



Integrating Climate Change Contexts into Numeracy Learning: Project-Based Activities in Primary School

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ABSTRACT

Climate change is a global challenge that impacts health, the environment, and socio-economics, thus demanding innovation in basic education. Numeracy plays an important role not only as a numeracy skill, but also as a means of building students' critical awareness of environmental issues. This study aims to analyze the application of climate change-oriented numeracy through the context of catfish cultivation for sixth-grade students at Muhammadiyah 3 As-Salam Primary School, Malang City. This research method uses a descriptive qualitative approach with a single-site case study design. Data were collected through participatory observation, in-depth interviews, and documentation, then analyzed using the Miles and Huberman model. The results showed that the application of integrated numeracy in project-based learning (PjBL), included the calculation of feed costs, economic profits, and analysis of fish growth data related to environmental factors such as temperature and water quality. Obstacles found included differences in students' numeracy abilities, limited contextual learning media, and students' tendency to memorize numbers without concluding. Teacher strategies to overcome these obstacles included learning differentiation, utilization of local resources, use of digital media, and reflective discussions. The conclusion of this study confirms that the application of climate change-based numeracy not only improves numeracy skills but also fosters students' ecological awareness from an early age.

Keywords: Numeracy; Climate Change; Application of Learning; Fish Cultivation; Primary School

ABSTRAK

Perubahan iklim merupakan tantangan global yang berdampak pada kesehatan, lingkungan, dan sosial-ekonomi sehingga menuntut adanya inovasi dalam pendidikan dasar. Numerasi berperan penting tidak hanya sebagai keterampilan berhitung, tetapi juga sebagai sarana membangun kesadaran kritis siswa terhadap isu lingkungan. Penelitian ini bertujuan untuk menganalisis penerapan numerasi berorientasi pada perubahan iklim melalui konteks budidaya ikan lele pada siswa kelas VI SD Muhammadiyah 3 As-Salam Kota Malang. Metode penelitian ini menggunakan pendekatan kualitatif deskriptif dengan desain studi kasus (single-site case study). Subjek penelitian adalah guru, siswa, dan kepala sekolah. Data dikumpulkan melalui observasi partisipatif, wawancara mendalam, dan dokumentasi, kemudian dianalisis menggunakan model Miles dan Huberman. Hasil penelitian menunjukkan bahwa penerapan numerasi terintegrasi dalam pembelajaran berbasis proyek (PjBL), meliputi perhitungan biaya pakan, keuntungan ekonomi, serta analisis data pertumbuhan ikan yang dikaitkan dengan faktor lingkungan seperti suhu dan kualitas air. Hambatan yang ditemukan meliputi perbedaan kemampuan numerasi siswa, keterbatasan media pembelajaran kontekstual, serta kecenderungan siswa menghafal angka tanpa menarik kesimpulan. Strategi guru untuk mengatasi hambatan mencakup diferensiasi pembelajaran, pemanfaatan sumber daya lokal, penggunaan media digital, dan diskusi reflektif. Simpulan penelitian ini menegaskan bahwa

penerapan numerasi berbasis isu perubahan iklim tidak hanya meningkatkan keterampilan berhitung, tetapi juga menumbuhkan kesadaran ekologis siswa sejak dini.

Kata Kunci: Numerasi, Perubahan Iklim, Penerapan Pembelajaran, Budidaya Ikan, Sekolah Dasar

INTRODUCTION

Climate change has serious impacts, ranging from hydrometeorological disasters, health problems, decreased food productivity, to socio-economic losses (Nurul Hidayah, 2025). Climate change has become one of the biggest environmental challenges in the world, and various countries are becoming increasingly aware of the importance of climate change education (Septiani, 2020). In the context of education, an important aspect in supporting the understanding of climate change in primary schools is the application of literacy and numeracy (Yulita et al., 2024). An undeniable fact is that reading, writing, and mathematical reasoning skills are still low, which also triggers concerns about the quality of education (Hafidzni et al., 2025). Numeracy is not just a mathematical skill; in primary school, it plays a crucial role in shaping the foundation of children's education, impacting not only academic values but also daily life (Iasha et al., 2025). Evidence from previous studies shows that the Project-Based Learning (PjBL) approach is efficacious in improving learning outcomes and critical thinking skills at the elementary level (Azizah et al., 2024; Nuraeni et al., 2023). The application of numeracy with climate change issues at the primary school level is important so that children can think critically and creatively when solving environmental challenges (Maulida et al., 2024). Educators can increase students' knowledge about climate change by connecting the topic to everyday life and ensuring that they feel involved in contributing to reducing climate change (Rahmah, 2022).

The urgency of integrating climate change education into primary numeracy learning has been strongly emphasized in recent global frameworks. According to (IPCC, 2023), education systems should not only teach environmental facts but also empower learners to interpret environmental data, evaluate sustainability decisions, and act responsibly through evidence-based reasoning. Numeracy, therefore, becomes a powerful cognitive tool to help students understand environmental change quantitatively – such as measuring temperature fluctuation, water usage, or resource efficiency – while fostering their capacity for critical judgment. In Indonesia, the integration of numeracy and climate change education at the elementary level remains fragmented. Numeracy and environmental content are typically taught separately and lack context. Initial observations at SD Muhammadiyah 3 As-Salam indicate strong potential to link numeracy with local economic activities (catfish farming and chili cultivation), but implementation is limited. Students can perform basic calculations but have difficulty relating the results to environmental factors that affect business outcomes.

Although several studies have explored numeracy integration in STEM or environmental education activities, no empirical studies have explicitly evaluated its integration in the context of catfish farming as a local economic activity within the framework of Project-Based Learning at the elementary school level. This study attempts to fill that gap.

The urgency of this research lies in the need for innovative numeracy learning models that not only strengthen numeracy skills but also instill awareness of the impacts of climate

change and the importance of wise resource management. By using catfish farming as a learning medium, students not only learn to calculate costs, profits, and fish growth, but also understand the relationship between simple economic activities and environmental sustainability. This approach is expected to address the national education need to prepare a generation that is numerate and concerned about global issues. The main novelties of this research are (1) the integration of numeracy with climate change issues through the local context of catfish farming, (2) the application of PjBL directly related to environmental sustainability, (3) the use of Miles & Huberman's analysis in processing students' numerical data, and (4) innovative family-based strategies to overcome technical barriers to learning. This approach makes the research contribute not only to improving numeracy skills but also to environmental education and climate awareness at the primary school level. Based on this background, the purpose of this study is to analyze the application of climate change-oriented numeracy through the context of catfish farming economic activities in sixth-grade students at SD Muhammadiyah 3 As-Salam, Malang City.

METHODS

Type and Design

This research method uses a descriptive qualitative approach with a single-site case study design. The objective was to describe in depth the practice of applying numeracy to sixth-grade students at SD Muhammadiyah 3 As-Salam in Malang City. The aim was not to test quantitative hypotheses but to map the phenomena, processes, supporting factors, obstacles, teacher strategies, and their impact on student understanding in a contextual and detailed manner. The qualitative descriptive approach allowed the researcher to capture the meaning of actions and interactions in the classroom through verbal data, observations, and documents. The research was conducted over three months (August–October 2025) in Malang City, Indonesia. Credibility was ensured through member checking, data triangulation, and peer debriefing.

Data and Data Sources

The research data were qualitative and included text and visual materials, namely interview transcripts, field observation notes, fragments of dialogue or process talk during learning, and documentary evidence such as photos of learning tools and student artifacts (worksheets, assignments, and numeracy notes). Data sources included key informants, namely sixth-grade teachers who taught numeracy, as well as participant informants in the form of sixth-grade students who were selected purposively, taking into account variations in academic ability and level of activity in the classroom. In addition, there were supporting informants, such as the principal, to obtain an overview of the school's numeracy policies and programs, and, where relevant, homeroom teachers or other subject teachers. The documentation collected included teaching and learning tools (lesson plans, syllabi, teaching materials), student work, records of numeracy programs or activities at school, and recordings or protocols of numeracy activities. The sample selection was conducted using purposive sampling to ensure direct involvement in numeracy practices (numeracy guidance teachers and representatives of high, average, and low-ability students), and the number of informants was adjusted until data saturation was achieved.

Data collection technique

Data were collected using several complementary techniques to strengthen the validity of the findings through source and methods. The researcher conducted participatory observation by being present in the numeracy learning process in grade VI to observe teacher-student interactions, teaching strategies, media used, and student responses and engagement. The observations were recorded in detail in descriptive and reflective field notes, and where possible, learning activities were recorded (audio/video) for transcription and interaction analysis. Additionally, semi-structured in-depth interviews were carried out with teachers (focused on teaching strategies, planning, assessment, and obstacles), selected students (to understand learning experiences, challenges, and perceptions of numeracy), and the principal to obtain context regarding policies and programs supporting numeracy. The interview guide was developed based on the research objectives, but remained flexible to encourage unexpected responses, and all interviews were transcribed in full. Documentation studies complemented these techniques by collecting learning tools (lesson plans, syllabi, teaching materials), student worksheets and portfolios, numeracy activity records, and other relevant evidence to verify and triangulate findings from observations and interviews. Data from observations, interviews, and documentation were integrated to check for consistency and reduce bias from a single source, including source triangulation (teachers, students, principals, documents) and method triangulation (observations, interviews, documents). Throughout the data collection, research ethics principles were emphasized, including obtaining permission from the school, informed consent from participants, data anonymization when requested, and handling sensitive information with care—especially with students—by explaining the research purpose and their rights, including the right to withdraw at any time. The study was conducted over three months (August–October 2025) at Muhammadiyah 3 As-Salam Primary School in Malang City, Indonesia. The school, which emphasizes environmental awareness and regularly integrates STEM-based projects, was chosen as an appropriate site for climate-related numeracy research. Ethical approval was granted by the Faculty of Teacher Training and Education Research Ethics Committee at the University of Muhammadiyah Malang (Approval No. 2025/FTTE/EDU-CLM). All participants were informed about the purpose of the research, and written consent was obtained from teachers, parents, and students. Data confidentiality and anonymity were maintained throughout the entire research process.

Data analysis

Data analysis in this study followed the Miles & Huberman model (Sugiyono, 2021) and was conducted cyclically and continuously until data saturation was achieved. The main process consisted of three interrelated stages. The first stage was data reduction, which involved selecting, summarizing, focusing, and simplifying raw data, such as interview transcripts, field notes, and documents into more concise and meaningful units through activities such as transcription, cutting relevant quotes, initial coding (open coding), creating analytical memos, and grouping observation notes according to emerging themes (such as teaching strategies, learning obstacles, or media use). The second is data presentation, which involves compiling the reduced data in a form that facilitates the identification of patterns and relationships between themes (tables, matrices, flowcharts, or conceptual models), for

example, an inter-theme matrix (teacher strategy × student response), a chronology of learning activities, or emblematic quotations that reinforce the findings, thereby facilitating the drawing of preliminary conclusions and verification. Third, drawing conclusions and verification, which involves formulating preliminary conclusions based on visible patterns and then verifying them by re-examining the original data through iteration, conducting member checking with informants, and peer debriefing to test the robustness of the interpretation, until conclusions are established that include an overview of the practice of applying numeracy, supporting and inhibiting factors, adaptive teacher strategies, and their impact on student understanding. To ensure the trustworthiness of the findings, the study employed data triangulation across sources (teachers, students, and school leaders) and methods (observation, interviews, and documents). Member checking was conducted after preliminary analysis to validate interpretations, and peer debriefing sessions were held among research collaborators to strengthen analytical rigor.

RESULTS AND DISCUSSION

Application of Climate Change-Oriented Numeracy

Based on the results of observations and interviews, the application of numeracy in grade VI of SD Muhammadiyah 3 As-Salam Kota Malang has been integrated into an integrated module with a climate change theme based on projects. Teachers involve students in fish farming and chili planting activities. As stated by (Dewi et al., 2024), this learning method can be interpreted as a way to implement a learning plan designed and structured as a real activity to achieve learning objectives, including numeracy learning in project-based learning (PjBL). Field findings are summarized in Table 1 to facilitate identification of data patterns and key issues arising from the implementation of this project :

Table 1. Data Findings

Dimensions of Findings	Description of Key Field Findings	Quantitative/Qualitative Data
Numeracy-Climate Integration	Numeracy is integrated into Project-Based Learning (PjBL) through contextual tasks (fish/chili cultivation).	32 students were divided into 6 groups. Tasks: calculating feed costs, measuring growth (weight/length), and presenting weekly data.
Numeracy Effectiveness	Improved students' data interpretation and proportional reasoning skills.	The students' accuracy in creating and interpreting growth charts increased from 35% (Pre-Project) to 78% (Post-Project).
Pedagogical Barriers	Heterogeneity in students' numeracy skills. Students had difficulty connecting observational data with mathematical calculations and drawing analytical conclusions (only able to copy numbers).	Observation of the group worksheets (Figure 3) showed substantial disparities in analysis between groups.

Technical/Ecological Barriers	The project location (rooftop) caused the experiment to fail.	The temperature of the catfish pond was too hot and the chili plants experienced environmental stress. The growth data collected was inconsistent and did not meet expectations.
Teacher Strategies	Teachers applied instructional differentiation and formative assessment.	Use of tiered worksheets (basic, intermediate, challenge) and clear division of roles within the group.

These activities are shown in Figure 1 below.



Figure 1. Students planting plants

Figure 1. Students are engaging in rooftop chili planting activities as part of climate change numeracy learning at Muhammadiyah 3 As-Salam Primary School. The activity integrates measurement, estimation, and data recording tasks, allowing students to apply mathematical reasoning in authentic environmental contexts. According to (Suryaningsih, 2020), the learning process of a project is not only about student involvement, but also the direct role of students in identifying problems, collecting data, analyzing, and reporting observations, which allows students to experience hands-on practice and allows them to discover and prove theories. Thus, practical learning can support students' understanding of the subject matter. The 32 sixth-grade students were divided into 6 groups of 5-6 students each. Students were not only directed to calculate the cost of feed and fertilizer, but were also asked to record data on the growth of fish and chili plants once a week for approximately 3-4 months.

The observation activity involved students directly in order to develop their competence in understanding and exploring nature systematically (Pujiyanto, 2021). In addition to mathematical numeracy, students also learn IPAS material, as changes in temperature, rainfall, water quality, and planting plants are forms of environmental conservation. Observations and interviews at SD Muhammadiyah 3 As-Salam indicate that the quality of the cultivation media (water quality) plays a central role in the growth of catfish, as observed by students. Biologically, water quality, including parameters such as dissolved oxygen, pH, turbidity, and

students could accurately construct a bar graph representing growth patterns, but post-project observation showed a 78% accuracy rate in presenting and interpreting graphical data. This improvement demonstrates that hands-on environmental projects can strengthen both conceptual and applied numeracy competencies, consistent with the findings of (Ulil et al., 2024) and (Vásquez et al., 2023), who highlight that contextual numeracy projects increase students' cognitive engagement and data literacy.

The integration of numeracy into environmental projects was vividly observed during students' activities in chili planting and catfish cultivation (see Figures 1 and 2). These contextual tasks provided opportunities for learners to apply measurement and calculation skills in authentic problem-solving settings. Furthermore, their weekly learning logs (Figure 3) illustrated consistent reflection and quantitative reasoning, indicating improved awareness of the relationship between environmental factors and numerical analysis.

In the chili planting project, teachers could integrate numeracy skills into each stage of the farming activities. Students were asked to calculate the number of seeds planted, the distance between plants, and the daily water requirements based on the area of land used. Next, students recorded the growth of the plants and presented the data in simple tables or graphs, thereby learning to read and analyze data. This shows that the application of numeracy is not only based on numerical descriptions but is also related to real problems experienced in fish farming and chili planting activities. Field results show that students feel more enthusiastic because numeracy is no longer seen as a boring numerical description, but is directly related to daily life activities.

Barriers to the Application of Context-Based Numeracy on Climate Change

In applying numeracy to climate change through fish farming and chili cultivation projects, several significant obstacles were found. First, the varying numeracy abilities of students made it difficult for some of them to connect the observation data with mathematical calculations. For example, when asked to create a graph of fish growth or record the growth of chili plants, some students could only copy numbers and were unable to conclude the relationship between the data and environmental factors, such as water requirements or temperature changes. Second, based on interviews with teachers and students, technical obstacles arose at the project site, namely that the fish and chili cultivation on the school rooftop did not develop optimally. The catfish struggled to grow because the water temperature was too hot. Meanwhile, the chili plants experienced environmental stress due to excessive sun exposure, causing the growth data collected by the students to fall short of expectations. This situation reduced the motivation of some students because the project results did not reflect the care they had put into it.

The most prominent obstacle was the heterogeneity of students' numeracy skills. Variations in ability caused some students to have difficulty interpreting data, even though they could copy numbers, resulting in an imbalance in analytical contributions between groups. Studies on instructional differentiation show that without consistent scaffolding, data-based projects tend to widen learning outcome disparities because students are not adequately prepared to undertake higher analytical stages (Gervasoni et al., 2021). Observations at SD Muhammadiyah 3 As-Salam reveal this phenomenon, with some groups producing complete tables but minimal interpretation, while other groups develop substantial analysis, a pattern

that complicates fair assessment and targeted teacher intervention (Dewi et al., 2024). Therefore, these obstacles require an explicit instructional design, namely worksheets with varying levels of difficulty, clear division of roles within groups, and formative assessment that provides feed-forward.

The second obstacle stems from the physical conditions of the experiment site, namely, the hot school rooftop. This environment causes high water temperatures and direct sunlight exposure, which stresses the plants and results in suboptimal cultivation and invalid growth data. Studies on the impact of environmental conditions on field learning practices show that local climate disturbances (extreme heat, flooding) affect the continuity of learning and the reliability of school experiment results (OECD, 2023). Field cases confirm that the data does not reflect the students' efforts, thereby reducing motivation. Therefore, adapting the experimental design (such as moving the media to the students' homes) is a practical response to overcome unexpected environmental problems (Engagement, 2023). Additionally, infrastructure barriers like limited access to simple measurement tools or computers to visualize data exacerbate the problem because teachers and students must spend time on technical aspects (Penn GSE, 2024).

The article (Fatwa et al., 2025) provides a strong empirical foundation. Although many studies have developed modules based on local wisdom for primary schools, bibliometric analysis shows that there is still a lack of studies that explicitly integrate numeracy with climate change issues. This aligns with the third obstacle, which concerns teachers' readiness to integrate numeracy with climate issues. Although teachers may have mastered basic mathematical concepts, many lack experience in facilitating PjBL, managing field data, and systematically guiding students' qualitative and quantitative interpretations. Reviews related to CPD show that without intensive training that includes coaching and lesson study, teachers tend to revert to safer traditional teaching practices when faced with time pressures and the demands of assessment (Morales-Aguilar et al., 2025). Observations indicate that the sustainability of the program in the classroom is highly dependent on teacher initiative and institutional support. When that support is weak, the project risks becoming merely an episodic activity (Dewi et al., 2024). Therefore, these obstacles require investment in contextual CPD that provides practical skills (compiling observation sheets, assessing numerical products, field coaching) and inter-teacher networks to share materials and experiences.

The fourth obstacle is curriculum pressure and an orientation towards standardized assessment. This includes systems that emphasize standardized test scores, which give teachers little incentive to allocate time to long-term project units that require formative evaluation and periodic observation. Analysis of education policy shows that without curricular legitimacy (allocation of hours, formal assessment of thematic units), initiatives such as climate numeracy tend to be positioned as additional activities, making them vulnerable to discontinuation when schedules are busy (Newsome et al., 2023). On the practical side, teachers need managerial support to schedule projects, secure reflection time, and incorporate project outcomes into school assessment portfolios, ensuring these efforts receive formal recognition. Without institutional improvements, curricular barriers will remain the main obstacles to the scale and sustainability of implementation.

The fifth obstacle relates to socio-cultural and communication aspects, including the issue of climate change, which can be perceived as sensitive in some communities. This makes

framing by teachers very important to avoid resistance from parents or stakeholders. Research on environmental education communication suggests a value-neutral approach that focuses on local solutions (such as water conservation) to maintain the involvement of various parties without triggering ideological debates (Cho et al., 2023).

Field observations indicate that early socialization with parents and their involvement in the process (such as home recording instructions) helps reduce concerns and increase practical support. However, communication must clearly convey the learning objectives and limitations of the experiment. In addition, unequal access to educational technology (graphics software and printers) is also a practical obstacle that requires partnership solutions or small budget allocations for basic equipment.

Teacher Strategies for Overcoming Barriers

The disparities in the application of numeracy skills can be overcome by systematically applying instructional differentiation, using worksheets with different levels: basic, intermediate, and challenge. Group roles are divided according to student abilities, and micro tasks are assigned for reinforcement. Empirical evidence shows that differentiation in rubrics and formative assessments can improve numeracy performance and participation among previously passive students (Gervasoni et al., 2021). The implementation of numeracy in learning will be more effective when linked to real-life situations, which is in line with the statement (Suwandayani et al., 2020).

Practices in the field that provide simple worksheets and step-by-step guides encourage students with low abilities to contribute to the analytical stages, so that understanding within a group becomes more even and can be assessed fairly (Dewi et al., 2024). In addition, periodic formative assessments allow teachers to identify remedial needs and quickly adjust task levels. Implementing differentiation requires preparation time but has proven effective in the medium term for improving contextual numeracy skills. An experimental study by (Ulil et al., 2024) shows that the application of a Project-Based Learning model supported by STEM teaching materials improves students' critical thinking skills (experimental posttest results > control) and provides a practical framework for designing contextual project-based learning.

To overcome infrastructure limitations (hot rooftops), effective technical and organizational strategies can be combined, such as adapting experiments (moving some media to students' homes/Family as Lab), scheduling observations during cooler hours, and using simple containers or shade to reduce environmental stress on organisms. The Family as Lab model not only improves the physical conditions of experiments but also increases family support and data completeness. However, parents must be given clear instructions and simple recording tools (Engagement, 2023). This practice also helps schools continue to produce reliable data sets for numerical analysis, even with limited school facilities (Dewi et al., 2024). At the school level, small policies such as providing a refrigerated storage room or simple shade for experimental media can also increase the success of field experiments (Penn GSE, 2024).

Strengthening teacher capacity through CPD has a major impact on program sustainability. Workshops that integrate PjBL theory with observation sheet drafting exercises, classroom coaching, and micro teaching among teachers can enhance their ability to manage cross-theme projects and accurately assess numerical products. Evidence shows that ongoing

CPD, including field mentoring, is more effective than one-off workshops, as it makes teachers more confident and able to apply numeracy-climate units repeatedly. Micro teaching helps share templates, such as student products and proven remedial strategies, so that the burden of developing materials does not fall on just one individual. Schools that allocate time for lesson study and joint reflection tend to see improvements in implementation quality.

The provision of simple material packages and tools (including weekly observation sheets, table/graph templates, assessment rubrics, and a computer or laptop) can reduce the technical burden on teachers and accelerate the process of data reduction, display, and verification in accordance with the principles of integrated quantitative-qualitative data analysis. Ready-to-use tools allow teachers to immediately focus their time on coaching interpretation rather than preparing administrative formats, and the literature shows that the availability of contextual materials increases the adoption of learning innovations (Vásquez et al., 2023). In the field, these simple packages can increase the number of products that meet the assessment criteria, enabling teachers to obtain sufficient evidence for triangulation and reflection.

Finally, communication and partnership strategies are needed to overcome value-neutral and resource barriers. This can be achieved through initial socialization with parents about learning objectives, framing materials that focus on practical solutions (such as water conservation and feed efficiency), and building cooperation with school committees or local NGOs for material/equipment support. This approach helps reduce potential resistance and opens up avenues for micro-funding or simple equipment donations so that projects no longer rely on constant improvisation (OECD, 2023). Stakeholder involvement also provides institutional legitimacy, making it easier for schools to allocate time and resources to thematic units such as these. The combination of pedagogical, technical, capacity, and community partnership strategies provides the strongest path to making climate numeracy a sustainable and impactful school practice. The results also suggest that numeracy learning embedded in real-life environmental problems aligns with the constructivist learning theory, where knowledge is built through meaningful interaction with authentic contexts. Integrating sustainability themes into numeracy allows students to apply mathematical reasoning to interpret environmental data, make predictions, and reflect on human-nature interactions. These findings reinforce the (OECD, 2023) framework that defines numeracy as the capacity to apply mathematical thinking in solving problems in diverse contexts, including social and environmental issues. Hence, the implementation at Muhammadiyah 3 As-Salam Primary School provides a replicable model for climate-responsive numeracy instruction in primary education.

CONCLUSION

Based on the presentation of the research results above, it can be concluded that the sixth-grade teachers at Muhammadiyah 3 As-Salam Primary School, Malang City, successfully developed and implemented numeracy learning through Project-Based Learning using fish farming activities. The module design not only included simple economic calculations, such as feed costs and profit analysis, but also linked numeracy skills to environmental and climate change issues, making the material more relevant to students. The interview results indicated that teachers had the pedagogical awareness to integrate numeracy with real environmental practices. Documentary evidence demonstrated the active involvement of students in

recording data, performing calculations, creating visualizations, and analyzing changes in fish growth. Overall, this approach enhances the meaning of numeracy learning for students and has the potential to strengthen numeracy literacy and ecological awareness, provided it is equipped with adequate environmental measuring tools and institutional support.

Research at SD Muhammadiyah 3 As-Salam shows that integrating numeracy into catfish farming and chili planting projects successfully increases the relevance and motivation for learning numeracy if the tasks are structured in stages (scaffolded) and accompanied by clear observation instruments. However, the validity of numerical analysis is often disrupted by environmental variability, including water quality and temperature, so environmental parameter measurements need to be included in student worksheets. For sustainability, it is recommended to apply differentiation (leveled worksheets), adapt Family as Lab if school facilities are inadequate, and strengthen institutional support through teacher CPD and local partnerships. With these steps, climate numeracy has the potential to become a valid, sustainable learning practice that impacts students' numeracy literacy and environmental awareness.

Overall, catfish farming activities play a dual role. First, they serve as a medium for applying numeracy through calculation, measurement, and data analysis. Second, they serve as a means of environmental and climate change education by emphasizing the importance of resource efficiency and environmentally friendly technology. Thus, the application of numeracy in primary schools not only improves students' numeracy skills but also instills their concern for sustainability amid the challenges of climate change. This study contributes to the growing discourse on environmental numeracy by demonstrating that numeracy learning can serve as a medium for sustainability education. By combining local ecological practices with mathematical reasoning, the research expands the theoretical scope of numeracy from a cognitive skill to a socio-environmental competence. The findings encourage policymakers and educators to integrate climate change contexts into the mathematics and science curriculum at the primary level. Schools are advised to promote project-based numeracy models that engage students in authentic environmental data collection and interpretation. Future studies could adopt a mixed-method approach or longitudinal design to measure long-term impacts on students' environmental awareness and mathematical literacy.

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