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Integrating Parent–Teacher Collaboration into a Deep Learning Approach for Numeracy Skills: A Needs Assessment Study

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abstract

Background: Fostering numeracy through deep learning requires teachers and parents to work together. This partnership cultivates meaningful learning experiences. Although existing literature explores numeracy, parental involvement, and deep learning separately, little research addresses the specific needs of teachers and parents as a basis for collaboration.
Aims: This study seeks to analyze what teachers and parents require to implement deep learning in primary school numeracy instruction.
Methods: The study used a descriptive mixed-methods approach. Seven teachers and eighty primary school parents participated. Data came from structured questionnaires and semi-structured interviews. The researchers analyzed the data using descriptive statistics and qualitative techniques, including data reduction, display, and drawing conclusions.
Results: The findings show that teachers view numeracy as essential, but instruction is still mostly conventional. Deep learning is not yet consistent. Teachers cited time constraints, a lack of operational guidelines, and low parental engagement at home as main obstacles. On the other hand, parents help with studies, but focus mostly on homework, not contextual numeracy activities. Parents also struggle with limited time, a lack of understanding of numeracy concepts, and few practical home-learning manuals.
Conclusion: These insights provide a foundation for developing a collaborative deep learning model that links teacher and parent roles to strengthen numeracy education in primary schools.

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1. Introduction

In the 21st century, numeracy has emerged as a critical competence for students, encompassing not only basic arithmetic but also logical reasoning, data interpretation, and problem-solving skills (OECD, 2023; Rufiana, 2024). Recognizing its paramount importance, Indonesian researchers have actively investigated effective numeracy instructional strategies over recent years. This scholarly momentum is largely driven by the urgent need to elevate

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student performance on the Minimum Competency Assessment (AKM)—a national evaluation designed to measure numeracy literacy across primary schools throughout Indonesia (Rohim, 2021).

Paradoxically, the aspiration to enhance numeracy literacy contrasts sharply with actual outcomes. PISA survey data for Indonesia indicate persistent deficiencies in student numeracy, with a substantial majority performing below the global minimum proficiency threshold (Randy, 2022; Rufiana et al., 2024). Although Indonesia demonstrated marginal progress relative to its 2018 PISA scores, the country consistently ranks within the bottom twelve participating nations (Kemendikbudristek, 2023; OECD, 2023; Rufiana et al., 2023). A closer examination reveals that while Indonesia's numeracy literacy score declined by 13 points, this downturn remains less severe than the global average contraction of 21 points.

Extant literature on numeracy can be categorized into several distinct thematic areas. The first body of research focuses on developing instructional strategies to enhance student numeracy, utilizing approaches such as realistic mathematics education (Maghfiroh et al., 2021), blended learning (Dantes & Handayani, 2021), and thematic instruction (Perdana & Suswandari, 2021). While these three methodologies concentrate on manipulating classroom pedagogical processes, parental involvement as a home-based learning partner remains excluded from their intervention designs. Yet, numeracy acquisition demands continuity; school-based instruction must be reinforced by internalizing numeracy concepts within daily routines, particularly when students are at home. Second, another line of inquiry highlights the contribution of the home numeracy environment to student mathematics achievement; however, these studies generally position parents as isolated agents, disconnected from the instructional designs orchestrated by classroom teachers. Third, literature on deep learning emphasizes the vital role of reflective and contextual learning experiences in developing higher-order thinking skills. Nevertheless, this framework is predominantly debated at conceptual and policy levels, with scarce empirical testing regarding its operational viability in multi-stakeholder collaborative contexts within primary education.

Recent scholarly literature emphasizes that the development of numeracy skills is heavily shaped not only by classroom instruction but also by the learning experiences and contexts encountered within the home environment. Active parental involvement in meaningful home-based numeracy practices has been shown to exert a significant influence on students' mathematical development. Specifically, research by Daucourt et al. (2021) demonstrates that the home mathematics environment yields a positive contribution to student mathematics achievement. This finding is further nuanced by Cosso et al. (2023), who highlight that the quality of home numeracy interactions can be constrained by parental psychological factors—such as math anxiety—which consequently impacts children's mathematical capabilities. Furthermore, Outhwaite et al. (2025) elucidate that parental self-efficacy serves as a cornerstone in facilitating an effective mathematical learning environment, ultimately fostering early conceptual understanding of mathematics in children.

Concurrently, research on deep learning has underscored the critical role of meaningful, reflective, and contextualized experiences in fostering higher-order thinking skills and real-world problem-solving capabilities (Entwistle & McCune, 2004). Rather than merely memorizing procedures, this pedagogical framework encourages students to actively construct

knowledge through authentic learning encounters, thereby cultivating a profound conceptual understanding. Deep learning functions as a transformative approach that honors the learner by fostering a mindful, meaningful, and joyful educational environment. This is achieved through a holistic and integrated synthesis of intellectual engagement, ethical reflection, aesthetic appreciation, and kinesthetic practice (Fullan et al., 2018; Harsono, 2025). Furthermore, this framework is posited as a strategic solution for cultivating the eight dimensions of the graduate profile.

Historically, these three lines of inquiry have evolved in isolation. Research on numeracy strategies remains confined to the classroom, studies on the home environment are restricted to the family domain, and the deep learning framework is largely limited to conceptual discourse. To date, literature lacks a comprehensive model that unifies these three elements into a collaborative framework involving teachers, students, and parents to foster numeracy development. This empirical void underscores the critical need for a comprehensive assessment to serve as the foundation for designing a collaborative, deep-learning-based instructional model. Consequently, the novelty of this study lies in its integration of deep learning principles within a tripartite collaborative framework—engaging teachers, students, and parents—to reinforce numeracy acquisition in primary education.

This study primarily aims to identify the specific requirements of teachers, students, and parents necessary for developing a parent–teacher collaborative deep learning model; more extensively, it seeks to provide a comprehensive and nuanced analysis of these instructional development needs at Elementary School (SD) Laboratorium UM (Universitas Negeri Malang). The significance of this inquiry lies in its potential to offer innovative solutions for sustainably enhancing student numeracy literacy. Furthermore, the resulting framework is anticipated to serve as a scalable model adaptable to other primary education institutions.

2. Methods

2.1 Research design

This study employs a mixed-methods approach with an explanatory sequential design (Creswell & Plano Clark, 2018) to gain a comprehensive understanding of the development needs for numeracy-based deep learning through teacher, parent, and student collaboration. In the initial phase, quantitative data were gathered via questionnaires distributed to teachers and parents; these preliminary results were subsequently explored and clarified in the second phase through in-depth interviews. As Ivankova et al. (2006) elucidate, this sequential framework structures the research process by collecting and analyzing quantitative data prior to qualitative inquiry. Integration of these two phases was achieved through a joint display, which juxtaposes quantitative and qualitative findings during the interpretive stage, thereby facilitating a systematic analysis of the convergence between numerical and narrative data (Fetters et al., 2013).

2.2 Research procedures

The research procedure was executed across five sequential phases. The process initiated with the development of instruments based on indicators synthesized from literature on numeracy, parental involvement, and deep learning frameworks. This was followed by

instrument validation conducted by experts in mathematics education and educational evaluation. In the third phase, questionnaires were distributed to teachers and parents, setting the stage for the fourth phase, which involved in-depth interviews with selected respondents to unpack and enrich the quantitative findings. Finally, the fifth phase integrated the quantitative and qualitative datasets to yield a comprehensive and cohesive interpretation of the developmental needs.

2.3 Participants

The research subjects comprised seven teachers and eighty parents from a private primary school in Malang, East Java. Due to the relatively limited size of the teacher population, a total sampling technique was employed, thereby including all population members as respondents. Conversely, the parent participants were selected through purposive sampling, guided by the specific criterion of active involvement in supporting their children's learning activities at home.

2.4 Data collection

Quantitative data collection was executed by distributing online questionnaires to teachers and parents over a two-week period. For the qualitative phase, semi-structured interviews were conducted with two teachers and four parents, purposefully selected to reflect a diverse range of questionnaire response characteristics. Each interview session lasted approximately 45 to 60 minutes. With the explicit consent of the participants, these interviews were audio-recorded and subsequently transcribed verbatim to facilitate rigorous analysis.

2.5 Data analysis

To align with the study's objectives, the research instruments were developed through a rigorous validation process, comprising needs assessment questionnaires for both parents and teachers, alongside in-depth interview guides. The parent questionnaire is structured into several core sections: respondent demographics; parental roles in numeracy education—encompassing their conceptual understanding of numeracy, home-based learning support patterns, and challenges encountered in fostering their children's mathematical skills; and existing collaborative dynamics with teachers, which explores communication quality, expectations for cooperative frameworks, and specific requirements for executing deep learning. Correspondingly, the teacher questionnaire focuses on classroom-based numeracy instruction and the barriers to designing contextualized numeracy materials; parent-teacher collaboration, which evaluates current communication effectiveness, active cooperative models, and obstacles to building synergy; and identified developmental needs.

Content validity of the instruments was evaluated by two experts specializing in mathematics education and educational evaluation. This evaluation yielded a Content Validity Index (CVI) of 0.83, indicating that the alignment between the instrument content and the measured constructs is highly appropriate. Additionally, Aiken’s V coefficients ranged from 0.84 to 0.96, with an average value of 0.91, confirming high content validity. Reliability analysis demonstrated strong internal consistency, as evidenced by a Cronbach’s Alpha coefficient of 0.89. For the qualitative phase, interview data were processed using thematic analysis—encompassing data reduction, coding, categorization, and interpretation—to uncover the underlying meaning of the findings (Braun & Clarke, 2006). This analytical procedure was

executed systematically to ensure the interpretive accuracy of the research outcomes (Sugiyono, 2017).

3. Results

3.1 Teacher Needs related to Deep Learning for Numeracy

The teacher respondents involved in this study comprised seven primary school teachers in Malang, with female educators constituting the majority. In terms of grade-level distribution, the sample is balanced between lower- and upper-grade teachers, thereby ensuring a comprehensive spectrum of perspectives on numeracy instruction across all primary education levels. Regarding teaching experience, a notable disparity was observed: the vast majority—six teachers (85.7%)—possess more than ten years of teaching experience, whereas only one teacher has been teaching for less than five years. The detailed profile of these teacher participants is illustrated in the figure 1.

Figure 1. Teacher Profile Graph Based on Gender and Teaching Experience

According to the demographic profile in Figure 1, the respondents consist predominantly of female teachers with over a decade of instructional experience. Notably, 85% of these educators identify numeracy as a pivotal competence that must be prioritized in primary school curricula—a perspective illustrated in the chart in Figure 2.

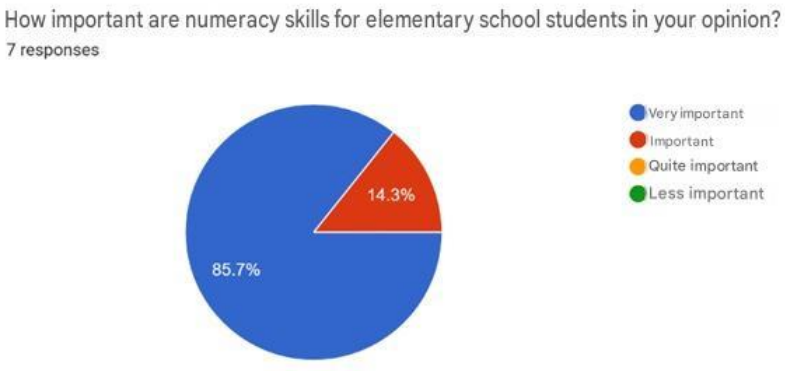

Figure 2. Graph of the Importance of Numeracy Skills for Elementary School Students According to Teachers

Figure 2 delineates teacher perceptions regarding current student numeracy attainment. Within this assessment, 14.3% of the surveyed educators categorized student numeracy levels

as low, while moderate and high achievement brackets each accounted for 28.6% of the responses.

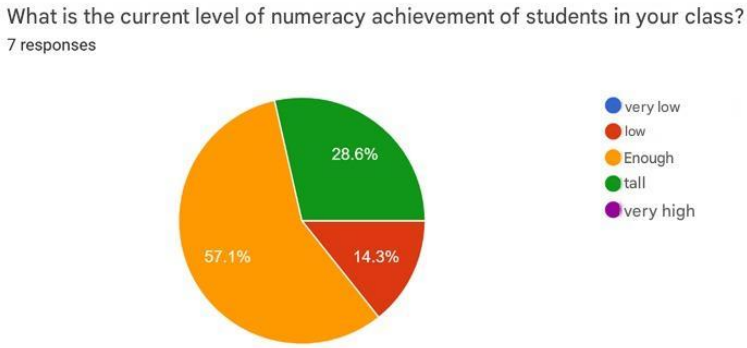

Figure 3. Graph of Student Numeracy Achievement Levels

Basic arithmetic operations emerged as the primary area of difficulty identified by the majority of teachers regarding student numeracy skills. Additionally, educators reported noticeable learning hurdles in other domains, including measurement, geometry, and data literacy. These findings are visually represented in Figure 4.

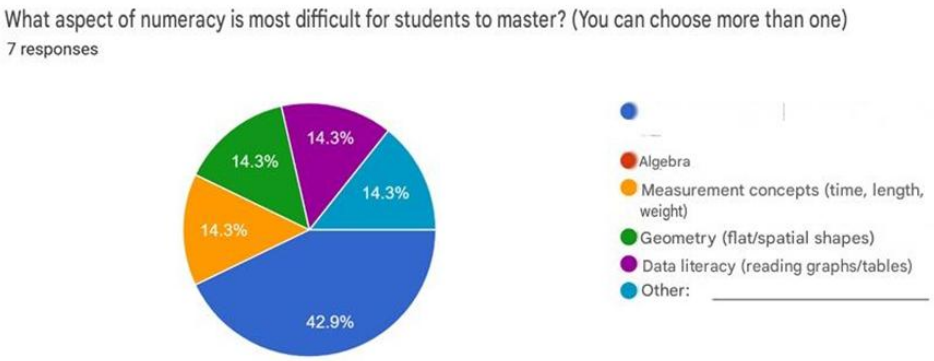

Figure 4. Graph of the Most Difficult Numeracy Aspects for Students According to Teachers

Conventional pedagogical methods, specifically lecturing and repetitive practice drills, remain the most prevalent approaches employed by teachers in numeracy instruction. While project-based and contextual learning frameworks have also been implemented, they are utilized with far less frequency than these traditional methods. The corresponding distribution of these instructional practices is illustrated in Figure 5.

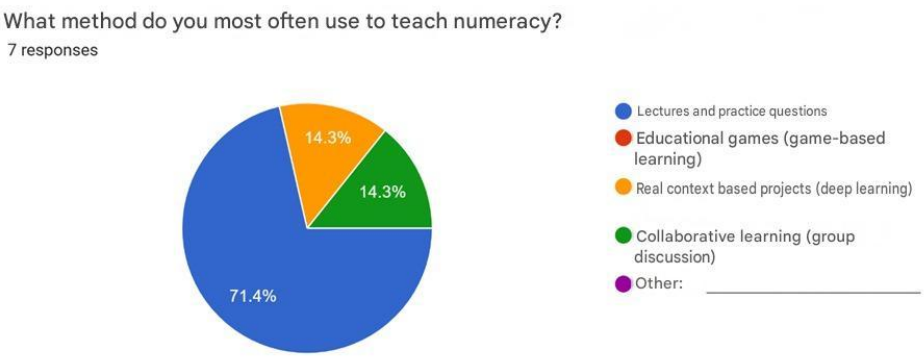

Figure 5. Graph of the Methods Most Often Used by Teachers in Numeracy Learning

While approximately 71% of the educators surveyed reported having attempted to incorporate deep learning approaches into numeracy instruction, only 29% integrate these practices on a routine basis. This pattern of implementation is depicted in Figure 6.

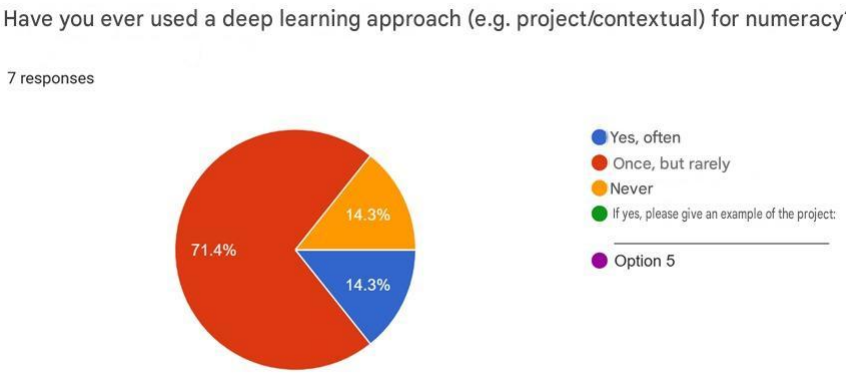

Figure 6. Graph of the Use of the Deep Learning Approach

3.2 Parental Perspectives on Needs for Numeracy Deep Learning Implementation

A parental needs assessment was conducted to construct a profile of parent demographics, the frequency of home-based numeracy guidance, and the specific mathematical activities undertaken with their children. Additionally, this analysis explored the obstacles encountered during these home-support sessions, alongside the specific resources and assistance required to optimize parental engagement in numeracy education.

The parent and guardian cohort comprised eighty individuals actively engaged in supporting their children's learning processes. Representing a diverse range of educational attainment levels and occupational backgrounds, these respondents offer a broad spectrum of perspectives on family-based involvement in home numeracy instruction. A detailed overview of this demographic profile is presented in Figure 7.

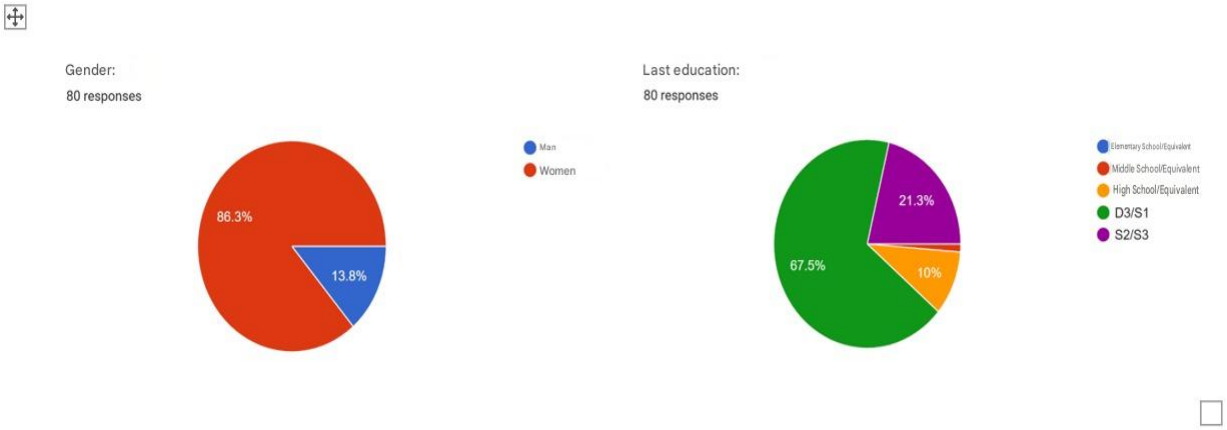

Figure 7. Parent Profile Graph Based on Gender and Last Education

The demographic distribution in Figure 7 reveals that mothers represent the primary demographic actively involved in facilitating their children's study at home. From an educational standpoint, the majority of the survey respondents have completed higher education. This profile points to a significant opportunity for developing school-family learning partnerships, as a substantial portion of the parents possess formal academic experience. At the same time, such educational heterogeneity underscores the importance of integrating differentiated strategies into collaborative frameworks to address these varying parental educational levels.

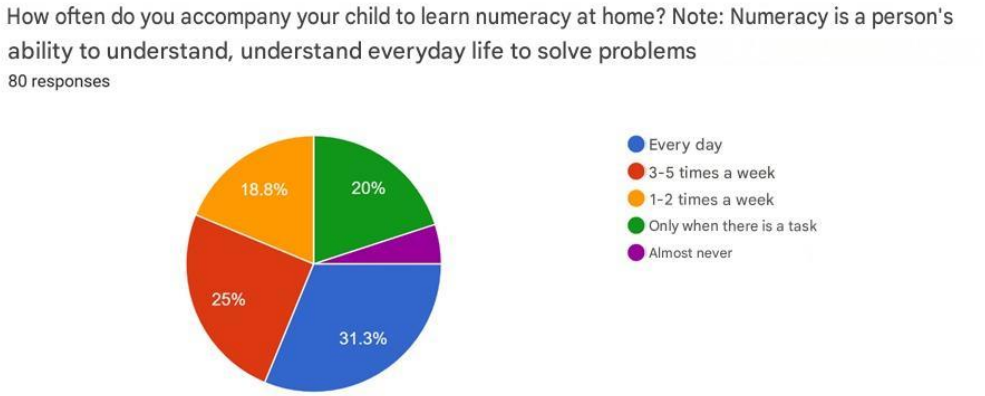

Figure 8. Graph of Intensity of Numeracy Assistance Time at Home by Parents

The data presented in Figure 8 indicate that numeracy support has become an established component of home learning routines for most families. While a portion of the parents guide their children's learning on a daily basis, others provide this assistance several times a week. Collectively, these findings suggest that parental engagement in numeracy education is already underway, although the level of intensity varies considerably across households. The form of numeracy activities carried out by parents and children is presented in Figure 9.

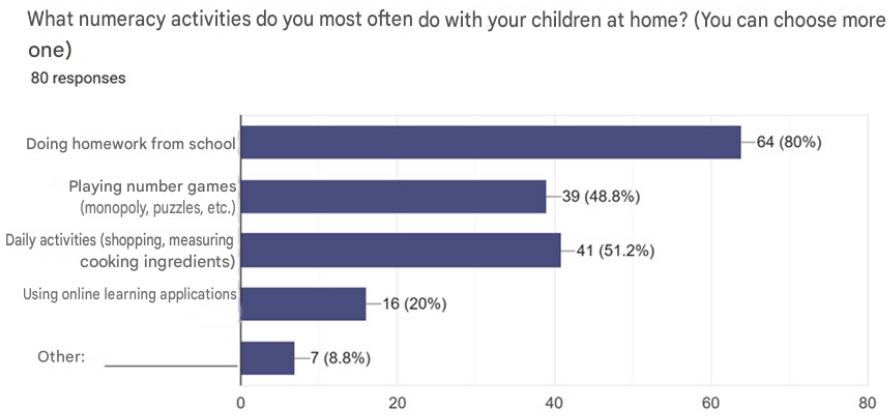

Figure 9. Graph of the Numeracy Activities that Parents Most Often Do with Their Children

As illustrated in Figure 9, the most common form of parental involvement is assisting children with school-assigned homework, with a primary focus directed toward task completion (task-oriented). In addition to homework support, some parents integrate numeracy into daily household activities, such as shopping, measuring ingredients, playing number-based games, and utilizing digital media. Nevertheless, contextual and experiential numeracy activities rooted in real-world scenarios have yet to become a dominant practice in home-based parental guidance. The specific challenges encountered by parents during these home numeracy sessions are detailed in Figure 10.

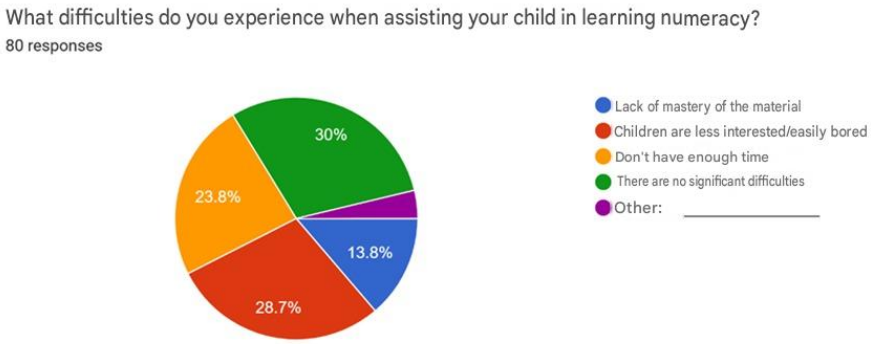

Figure 10. Graph of Difficulties Experienced by Parents When Accompanying Children in Learning Numeracy

The data compiled in Figure 10 indicate that time constraints constitute the primary obstacle parents face when facilitating home-based numeracy learning. Beyond these scheduling limitations, families also grapple with low student motivation, a restricted parental grasp of mathematical concepts, and difficulties in identifying appropriate instructional strategies. Consequently, these findings highlight that parental engagement in numeracy development is not merely a function of willingness; rather, it is highly contingent upon the availability of time, content knowledge, and external support.

Overall, the findings indicate that both educators and parents demonstrate a high level of awareness regarding the critical importance of numeracy in primary education. Nevertheless, translating deep learning frameworks into effective numeracy instruction continues to encounter multi-faceted challenges within both school and home environments. These insights underscore the necessity of developing collaborative models or practical guidelines capable of bridging formal classroom instruction with home-based learning experiences in a more structured, sustainable manner. Specifically, parents expressed a critical need for concrete examples of contextual activities, readily accessible learning materials, and more proactive communication with teachers regarding their children's academic progress.

4. Discussion

4.1 The Gap between Perceived Importance of Numeracy and Actual Student Achievement

From the perspective of educators, numeracy literacy serves as a foundational competency underpinning logical reasoning, problem-solving, and practical decision-making. This viewpoint resonates with the broader conceptualization of numeracy advanced by Geiger et al. (2015), which transcends mere computational dexterity to encompass the critical interpretation, evaluation, and application of quantitative data in real-world scenarios. Such proficiency is increasingly vital at the primary school level; here, students must move beyond rote mathematical algorithms to interpret information, formulate data-driven judgments, and resolve contextual problems in their daily lives.

Although educators demonstrate a keen awareness of the significance of numeracy, this recognition stands in stark contrast to their concerns regarding current student achievement. Teachers report that students frequently struggle when mathematical concepts are embedded within authentic scenarios requiring interpretation and reasoning, rather than straightforward calculation. These difficulties typically arise in tasks such as decoding graphs, analyzing data, or connecting mathematical ideas to scientific and social phenomena. This pattern aligns with prior research indicating that applying mathematical knowledge across diverse contexts is far more challenging than executing routine tasks (Binali et al., 2024; Nwagwu, 2024; Rufiana et al., 2024). Similar findings by Geiger et al. (2015) and Kalobo (2016) confirm that many students struggle to transfer their mathematical understanding to real-world situations. The persistence of these challenges strongly suggests that classroom instruction has yet to fully cultivate contextual mathematical reasoning.

Challenges in fundamental domains—such as arithmetic operations, measurement, geometry, and data literacy—become increasingly compounded when students are required to interpret, represent, and apply these concepts across diverse scenarios. As demonstrated by Hornburg et al. (2018) and Vendicacion et al. (2025), the development of mathematical competence is heavily contingent upon the opportunities students are afforded to engage in meaningful mathematical experiences. Consequently, the difficulties identified in this study should not be construed merely as isolated cognitive deficits; rather, they serve as a critical indicator of the limited opportunities students currently have to construct deep conceptual understanding through meaningful learning experiences.

4.2 The Dominance of Conventional Approaches and Inconsistencies in Deep Learning Implementation

Despite educators recognizing the urgency of numeracy skills, classroom practices remain predominantly centered on lectures and rote exercises. This situation reflects a recurring pedagogical dilemma: the difficulty teachers face in balancing curriculum demands and time constraints with the implementation of instructional methods tailored to their classroom dynamics. Research indicates that contextual, problem-based, and project-based learning offer students far greater opportunities to cultivate mathematical reasoning than traditional methods (Brungs et al., 2025; Huda et al., 2025; Voskoglou, 2019). Nonetheless, because these student-centered approaches demand substantial preparation, sophisticated classroom management skills, and robust support systems, teachers frequently revert to familiar pedagogical practices despite acknowledging their inherent limitations.

The low frequency of consistent deep learning implementation identified in this study reflects a broader systemic challenge. While several educators reported experimenting with project-based or contextual learning activities, only a small fraction have integrated these practices into their regular routines. This pattern closely aligns with the findings of Putra et al. (2023) and Yudistira et al. (2025), which indicate that teachers frequently encounter both structural and pedagogical barriers when attempting to cultivate numeracy-oriented learning environments. Furthermore, limitations in pedagogical content knowledge (PCK) significantly undermine teachers' confidence in designing instructional experiences that simultaneously integrate mathematical content, contextual problem-solving, and higher-order thinking skills (Amri et al., 2025).

4.3 Constrained and Reactive Teacher-Parent Collaboration

Collaboration between educators and parents in supporting student numeracy remains comparatively limited, with interactions predominantly characterized by a reactive approach. These exchanges typically center on administrative tasks, such as monitoring homework completion and addressing student learning difficulties after they arise. A similar dynamic was identified by Bubuli and Macapobre (2023), who emphasized that teacher-parent partnerships in primary school numeracy education require substantial reinforcement through more structured collaborative mechanisms.

4.4 The Role of Parents in Supporting Home Numeracy

Parents play a pivotal role in facilitating their children’s numeracy development within the home environment. Given that the majority of respondents in this study hold higher education qualifications, there exists substantial potential for active parental involvement. Prior research consistently indicates that parental educational background contributes positively to both children's learning opportunities and their subsequent academic achievement (Martinez et al., 2022; Tan et al., 2020). This correlation is often attributed to the greater confidence academically well-equipped parents possess when guiding home study and engaging with school institutions. Nonetheless, formal education levels alone do not automatically guarantee the effectiveness of home-based numeracy support. As Cheung et al. (2021) observe, while parental education and personal numeracy fluency directly shape the quality of the home

numeracy environment and children's outcomes, targeted support remains essential to help parents cultivate numeracy-rich home environments, particularly within low- to middle-income households.

Despite high levels of parental involvement, this engagement remains predominantly concentrated on homework assistance. Such a pattern reflects a traditional conceptualization of parental support; indeed, as Silinskas and Kikas (2019) observe, parental involvement tends to center on homework supervision rather than fostering conceptual understanding or mathematical reasoning. While helping with homework may contribute to short-term academic performance, it does not necessarily afford children the opportunity to explore mathematical concepts within authentic and meaningful contexts.

Contextual numeracy activities—such as shopping, measuring baking ingredients, comparing quantities, and playing mathematical games—are reportedly less frequent than homework-related tasks. This trend suggests that some parents have yet to fully recognize the educational value of everyday experiences as opportunities for fostering their children's mathematical skills. As demonstrated by Girard et al. (2021), children benefit significantly when mathematical concepts are integrated into routine family activities; such experiences allow them to bridge abstract mathematical ideas with concrete, practical situations while simultaneously enhancing the scope and quality of the home learning environment.

Several constraints impede parental involvement in numeracy education. Time limitations emerge as the most prevalent obstacle, followed by low student interest and a lack of parental confidence in explaining mathematical concepts. These findings reinforce prior research asserting that parental engagement is shaped by both practical and cognitive factors (Bubuli & Macapobre, 2023; Ghazali et al., 2021). While parents generally demonstrate a willingness to support their children's learning, scheduling conflicts and uncertainty regarding appropriate instructional approaches frequently undermine the efficacy of their involvement. Consequently, schools must take these considerations into account when designing collaborative educational initiatives.

The challenges experienced by parents are further elucidated by the home numeracy environment (HNE) framework proposed by Cheung et al. (2021) and Mutaf-Yıldız et al. (2020), which posits that children's mathematical development is shaped not only by the frequency of parental involvement but also by the quality of the home-based numeracy interactions. Such interactions encompass activities embedded in daily routines, including discussions about numbers, estimations, comparisons, measurements, and problem-solving. Ultimately, the findings of this study indicate that most parents have yet to receive adequate guidance on how to naturally integrate numeracy experiences into their everyday lives.

4.5 Implications for Developing Deep Learning-Based Numeracy Programs

The aforementioned research findings have direct relevance for the design and development of deep learning-based numeracy programs. Parents' requests for practical guidance—specifically contextual materials and easily accessible learning resources—reflect a high level of willingness to participate, provided that appropriate support is made available. Indeed, Cheung et al. (2020) demonstrate that successful family engagement initiatives are typically characterized by flexibility, contextual relevance, and the provision of usable resources. Furthermore, Graven and Jorgensen (2024) highlight that intervention programs

combining numeracy-focused storytelling with structured home activities can foster meaningful learning opportunities, particularly for families with restricted access to formal educational resources. Ultimately, the success of such initiatives hinges on providing parents with concrete materials and clear, actionable activity guidelines.

Collectively, the findings of this study indicate that the parental role extends far responsibility for homework supervision; instead, parents can actively support numeracy learning by cultivating a numeracy-rich home environment. Within a deep learning framework, parents have the potential to serve as active partners who facilitate authentic mathematical experiences outside of formal school hours. Realizing this potential, however, requires structured, well-facilitated collaborative mechanisms that offer tailored guidance aligned with the unique characteristics of each family. Additionally, instructional resources—such as targeted media or learning materials—must be developed to bridge the gap between classroom mathematics and everyday life. Strengthening this collaboration has the potential to contribute substantially to the cultivation of a sustainable numeracy learning ecosystem at the primary education level.

5. Limitations

Several limitations of this study warrant acknowledgment. First, the participant cohort was restricted to a single primary school in Malang, which potentially limits the generalizability of the findings to broader educational contexts. Second, the study relied heavily on self-reported questionnaire and interview data, which may be subject to social desirability or recall bias. Third, students were not directly engaged as respondents; consequently, the findings predominantly reflect the perspectives of teachers and parents. Future research should involve a more diverse cohort of participants and encompass varied school environments to construct a more comprehensive understanding of the phenomenon.

6. Conclusion

This study identifies the specific developmental needs of teachers and parents in supporting deep learning-based numeracy instruction in primary schools in Malang. While both teachers and parents recognize numeracy as a foundational competency, this shared understanding has not been translated into practice: teachers remain constrained by time, resources, and the absence of clear collaborative structures, while parental involvement is largely limited to homework supervision without meaningful integration of real-world numeracy contexts at home. These findings point to three practical needs for advancing numeracy instruction: (1) concrete, actionable guidelines that enable teachers and parents to apply deep learning principles in numeracy teaching; (2) a differentiated school–family collaboration framework responsive to varying student and family characteristics; and (3) activity-based numeracy projects that reposition parents as active facilitators rather than passive homework monitors. Theoretically, this study extends the discourse on numeracy development by demonstrating that classroom-based interventions alone are insufficient; sustainable improvement requires structured, needs-based collaboration between schools and families. Practically, the findings offer a foundation for designing collaborative models that are contextually grounded rather than generic.

Author Contributions

Intan Sari Rufiana initiated the conceptual framework and designed the study. Data acquisition and analytical procedures were conducted by Slamet Arifin, Fierda Nursitasari Amaliya, and Mohammad Yusuf Randy. All authors participated in the drafting and critical revision of the manuscript, and every contributor has reviewed and approved the final version prior to submission.

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