. Literacy acts as a link between the individual and society, as well as being an important tool for individuals to develop and actively participate in a democratic society. From a language perspective, Literacy Learning aims to enable students to use various language systems to construct specific meanings. From a cognitive point of view, literacy learning is designed so that students are able to take advantage of various mental processes and strategies to form meanings based on texts, objectives and audiences. From a cultural perspective, Literacy Learning aims for students to form meanings in the context of certain social groups, across social groups, and understand the norms and values that prevail in these groups. Finally, Literacy Learning aims for students to develop their literacy dimensions so that they are able to negotiate the meaning contained in the text (Abidin *et al*., 2021). Numeracy can be defined as the ability to apply mathematical number concepts and computational operations skills in everyday life and the ability to interpret information in quantitative form (Khakima *et al*., 2021). Numeracy involves basic math skills such as addition, subtraction, multiplication, and division, as well as the ability to analyze data, make estimates, and solve problems involving numbers. Numeracy is very important in science learning because many science concepts require quantitative understanding, such as measurement, data analysis, and graph interpretation. For example, the principle of numeracy helps to get a physical picture of quantities because quantities are always expressed by numbers.

Numeracy literacy is defined as a person's ability to use reasoning. Reasoning means analyzing and understanding a statement, through activities in manipulating symbols or mathematical language found in everyday life, and expressing these statements through writing or orally (Perdana & Suswandari, 2021). Numeracy literacy is not only limited to the ability to count, but also involves a conceptual understanding of how numbers and data are used in various situations. In science learning, numeracy literacy helps students to understand science concepts that involve quantitative data, such as graphs, tables, and experimental results. One of the most important subjects in education is natural science (IPA), because IPA can help students in dealing with various problems in the modern world. Therefore, learning methods are needed that can equip students with strong competencies, science and technology literacy, critical, creative, and logical thinking skills, as well as the ability to collaborate and communicate effectively (Yuliati, 2017). Knowledge gathered through experimentation, observation, and deduction to produce a reliable explanation of a phenomenon is known as natural science (Lepiyanto, 2017).

Literacy and numeracy are two basic competencies that are very important in education, especially in Learning Natural Sciences (IPA). Literacy in general, refers to an individual's ability to read, write, speak, and understand information, while numeracy deals with the ability to use mathematical concepts in everyday life. These two skills are interrelated and form the foundation for the development of critical thinking and problem-solving abilities, especially in the context of science (Abidin *et al*., 2021). Scientific literacy, as part of literacy, includes the ability to understand scientific concepts, interpret science information, and apply that knowledge in real situations. Meanwhile, numeracy assists students in analyzing quantitative data, interpreting graphs, and understanding mathematical concepts related to science (Khakima *et al*., 2021). Science literacy is one of the abilities that is very important to pay attention to so that students can use science in an acceptable way (Faudi *et al*., 2020). Science literacy is the ability to understand the features of science learning, draw conclusions from various facts to determine the scientific process, and investigate various questions using new information. It also includes the ability to explain problems from the surrounding environment.

Children must be able to think critically, solve problems, develop their creativity through various science experiments, communicate their observations, and cooperate with friends when conducting science experiments in order to participate in science literacy activities. (Sari *et al*., 2021). In addition, numeracy plays an important role in everyday life, where the ability to calculate and apply mathematical concepts is key to solving various challenges faced. Effective numeracy learning supports students in managing quantitative information and making decisions based on data (Rachmawati & Nugrahimi, 2023).

Because they can identify and discover various applications of science in daily activities, students who receive science literacy instruction are more engaged in classroom activities and show greater interest (Nuzula & Sudibyo, 2022). Science literacy is an important ability that students need to have in addition to reading and arithmetic skills. Science literacy, according to research, is the skill needed to understand scientific ideas and interpret relevant scientific data in the context of everyday life. Science literacy enhances students' understanding of environmental issues and empowers them to address and solve difficult problems using science-based approaches. Despite the fact that science literacy has many benefits, various circumstances can affect students' capacity for science literacy. Low reading ability, unsupportive learning and limited access to contextualized textbooks are among them. To provide the younger generation with the necessary skills to face the problems of globalization, good science education must be planned and implemented (Nurlaili *et al*., 2023). Therefore, the purpose of this essay is to analyze the importance of literacy, numeracy and science education and how these factors affect students' preparedness for future problems.

RESEARCH METHODS

The research method used is Qualitative Research with types of research including: This research uses the literature study method, which is a research method carried out by examining data from various written sources that are relevant to the research topic. Such as articles or scientific journals. This literature study is research related to reading, collecting, recording, sorting, then managing the literature that has been obtained (Hanifah & Purbosari, 2022) and then researchers use qualitative methods, namely descriptive research and analysis of research science directed at finding knowledge or theories on journals and articles (Waruwu, 2023). Then the researcher connects between references related to the research topic discussed. Researchers studied various scientific journals and previous research results to be made later in the results of the discussion. From the search results, four (4) journal articles were obtained. Then the researcher limits it again to the category of journals published within 5 years. Then the researcher saw the information to be studied in this journal and then from the results of the study the researcher took or got information to be included in the results of the discussion, namely the ability of science literacy results of SMP Negeri 32 Surabaya students gave a positive response with the highest increase in the competency / science process aspect, which reached N Gain 0.53. At SMP Negeri 1 Kalibaru, the results are quite good with a moderate category. And at SD 1 Surakarta, the results showed that students' science literacy skills were in the poor category.

RESEARCH RESULTS AND DISCUSSION

Table 1. Literatur Review Results

No	References	University Of Writers	Research Locations	Result
1	Nuzula, N. F. & Sudibyo, E. (2022)	Universitas Negeri Surabaya	SMP Negeri 32 Surabaya	The results showed that the application of problem based learning model can improve the science literacy of students with moderate N-Gain Category. The average N-Gain of science

				literacy test class VIII I was 0.38, with the highest increase in the aspect of competence / science process that reached N-Gain 0.53. In addition, students respond positively to this learning, which supports the development of students ' scientific literacy skills.
2	Filjinan, S. K. *et al*., (2022)	Universitas Jember	SMP Negeri 1 Kalibaru	The results showed that the interactive e-comic developed has a very high validity with an average score of 93%, very high practicality with an average score of 92.5%, and a fairly good effectiveness with an N-gain score of 0.60, which is included in the medium category. This study aims to improve students ' science literacy in science learning.
3	Nurlaili, *et al*., (2023)	Universitas Mataram	SDN 1 Surakarta	The results showed that the ability of science literacy grade V SDN 1 Surakarta students are in the category of poor with an average percentage of 42.88%. Students are categorized based on the score obtained into high, medium, and low categories. Students in the high category are included in the conceptual science literacy level, students in the medium category are included in the functional science literacy level, and students in the low category are included in the nominal science literacy level.
4	Mursyid, R. *et al*., (2024)	Universitas Djuanda	SD Negeri Benda Cicurug	The results showed that there was a low influence of scientific thinking skills in science literacy on student learning outcomes in science subjects in the sixth grade of SD Negeri Benda. The correlation value obtained was 0.05 or 5%, and the Mann Whitney U test showed a value of 0.138, which means there is no difference in learning outcomes between Class VI.A and VI.B. In conclusion, there is no significant effect of scientific thinking skills in science literacy on student learning outcomes in science subjects.

Discussion

The results of this Nuzula & Sudibyo (2022) study focus on applying the problem based learning (PBL) model to improve student science literacy. The study was conducted in SMP Negeri 32 Surabaya with 20 students of Class VIII I. The method used is pre-experiment with one group pretest posttest design. The results showed that the application of PBL model can improve the science literacy of students with moderate N-Gain category, the average N-Gain of 0.38. The highest increase occurred in the aspect of competence / science process with N-Gain 0.53, which shows that students are more active in learning activities and are able to develop their science competence abilities. Students also responded positively to this learning, which shows that the PBL model is not only effective in improving science literacy, but also in creating a pleasant learning atmosphere and supporting the development of students ' abilities. However, despite the improvement, the context aspect of Science showed a lower N-Gain, which was 0.23, which indicated that students still had difficulties in applying science knowledge in everyday situations.

Results in research Filjinan, S. K. (2022) shows that interactive e-comics get an average validation score of 93%, which is included in the very valid category. This shows that the content and design of e-comics are in accordance with the learning objectives and can be used effectively in the teaching and learning process. The average practicality score of interactive e-comics reached 92.5%, also included in the very practical category. This means that the e-comic is easy for teachers and students to use, and can be well integrated into learning activities. An N-gain score of 0.60 indicates that interactive e-comics have a fairly good effectiveness in improving students ' science literacy, which is included in the medium category. This can be seen from the increase in students ' post-test scores, which reached an average of 84.3, indicating progress in understanding the material. The use of interactive e-comics makes students more active in learning. The interaction between teachers and students becomes more

dynamic, and students are directly involved in the learning process through activities that are in e-comics, such as filling in the blanks and accessing links to images and videos related to the material.

Results on the research of Nurlaili *et al*., (2023) highlights the science literacy skills of Grade V students at SDN 1 Sukarara, especially in heat transfer materials. The results showed that students ' science literacy skills were in the poor category, with an average percentage of 42.88%. Students are grouped into three categories based on the scores obtained, namely, 1) high category, students in this category have conceptual science literacy, which shows a deep understanding of science concepts. 2) medium category, students in this category demonstrate functional science literacy, where they can apply science knowledge in a practical context. 3) low category, students in this category fall into nominal science literacy, which indicates a very limited understanding of science concepts. This study also emphasizes the importance of applying contextual learning methods to improve students ' science literacy skills. Innovation is needed in learning activities so that students can better apply their science knowledge, such as by implementing meaningful reading and learning habits.

Results in research Mursyid, R. *et al*., (2024) discussion of the results of the study showed that there was a low influence of the ability to think scientifically in scientific literacy on student learning outcomes in science subjects in the sixth grade of SD Negeri Benda. The correlation value obtained is 0.05 or 5%, which indicates that the effect is not significant. This means that although there is a relationship between scientific thinking ability and learning outcomes, the strength of the relationship is very weak. In addition, the results of the Mann Whitney U test showed a value of 0.138, which is greater than 0.05. This shows that there is no significant difference in learning outcomes between students in Class VI.A and VI.B. Problem-based learning (PBL) methods have been shown to be effective in improving students ' science literacy and numeracy. PBL encourages students to think critically, actively participate in learning, and seek solutions to given problems.

According to Nuzula & Sudibyo (2022), the application of PBL can improve the science literacy of students with medium to high N-Gain categories, especially in the aspect of science competence/process. In addition, the use of learning media such as interactive e-comics has also been shown to be effective in improving students ' understanding of science concepts. Interactive E-comics combine attractive visuals with interactive storylines, making it easier for students to understand complex science concepts (Filjinan *et al*., 2022). Thus, numeracy literacy in science learning requires not only conceptual understanding, but also practical skills in analyzing and interpreting data. Innovative learning approaches, such as PBL and interactive e-comics, can be a solution to improving students ' numeracy literacy. However, the successful implementation of numeracy literacy also requires support from various parties, including teachers, schools, and governments, to create a supportive learning environment and provide adequate facilities.

CONCLUSION

Increasing numeracy literacy in science learning is a great challenge to deepen students ' understanding of science concepts. Numeracy literacy includes not only the ability to count, but also involves data analysis, understanding of quantitative concepts, and interpretation of numerical information. In the digital age, these skills are essential for developing critical thinking and data-driven problem solving. Various innovative methods, such as problem-based learning (PBL) and interactive e-comics, have been shown to be effective in improving numeracy literacy and science understanding. PBL encourages students to think critically, participate actively, and seek solutions, while interactive e-comics facilitate understanding of

science concepts through engaging visuals and interactive storylines. However, challenges such as limited facilities, low interest in reading, and differences in student literacy levels still hinder progress. Other factors such as teaching methods, learning environment, family support, and students' mental readiness also affect learning outcomes. Therefore, collaboration between teachers, schools, parents, and the government is needed to create a supportive learning environment, provide adequate facilities, and train teachers in teaching science numerically. With a holistic approach, students ' numeracy literacy can be improved, preparing them for global challenges and technological advances. To improve students ' understanding of science learning through strengthening numeracy literacy, various innovative and effective ways are needed. Teachers can apply problem-based learning methods that have been tested to improve students ' scientific literacy, especially in the field of science competence. In addition, the use of interconnected media such as e-comics needs to be improved because it is proven to have a high level of effectiveness and ability in helping students understand science concepts in a more interesting and fun way.

Schools also need to improve interconnected learning approaches so that students can more easily connect science theories with everyday life. One way that can be done is to provide more activities based on experiments or discussions that encourage students to think critically and solve problems independently. In addition, regular evaluation of the capabilities of the learning methods used is essential to know the development of students ' understanding and adapt the way of teaching that better suits their needs. In addition to the role of teachers and schools, support from parents is also very necessary in improving science literacy and numeracy of students. Parents can help by providing a supportive learning environment, such as getting children used to reading science material or discussing natural phenomena that occur around them. With the cooperation between teachers, schools, and parents, the stabilization of numeracy literacy in science learning can be more perfect and have a positive impact on student learning outcomes.

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