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Deep Learning Approach to Numeracy Literacy Learning in Elementary Schools

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Abstract. Students show that they often cannot apply mathematical knowledge in other fields directly and the teaching and learning activities that occur are dominated by conventional learning, focusing on one-way knowledge transfer from teachers to students, this kind of learning is no longer adequate to meet the demands of the modern era. This article aims to analyze and understand the implementation of numeracy literacy learning at the elementary school level using a deep learning approach to make learning more personal and in-depth. This study uses a qualitative method using data collection techniques with interviews, questionnaires, and literature studies, and data analysis is carried out using analysis techniques according to Miles and Huberman. The data obtained will be subjected to data reduction, data presentation, and drawing conclusions or verification. This study shows that students have an awareness in the use of numbers and symbols, analytical and problem-solving practices, the relevance of learning to everyday life, enjoyable learning experiences, and a positive atmosphere that encourages active involvement.

Keywords: Numeracy Literacy, Deep Learning, Elementary School

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INTRODUCTION

The lack of alignment between the curriculum and the needs of students is often a major obstacle in the implementation of literacy and numeracy education. Although the curriculum has been designed comprehensively it does not always correspond to the developmental levels and individual learning needs of students. Some students require a more personalized and interactive approach, while others may benefit from structured and conventional teaching methods (Fikriawan, Darmawan, and Rizaldi 2024). Numeracy literacy is closely related to mathematics. However, mathematics is often perceived as a difficult subject by many students, particularly when they are required to translate real-life problems into mathematical representations. This perception creates a negative impression of the subject, which has a detrimental effect on learning motivation and academic adjustment at school (Salvia, Sabrina, and Maula 2022).

In the 21st century, students are expected to possess various literacy competencies, including numeracy literacy. Numeracy literacy refers to the knowledge, skills, behaviors, and dispositions required to apply mathematical understanding in different life contexts (Hazimah and Sutisna 2023). In the 21st century, students are expected to possess various literacy competencies, including numeracy literacy. Numeracy literacy refers to the knowledge, skills, behaviors, and dispositions required to apply mathematical understanding in different life

contexts (Mahmud and Pratiwi 2019). Numeracy literacy consists of three aspects: counting, numerical relations, and arithmetic operations. Counting refers to the ability to count objects verbally and identify the number of objects (Perdana and Suswandari 2021). Numerical relations involve the ability to compare quantities such as more or less, higher or lower, and longer or shorter. Arithmetic operations include basic mathematical skills such as addition and subtraction (Mahmud and Pratiwi 2019). Through numeracy literacy, individuals can develop the ability to obtain information, explain concepts, analyze data, use mathematical symbols, and communicate ideas effectively (Yuda and Rosmilawati 2024). Based on the previous description, Education and literacy are therefore interrelated and constitute fundamental needs and rights of every individual, including students with special needs (Heryani and Haerul 2023).

The reality among students shows that they are often unable to directly apply their mathematical knowledge in other fields, creating a need for all teachers to facilitate this process so that students can integrate and apply their knowledge more effectively (Mahmud and Pratiwi 2019). In learning, students are not involved in the process of discovering concepts, so they tend to forget easily and become confused when faced with questions given by teachers (Dila and Zanthy 2020). As found by (Hazimah and Sutisna 2023), the low level of numeracy comprehension among fifth-grade students is influenced by many factors, one of which is the dislike of most students for anything related to mathematics.

Conventional learning approaches that emphasize one-way knowledge transfer from teachers to students are no longer adequate to meet the demands of the modern era (Wijaya, Haryati, and Wuryandini 2025). Learning approaches need to become more interactive and collaborative so that students actively participate in the learning process and develop critical and creative thinking skills. One approach that supports these competencies is the deep learning approach. In this study, the term *deep learning* refers to a pedagogical learning approach, not the concept of deep learning used in artificial intelligence or machine learning. As a pedagogical concept, deep learning focuses on meaningful learning experiences that encourage critical thinking, collaboration, and student engagement.

The deep learning approach emphasizes the development of 21st-century competencies, including critical thinking, collaboration, communication, creativity, culture, and connectivity, often referred to as the 6Cs (Montessori, Murwaningsih, and Susilowati 2023). Deep learning is a learning approach that aims to train students' critical thinking skills. This approach provides significant experiences for students and encourages the development of

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independence and collaborative skills (Adnyana 2024). In addition, deep learning includes three basic elements, namely meaningful learning, mindful learning, and joyful learning (Adnyana 2024; Wijaya et al. 2025).

Through meaningful learning, students connect new knowledge with prior experiences. Mindful learning encourages students to become aware of their learning processes and develop reflective thinking. Joyful learning creates a positive and engaging learning environment that motivates students to participate actively in learning activities. Therefore, teachers play an important role not only in delivering content but also in designing meaningful learning experiences that encourage student engagement and problem-solving skills (Siahaan 2018). Based on this background, this study aims to analyze the implementation of numeracy literacy learning in elementary schools using a deep learning approach. The study seeks to explore how teachers integrate meaningful, mindful, and joyful learning principles into numeracy literacy instruction.

METHODOLOGY

This study employed a qualitative research approach. Qualitative research focuses on understanding social phenomena through descriptive data in the form of words rather than numerical measurements (Fadjarajani et al. 2020). The participants of this study consisted of one sixth-grade elementary school teacher who implemented numeracy literacy learning using a deep learning approach. The teacher was selected purposively based on their experience in teaching numeracy-related topics and integrating contextual learning activities in the classroom.

Data were collected through three techniques: interviews, questionnaires, and literature studies. The interview used a semi-structured format consisting of several open-ended questions designed to explore the teacher's experiences in implementing numeracy literacy learning through deep learning principles. The interview lasted approximately 30–45 minutes and was conducted to obtain in-depth information about teaching practices, student engagement, and challenges encountered during the learning process. The questionnaire consisted of several statements related to students' engagement, awareness of numeracy applications in daily life, participation in learning activities, and their responses to contextual learning experiences. The questionnaire items were developed based on indicators of numeracy literacy and deep learning concepts derived from previous studies. To support the validity of the data, a literature study was also conducted using books, scientific articles, and other academic sources related to numeracy literacy and deep learning approaches.

The collected data were analyzed using the interactive analysis model proposed by Miles and Huberman (Zulfirman 2022), which consists of three main stages: data reduction, data display, and conclusion drawing. In the data reduction stage, the researcher selected, simplified, and categorized relevant information obtained from interview transcripts and questionnaire responses. In the data display stage, the organized data were presented in narrative form to facilitate interpretation. Finally, in the conclusion drawing stage, patterns and relationships within the data were interpreted to generate research findings regarding the implementation of numeracy literacy learning using a deep learning approach.

RESULTS AND DISCUSSION

Numeracy Literacy

Numeracy literacy refers to the knowledge and skills to (1) obtain, interpret, use, and convey various numbers and mathematical symbols to solve practical problems in various contexts of life; and (2) analyze information presented in various formats to make decisions (Rohim 2021). Numeracy is a person's proficiency in formulating, identifying, and implementing basic mathematics in various contexts necessary in everyday life (Izzatin dalam Hazimah & Sutisna, 2023). Numeracy skills can be measured through proficiency and skills in applying mathematics practically to meet life's needs, as well as understanding information presented mathematically, such as diagrams, graphs, and tables (Izzatin et al. 2022). The indicators of numeracy literacy (Han in Salvia et al., 2022) are as follows:

Table 1. Numeracy Literacy Indicators

No	Indicator
1	Using various numbers and symbols related to basic mathematics to solve problems in various contexts of everyday life
2	Analyzing information presented in various forms (graphs, tables, sections, diagrams, etc.)
3	Interpreting the results of the analysis to predict and make decisions

Based on the interview results, in terms of the use of numbers and symbols related to basic mathematics for solving problems in everyday life, students find it easier to relate to buying and selling or money-related concepts. When using money in buying and selling activities, there will be concepts of debt and payment. One application of debt and payment is

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found in learning about integers. When learning using the words “minus” and “positive,” students still have difficulty solving problems. However, when the words “minus” and “positive” are replaced with ‘debt’ and “payment,” it becomes easier for students to solve problems.

The use of numbers and symbols related to basic mathematics is not only found in the learning process, because mathematical numbers and symbols are inseparable from everyday life. In addition to the learning process, students use mathematical numbers and symbols when they play. In futsal games, scores are used to determine which team has scored the most goals and will be the winner. Determining the score in futsal games is one example of the use of basic mathematical numbers and symbols in everyday life.

One of the subjects taught in elementary school mathematics is statistics. In elementary school statistics, simple graphs, tables, and diagrams are presented. To facilitate learning, teachers use simple examples by creating graphs of the number of male and female students in their class. Using examples that are familiar in everyday life, such as the population of students in the class, aims to facilitate learning, because students have difficulty applying statistics using narrative texts alone. For example, based on interview results, students still have difficulty determining the difference between one piece of data and another.

Another difficulty encountered in analyzing information is that students find it difficult to calculate percentages or solve problems presented in pie charts. When given problems with large amounts of data, such as the number of people infected with Covid-19, students still find it difficult to determine the numbers. The way teachers and students interpret the results of the analysis to make decisions is by explaining them directly according to the content and context. In addition, students will be asked to come forward and explain the results of the data obtained. Students' ability to make decisions based on data interpretation is quite good when the data presented is familiar or relevant to them, rather than large amounts of data that are beyond their reach.

Deep Learning

Deep learning is a learning approach that aims to train students' critical thinking skills (Adnyana 2024). Deep learning is a process for acquiring six global competencies, namely character, citizenship, collaboration, communication, creativity, and critical thinking. These competencies also include compassion, empathy, social-emotional learning, entrepreneurship, and other skills necessary for individuals to function well in a complex world (Fullan, Quinn, and McEachen 2018). Deep Learning is an approach that emphasizes the creation of a

learning environment and a learning process that is mindful, meaningful, and joyful through intellectual, ethical, aesthetic, and kinesthetic development in a holistic and integrated manner (Nugroho et al. 2025).

Meaningful Learning is an important foundation in the deep learning approach, as it allows learners to understand learning materials deeply and comprehensively. Through relevant and contextual learning experiences, learners can relate new knowledge to previous experiences, thereby improving understanding and information retention. This approach encourages learners to actively engage in the learning process, making learning more meaningful and impacting their cognitive development (Wijaya et al. 2025).

Mindful Learning is the ability to use rational reasoning in decision-making, as well as to act with full awareness of the possible impact of those actions on oneself specifically. This approach encourages individuals to be reflective and responsible for the choices they make (Siahaan 2018). The mindful learning approach, which is derived from the concept of mindfulness, describes a psychological state in which individuals are consciously open to new things, sensitive to different conditions and contexts, and understand everything implicitly with a focus on the experience at hand (Abdurrochim, Hanifah, and Syahid 2024).

Joyful learning is learning that places students as the main characters in the learning process and teachers as facilitators. Joyful learning can increase students' imagination, trigger their enthusiasm for learning, and motivate them to continue learning (Ariawan and Pratiwi 2017). Thus, the word “enjoyable” in this context refers to the state of learners expressing feelings of happiness during the teaching and learning process. These feelings of happiness are not only felt in the heart, but also expressed naturally. This expression is expected to make the classroom, as the main environment in the teaching and learning process, more “lively” and sustainable (Wicaksono 2020).

Joyful, meaningful learning that makes students aware of their learning is an application of the deep learning approach. By applying apperception at the beginning of the lesson, teachers try to spark students' enthusiasm and focus on the learning process. Teachers will ask light questions to direct the class's focus to the learning objectives for that day. In addition to asking questions relevant to the learning objectives, teachers conduct warm-ups such as cheering and stretching. The teacher mentioned that mindful learning is accompanied by the emotional abilities of students. Therefore, in learning, there needs to be awareness to make students pay attention to the learning process.

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Meaningful learning is carried out by presenting everyday events or incidents. Based on the interview results, students feel enthusiastic when learning takes place outside the classroom. For example, in science lessons, students are invited to see water hyacinth plants firsthand. Learning that is relevant and contextual can provide a deep and comprehensive understanding of the subject matter.

To create enjoyable learning, teachers internalize games into the learning process. During learning, teachers also insert ice-breaking activities to relieve fatigue for a moment and make the learning atmosphere more enjoyable. On the other hand, ice breaking can be a situation to see the potential of students. For example, doing ice breaking with arithmetic quizzes, from this activity, students who are quick at calculating, enthusiastic, and so on will be seen.

An example of applying games in learning is by playing Monosean or ASEAN Monopoly. It is a regular monopoly game, but the content is related to ASEAN. Learning will be more enjoyable and less stressful because the atmosphere created is serious but still fun. Learning is considered enjoyable when students are enthusiastic about the game, smile continuously, and keep asking to play the game again.

Numeracy Literacy Learning with a Deep Learning Approach

The process of numeracy literacy learning with a deep learning approach is meaningful and enjoyable, and students must be mindful when learning. Based on the questionnaire results, teachers agree that in numeracy literacy learning, students show attention to the use of numbers and symbols in everyday life, actively listen and engage in discussions when analyzing information, and recognize the importance of problem-solving processes. In learning, students can relate numeracy literacy material to their daily experiences, understand the meaning of the use of numbers and symbols in problem solving, and show interest in learning because the material taught feels relevant. From the learning process carried out, students appear enthusiastic and excited in numeracy literacy activities because the classroom atmosphere supports a fun learning experience so that students are actively involved in learning.

Teaching and learning activities in the classroom are often carried out contextually in accordance with events occurring in the surrounding environment. Based on the interview results, subject teachers mentioned that there is still a lack of reading materials that make it easy for students to learn. This makes it easier for teachers to take quick action by continuing

to relate to the most relevant things in the context. However, there will be difficulties in the future when students are faced with exams whose questions are not compiled by the teacher themselves.

The practice carried out in numeracy literacy learning is to utilize student engagement. The learning atmosphere will be more lively when students are present in the classroom. When teachers teach but students are not engaged in learning, the material is not conveyed properly and learning becomes unconscious. Learning is linked to everyday experiences and events to suit the context. The method used in numeracy literacy learning with a deep learning approach is to prepare games that contain challenges. The challenges make students enthusiastic about participating in learning, and the learning objectives are easier to achieve. They are easier to achieve because the learning atmosphere is enjoyable, making students aware of the learning process. When students are aware and the learning is made enjoyable, the learning content will be easier to understand and the learning will feel more meaningful. This is in line with the concept promoted by the Minister of Primary and Secondary Education (Mendikdasmen) Abdul Mu'ti, who emphasizes the importance of a more meaningful and contextual learning experience (Taofik dalam Suwandi, Putri, and Sulastri 2024).

CONCLUSION

Numeracy literacy learning that applies a deep learning approach creates a fun learning atmosphere. In addition to being fun, the learning process will certainly be more conscious and meaningful in terms of student engagement. This is because in the learning process, students are encouraged to learn more contextually and comprehensively about a subject matter. This is in line with the indicators from the study, namely those related to numeracy literacy with a deep learning approach in elementary schools. These include the achievement of indicators of student awareness in the use of numbers and symbols in everyday life, practice in analyzing and problem solving, the connection between learning and everyday life, enjoyable learning experiences, and the creation of a positive atmosphere that encourages active student participation.

Based on the results of this study, a recommendation that can be given to optimize the implementation of numeracy literacy learning with a deep learning approach in elementary schools is the provision of reading materials that facilitate learning. This applies to both classroom learning and when students study independently. Further research can develop books or other resources for numeracy literacy learning in elementary schools.

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