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Design Research on Realistic Mathematics Education Using Sedekah Rame to Develop Students' Number Sense

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ABSTRACT
The dominance of procedural learning in mathematics highlights the need for contextual learning to develop students' number sense. This study aims to develop a realistic mathematics education learning design based on the local cultural context of Sedekah Rame to enhance junior high school students' number comprehension. This research employed a validation design research method through three stages: preliminary design, teaching experiments, and retrospective analysis. The participants were 8th-grade students of SMP Negeri 3 Lubuklinggau. Data were collected using observation sheets, student worksheets, interviews, field notes, and documentation. Qualitative data analysis was conducted through data reduction, data display, and conclusion drawing with triangulation to ensure validity. The learning design focused on four indicators of number sense: estimation, mental calculation, assessment of numerical magnitude, and assessment of result rationality. The findings show that the Sedekah Rame context provides meaningful mathematical situations and supports the emergence of flexible numerical strategies. However, the development of number comprehension requires strong conceptual understanding and continuous learning experiences. The findings indicate that the Sedekah Rame cultural context supports the development of students' number sense by encouraging flexible numerical reasoning. However, strengthening conceptual understanding and providing continuous, well-structured learning experiences are essential to achieve more consistent improvement.

ABSTRAK
Dominasi pembelajaran prosedural dalam matematika menyoroti kebutuhan akan pembelajaran kontekstual untuk mengembangkan pemahaman angka siswa. Studi ini bertujuan untuk mengembangkan desain pembelajaran PMRI berbasis konteks budaya lokal Sedekah Rame untuk meningkatkan pemahaman angka siswa SMP. Penelitian ini menggunakan metode penelitian desain validasi melalui tiga tahap: desain pendahuluan, eksperimen pengajaran, dan analisis retrospektif. Partisipan adalah siswa kelas 8 SMP Negeri 3 Lubuklinggau. Data dikumpulkan menggunakan lembar observasi, lembar kerja siswa, wawancara, catatan lapangan, dan dokumentasi. Analisis data kualitatif dilakukan melalui reduksi data, penyajian data, dan penarikan kesimpulan dengan triangulasi untuk memastikan validitas. Desain pembelajaran berfokus pada empat indikator pemahaman angka: estimasi, perhitungan mental, penilaian besaran numerik, dan penilaian rasionalitas hasil. Temuan menunjukkan bahwa konteks Sedekah Rame memberikan situasi matematika yang bermakna dan mendukung munculnya strategi numerik yang fleksibel. Namun, pengembangan pemahaman angka membutuhkan pemahaman konseptual yang kuat dan pengalaman belajar yang berkelanjutan. Temuan menunjukkan bahwa konteks budaya Sedekah Rame mendukung

perkembangan kemampuan numerik siswa dengan mendorong penalaran numerik yang fleksibel. Namun, memperkuat pemahaman konseptual dan menyediakan pengalaman belajar yang berkelanjutan dan terstruktur dengan baik merupakan hal yang esensial untuk mencapai perbaikan yang lebih konsisten.

INTRODUCTION

Number sense plays a crucial role in students' mathematical thinking. This ability helps them understand the concept of number and how to treat it flexibly and meaningfully. Number sense encompasses more than just calculations. It encompasses sensitivity to numbers, connecting numbers, selecting more efficient strategies, estimating numbers, and all the skills involved in thinking in context, or what we call reasonableness (Fauziah & Pandra, 2024). It also relates to objects, which we call results. This is a crucial skill at the junior high school level, as students begin to encounter more abstract concepts in mathematics, such as comparisons, percentages, and quantitative data, in decision-making.

However, several studies have found that junior high school mathematics instruction fails to develop number sense fully. Students tend to solve math problems mechanically, memorizing algorithms without understanding the meaning of the numbers (Maghfirah & Mahmudi, 2018). Students also experience difficulties when faced with situations involving estimation, comparison, or assessing the reasonableness of results, especially non-routine ones (Hastuti & Setyaningrum, 2023). This indicates a discrepancy between procedural mastery and conceptual understanding, which is a hallmark of weak number sense.

It is not just at the school or classroom level that these issues manifest; they are also evident when considering the level of mathematical literacy in Indonesia. Most of the country's students are unable to grapple with a passage of text containing numerical information, select and implement an appropriate solution path, and assess the general usefulness of the results and the steps to obtain them in realistic situations (Yuda & Rosmilawati, 2024). These three factors represent the main components of one's ability to understand and use numbers in practical situations. Hence, one factor influencing Indonesia's mathematical literacy crisis is the inability to understand and use numbers in practical situations. One factor colleagues indicate might contribute to the observed situation is the learning of mathematics focused on formal procedures and devoid of contextualization, which positions numbers as mere abstract symbols (Fitriasari et al., 2024). Students cannot develop numerical instincts and thinking flexibility when procedures are algorithmically written to be followed, and mental strategies for estimation and the rationality of the results are absent.

Under these circumstances, RME (Realistic Mathematics Education) provides the most suitable framework for advancing numeracy skills in Indonesian education. Realistic Mathematics Education (RME) in Indonesia is better known as Pendidikan Matematika Realistik Indonesia (PMRI). PMRI perceives mathematics as a human activity, learnt in holistic, contextual situations near learners (Fauziah et al., 2020; Zulkardi & Putri, 2019). The processes of horizontal and vertical mathematization, in both the informal and formal stages of understanding, aim to gradually develop learners' concepts of mathematics. This emphasis on understanding the relational nature of numbers and learning mathematics as more than a set of procedures is a worthy change in attitude.

Several studies have shown that PMRI is efficacious in improving students' conceptual understanding and engagement in mathematics learning (Fauziah et al., 2020). Furthermore, integrating local cultural contexts into PMRI learning is gaining increasing attention because it can make learning more relevant, contextual, and meaningful for students (Andriani et al., 2020; Siligar et al., 2025). Cultural contexts provide real phenomena rich in mathematical activities, which can be used to train numerical intuition and flexibility in numerical thinking. Among the local cultural contexts that have been used in the development of PMRI learning designs are the Limasan house (Widyawati et al., 2016), the Menggono Tradition (Nursyahidah et al., 2021), the Mitoni Tradition (Muna et al., 2024), the Mayoshi Culture (Sohilait & Sidik, 2025), the Prada Songket (Sanita et al., 2024) and the Yogyakarta's Kawung Batik Fabric (Fadilah et al., 2024).

However, research specifically developing PMRI learning designs tailored to local culture to foster numeracy skills among junior high school students remains limited. Previous studies generally used specific cultural contexts such as traditional houses, ritual traditions, or craft products. However, few explicitly linked these to numeracy indicators, particularly within the cultural context of the Lubuklinggau region. This gap is critical given the increasing emphasis on numeracy as a core educational competency and the need for learning designs that support meaningful and conceptually grounded mathematics learning. Therefore, this study is urgently needed to develop a culturally relevant PMRI learning design while contributing theoretically to local learning theory and ethnomathematics. One example of local wisdom with considerable potential as a context for learning mathematics is the Sedekah Rame tradition.

Tradition is closely connected to and relevant to the understanding of arithmetic within the scope of number sense indicators: estimation, calculation, magnitude, and the rationality of results (McIntosh et al., 1992). The Sedekah Rame context provides opportunities for learning mathematics through activities that naturally involve numerical reasoning, such as estimating quantities of shared goods, comparing numerical amounts, performing mental calculations, and evaluating the reasonableness of results in distribution processes. These mathematical activities are embedded in meaningful social interactions, allowing students to connect abstract numerical concepts with real-life situations. At the same time, Sedekah Rame serves as a cultural practice that emphasizes values of cooperation, sharing, and collective responsibility, making mathematics learning socially and culturally relevant to students' experiences. The use of the Sedekah Rame context and the issues presented in the background form the basis of this study's objective, which is to develop a learning design for the use of the Sedekah Rame context in the Indonesian Realistic Mathematics Education (PMRI) series at the junior high school level in order to develop an understanding of numbers.

Such a background justifies the objective of this study: to develop a learning design for the use of the Sedekah Rame context within the scope of Indonesian Realistic Mathematics Education (PMRI) at the junior secondary school level to develop number comprehension. This study is intended to develop a local Instruction theory (LIT) that provides an avenue to advance the theory of PMRI learning and offers an alternative to teachers'aid in the design of mathematics learning in a context that is beneficial to the development of number sense.

METHOD

This study employed a design research approach using a validation study type, aiming to develop and validate local learning theories to enhance students' number understanding abilities through PMRI. This approach was chosen because design research enables researchers to methodically design, implement, and modify educational interventions based on students' responses and thought processes during the instruction (Bakker, 2018). This study was carried out through the three stages of design research: preliminary analysis, teaching experiments, and retrospective analysis.

In the preliminary analysis phase, the researcher reviewed the literature on number comprehension, PMRI and research design to determine the learning objectives and the indicators of number comprehension, which became the focal point of the study. From this analysis, the researcher designed a Hypothetical Learning Trajectory (HLT) that included learning objectives, a sequence of context-relevant activities for Sedekah Rame, and an anticipation of students' thinking development for each activity. The HLT was aimed to foster four number comprehension indicators: estimation, mental calculation, judgment of the numerical magnitude, and rationality of the results.

As noted by Akker et al. (2006), the teaching experiment consisted of two phases: the pilot and the teaching. In the first pilot experiment phase, the HLT was piloted with small groups to assess students' growth. They identified the students' learning obstacles and the gains/losses of the designed context and activities. The results of these activities were used to fine-tune the HLT and make it more suitable for the students. The pilot experiment phase consisted of six students. They had differentiated skills (high, medium, and low) to determine the initial viability of the learning design. The revised HLT was then used in the main teaching experiment phase, in which the class size was larger. In the eighth-grade class at SMP Negeri 3 Lubuklinggau, the learning design was used during the teaching experiment phase with 28 students. The class was mentored by the mathematics teacher, who served as the model teacher, while the researcher served as the observer and guide for learning reflection. Here, the researcher examined how students were acquiring number sense through PMRI activities and how the learning design functioned in practice in the classroom.

The retrospective analysis phase occurred after the teaching experiments concluded. The data obtained during the learners' retrospective analysis were compared to the learning trajectories predicted in the HLT with the learners' actual learning trajectories. The purpose of this analysis was to understand the strengths and gaps in the learning design and to develop a local learning theory explaining how and why the PMRI learning design, grounded in the Sedekah Rame context, can enhance learners' sense of number.

A variety of methods were used in this study to analyze and understand what occurs during the learning cycle and its outcomes. These methods include observations, videos, interviews, and work analysis. A qualitative analysis of the data was conducted using a description, followed by a synthesis to produce a cohesive whole. To validate the findings, researchers integrated data from different methods (i.e., observations, videos, interviews, and student work analysis). To analyse and compare students' actual learning pathways with their predicted learning pathways, the learning trajectories were the HLT. Data validity was achieved through methods and source triangulation and cross-interpretation among the researcher, the model teacher, and other observers. Therefore, the findings can be traced to the data collected during research.

RESULTS AND DISCUSSION

This study yields one learning design for PMRI learning within the cultural context of Sedekah Rame, aimed at educating junior high school students in number sense skills. The presentation of results follows the primary stages of the research design: preliminary analysis, experimental design, and retrospective analysis. The results are then discussed in the context of PMRI and number sense theory.

The purpose of the initial analysis was to identify the first barriers to learning number sense and to construct the first Hypothetical Learning Trajectory (HLT) to inform the planning of learning interventions. This was done through a review of the literature, interviews with the teachers, and a preliminary analysis of the students' skills. In this analysis, 8th-grade students were still found to have a gap in developing positive number sense. Teachers noted that their students tend to use algorithmic procedures without understanding what the numbers on the paper actually mean. They do not proactively estimate numbers, lack variety in their method choices, and never check whether their answers are reasonable. This supports Hurst & Hurrel's (2020) claim that overly procedural learning is a risk for learning number sense.

Based on the literature review and analysis of the cultural context of Sedekah Rame, Sedekah Rame is one of the traditional ceremonies and local wisdom that is very important and has been carried out from generation to generation, especially among the Sindang Kelingi Clan community who inhabit the area, including Batu Urip, Lubuklinggau (Susilo et al., 2024), as shown in **Figure 1**.

Figure 1. The cultural context of Sedekah Rame
Source: https://sumateraekspres.bacakoran.co/sumsel/read/22122/hut-lubuklinggau-warga-batu-urip-gelar-sedekah-rame#goog_rewarded

The researchers formulated four indicators of number understanding that were the focus of the study, namely: (1) estimation, (2) mental calculation, (3) assessment of numerical magnitude, and (4) assessment of the rationality of results (McIntosh et al., 1992). These four indicators were then mapped into an initial HLT designed to facilitate students' mathematisation process through a meaningful cultural context. **Table 1** shows the results of the initial HLT designed by the researchers.

Table 1. The initial HLT

Number Sense Indicators	Learning Activities	Hypothetical Learning Processes/Conjecture	Teacher Anticipation and Intervention
Estimation	Students were asked to estimate how much rice is required to serve 1500 portions of food in the Sedekah Rame activity, assuming one portion of food is donated to 3 or 4 people, without formal computation.	Extreme estimates (too high or too low); Some students guess without any basis in experience.	The teacher does not judge right or wrong, but encourages reflection through real experiences (daily food portions) to cultivate intuition about quantity.
Mental calculation	Students calculated rice requirements using standard portion information of 0.25 kg per serving and were asked to choose the most efficient calculation strategy.	Most use decimal multiplication; a small number convert 0.25 to ¼ and perform division.	The discussion on strategies, the efficiency of decimal-fraction conversions, and the generalization of mental strategies are all encouraged by the teacher.
Assessment of numerical magnitude	Students analyze material shortages (e.g. 25 kg) in two different total requirement scenarios (100 kg and 1000 kg).	Students view numbers in absolute ways; struggle to comprehend disparities in relative significance.	The teacher directs students to compare using ratios or percentages to emphasize the relative meaning of numerical quantities.
Assessment of the rationality of results	Students consider two option sets a committee might decide on to deal with shortages of a particular raw material: reducing the size of each portion or reducing the number of portions served.	Decisions are based on emotional considerations; a small number begin to use mathematical arguments.	The teacher guides students to connect the results of calculations with the consistency of decisions and their impact mathematically.

Based on **Table 1**, HLT is designed progressively to address students' specific weaknesses in number understanding. In the estimation phase, the emergence of extreme estimates indicates an underdeveloped understanding of quantity, so teacher interventions are directed at connecting estimation to real-life consumption experiences to strengthen students' initial quantitative understanding (Fitriasari et al., 2024; Serrazina & Rodrigues, 2021). In the mental computation phase, the dominant use of the stacked decimal algorithm emphasises procedural dependencies, while the conversion of 0.25 to ¼ is positioned as a key strategy to encourage numerical flexibility and calculation efficiency (Adamuz-Povedano et al., 2021; Hadi, 2015).

Furthermore, in the numerical magnitude assessment phase, students' difficulties in interpreting the difference of 25 kg relatively were overcome through the comparison of two scales that needed to be developed to produce proportional reasoning and an understanding of relative magnitude (Lin et al., 2016; Nasir, 2018). In the rationality of the results assessment phase, students' tendency to make decisions based on emotional considerations highlighted the importance of teacher guidance to help students connect calculation results with the consistency and mathematical implications of decisions in real contexts (Rahmawati et al., 2023; Yang & Lin, 2015)

The validation of the HLT design took place during the focus group discussion with the three SMP N 3 Lubuklinggau teacher reviewers and the three expert reviewers. Engaging peers and practitioners to validate the design during research is an important activity in the design research process (Akker et al., 2006; Plomp, 2013). Since reviewers are experts, they can assess whether the design aligns with the learning principles. Teachers and reviewers are classroom practitioners and can assess whether the design is appropriate for the classroom. An initial draft of the HLT was then reviewed and revised based on feedback. The first iteration of the HLT, revised to accommodate the principles and characteristics of the PMRI, is aligned and proportional to the indicators in terms of the number of units.

The pilot experiment demonstrates that HLT can aid the evolution of students' numeracy skills, but not yet to their fullest potential. Based on students' responses, during the estimation stage, most students displayed extreme overestimations or underestimations, not meeting the appropriate range. In this estimation, students demonstrated weak numerical intuition and estimation abilities across a large portion of the quantitative components, as Yang & Wu (2010) also noted. During the mental computation stage, most students used either the stacked decimal multiplication algorithm or flexible multiplication, with the latter occurring when a quarter was converted to a decimal and used as a flexible strategy. From this, it can be concluded that a core component of number sense, or the ability to be numerically flexible, has not been equally developed (Serrazina & Rodrigues, 2021). At the stage in which students assessed numerical magnitude and, sequentially, the rationality of their conclusions, students used either a nihilistic approach, interpreting the quantity contained in a number, or made their decisions based on feelings, again sidestepping any actual, rational mathematical order. Based on the above pilot experiment of HLT, more, as yet, relatively unstructured components of a conceptual framework and guiding questions were integrated. In **Table 2**, the HLT were presented according to the outcomes of the pilot experiment.

Table 2. HLT Revision based on Pilot Experiment

HLT Phase	Pilot Experiment Findings	Revisions Made
Estimation	– Students' estimates are unrealistic. – Many estimates are extreme (1500 kg or 150 kg). – Students lack clear portion sizes.	– Added a framework for real-life experiences (questions about portion sizes). – Prepared a visual representation of a 0.25 kg portion.  – Strengthen reflective questions.
Mental calculation	– The majority of students used multiplication. – The efficient strategy (1500 : 4) only appeared in a few groups.	– Provides strategy exploration exercises. – Encourages comparative strategy discussions.
Assessment of numerical magnitude	– Students only see a difference of 25 kg. – They don't differentiate between 25/100 and 25/1000. – Percentage analysis doesn't happen spontaneously.	– Provide visual aids (comparative bar charts). – Add percentage questions. – Guide thinking from absolute to relative by deliberately comparing contexts.
Assessment of the rationality of results	– Many students chose the option based on a sense of fairness. – The mathematical argument is still weak.	– Emphasize the meaning of rationality in a mathematical context. – Provide a comparison table for decisions A and B. – Provide guiding questions regarding data consistency.

Based on **Table 2**, several parts of the HLT were then revised based on the results of the preliminary experiment. This revised HLT was then used in the teaching experiment stage. During the teaching experiment, some improvement, albeit still non-uniform, in students' numerical understanding was seen with the application of new HLTs. During the estimation phase, some students began to give more realistic estimates after being shown portion visuals and reflective questions. However, the wide range of estimates still indicated that students were still very much lacking in numerical intuition. The teacher's interviews about the spontaneous comments made by the students captured the following:

Student A: "Looking at the portion, one dish is only that much. So, for 1,500 people, that's a lot, but it can't possibly be thousands of kilograms."
Student B: "I'm still confused, Ma'am. I'm worried it won't be enough, so I'll just say it's a bit much because it's just an estimate."
Student C: "At first, I was just guessing, because I couldn't imagine it. But after seeing the picture of the rice portion, I think one person doesn't eat that much, so it probably wouldn't be thousands of kilograms."

Estimation ability is correlated with the students' mental representations of the quantities involved. Concrete visualisations help students make number-world connections, which lead to realistic estimation (Serrazina & Rodrigues, 2021). However, the variation in the estimation implies an internal numerical sense which is not yet stable. In fact, estimation is not an instantaneous ability, it takes time and repeated practice in context (Adamuz-Povedano et al., 2021). To be sure, numerical sense is required to improve the estimation. However, to further improve students' numerical understanding, consistent practice is needed to strengthen their mental number sense reliably. The practice should equip students to flexibly and contextually evaluate the quantities in focus.

In the mental calculation phase, there was an increase in the emergence of more efficient strategies, such as dividing 1500: 4. However, most students still relied on formal algorithms and made decimal place value errors, as shown in **Figure 2**.

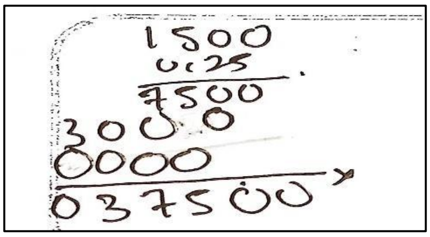


Figure 2. Answers of students who made place value errors

Figure 2 shows that students attempted to calculate rice requirements using decimal multiplication for the operation 1500 × 0.25. However, they made a fundamental error in assigning decimal place values. They treated 0.25 as if it were the integer 25 and then mistakenly added zeros to the final result. This finding supports Rahayu et al (2018) argument that weaknesses in decimal operations stem from an immature understanding of place value.

The assessment stage of the magnitude of numbers is carried out by displaying two bar charts: 25 of 100 and 25 of 1000, to help students see that a number can have a large or small meaning depending on the overall context. The following comparison chart is provided to help students assess the quantities shown in **Figure 3**.

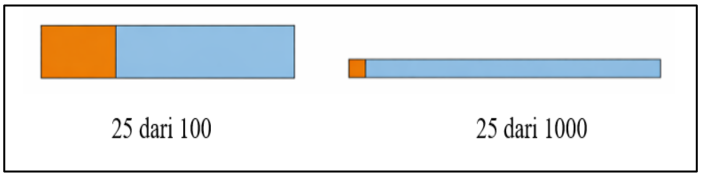
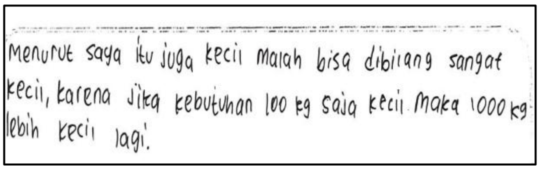


Figure 3. Bar chart of phase comparison of assessing magnitude

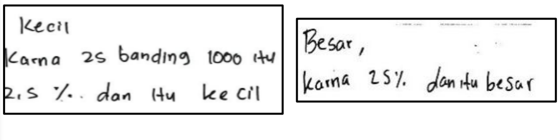
Although this visual representation has been refined in the revised HLT, some students still interpreted the number 25 kg as small in both situations, as shown by the students' answers in **Figure 4**.



English version
in my opinion, that is also small in fact, it could be called very small because if a requirement of 100 kg is considered small, then 1000 kg is even smaller

Figure 4. Student answers in the numerical magnitude assessment phase

This happens because confident kids have not yet developed a mature understanding of proportion, which makes it challenging for them to grasp that a single value can have different interpretations in different contexts. Abreu-Mendoza & Gunderson (2025) demonstrated that many students continue to focus on absolute value rather than relative value when comparing two or more quantities. Furthermore, Serrazina & Rodrigues (2021) argued that visual representations are beneficial. However, when students lack sufficient experiential background in interpreting comparisons, they tend to attribute the same value to the same number even when the figures' contexts differ. This indicates that understanding proportion requires more complex, multifaceted learning experiences (Lin et al., 2016).



English version

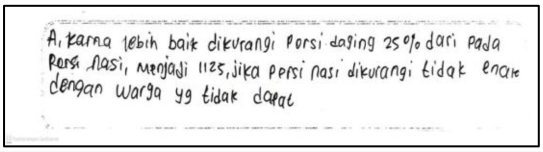
Small. Because 25 compared to 1000 is 2.5%. And that is small.

Large, because it's 25% and that is large

Figure 5. Student responses in the numerical magnitude assessment phase

Others are beginning to distinguish that 25 out of 100 is 25%, while 25 out of 1000 is 2.5% as shown in **Figure 5**. Referring to **Figure 5**, students can evaluate values and justify the size of a given number in relation to other numbers in a set. The teacher has attempted to help the students analyze bar graphs. However, the unevenness of their responses to bar graphs and their understanding of relative size/base and scale remains problematic. This stage indicates that while visual representations may assist in tackling the problem, they are not sufficiently robust to change students' absolutist thinking into proportional thinking. When scaffolding prioritizes part-whole relationships, students tend to focus on a single number rather than the meaning of ratios or percentages (Serrazina & Rodrigues, 2021).

In the indicator assessing rationality, students were asked to compare two committee decision options in response to a 25% meat shortage: reducing portions (option A) or reducing the number of portions (option B). The teacher used a comparison Table as scaffolding to help students assess the consistency between the data and the decision. However, many students still chose option A for emotional reasons, such as the desire for "everyone to get a share," as shown in **Figure 6**.


A, karna lebih baik dikurangi porsi daging 25% dari pada porsi nasi, menjadi 1125, jika porsi nasi dikurangi tidak enak dengan warga yg tidak dapat

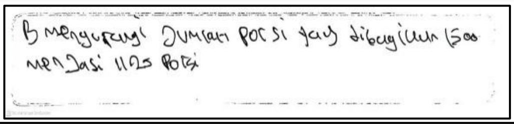
English version
A, because it is better to reduce the meat portion by 25% rather than the rice portion, becoming 1125; if the rice portion is reduced, it wouldn't be right (or would feel bad) for the residents who don't receive any.

Figure 6. Answers of students who chose Option A

This is explained by the student's direct response to the problem reiteration made by the teacher:

Teacher: "Why did you choose option A?"
Student: "I chose A because it is okay to reduce the portion by a bit as long as there is a share for everyone".

From this utterance, it is clear that the student still understands some qualitative aspects of the decision but cannot see the whole picture. Only a small proportion of students were able to relate their decisions to mathematical data, for example, that 75 kg is only enough for 1125 standard portions, as shown in **Figure 7**.


B mengurangi jumlah porsi yang dibagikan 1500 menjadi 1125 porsi

English version
B reduces the number of portions distributed from 1500 to 1125 portions.

Figure 7. Answers of students who choose option B

Despite active class discussions, the connection between percentage calculations and rational decision-making was not fully established. The teacher then attempted to deepen the guiding questions, but student responses remained varied and not fully grounded in data. During the evaluation of the reasonableness of the results, a few students managed to pair mathematical computations with the logical steps of decision-making, whereas most still anchored their decisions in the affective domain. There is new evidence stating that several students find it difficult to see the correlation between the results of a computation and the decisions that need to be made due to a lack of practice, or exercises, of quantitative reasoning and reflection on the outcomes that were mathematical in nature (Nichols, 2025; Rahmawati et al., 2023). Therefore, mathematical rationality should be assimilated through exercises that explicitly pair numerical computations with the prediction and evaluation of the nexus, as well as the logical coherence of decisions in real-world scenarios.

Based on the results of the teaching experiment above, **Table 3** summarises the findings and their impact on the revised HLT.

Table 3. Findings from the Results of the Teaching Experiment

Number sense indicator	Results Found	Emerging Obstacles	Impact on HLT
Estimation	60,7 % students are starting to approach realistic estimates.	39.3% of students still provide extreme estimates; students do not consistently understand the 0.25 kg scale.	Requires additional food portion exploration activities.
Mental calculation	28.6% of students started using 1500: 4.	about 71.4% use nested multiplication while 25% of them make computational errors. The relationship 0.25 ↔ ¼ is still not well understood.	It takes time to be taught how to do instruction and then practice to learn about fractions and decimals
Assessment of numerical magnitude	55% of students began to differentiate between 25% and 2.5%.	45% of students think of the number 25 as small in the abstract; given the bar graph, students have not been provided any context as to what the number refers to.	More practice needs to be allocated to the students pertaining to the subject of evaluating different percentages
Assessment of the rationality of results	50% are able to choose Option B based on calculations	50% still cite an emotional basis; the idea of rational = data consistent is still absent.	There is a necessity for students to receive extra guidance for formulating argumentation efforts and comparing varied situations.

Based on **Table 3**, the results of the teaching experiment show that the intervention in the revised HLT is not strong enough. Hence, the HLT needs to be revised again so that learning is more focused and in-depth and provides a more transparent structure for students in building mathematical understanding. Thus, more cycles of trials are required to ensure that the HLT is better developed, more responsive to students, more flexible, and can help students build number sense more systematically through a series of revisions based on classroom data. This is an iterative research design. One of the hallmarks of this type of research is that the design of the learning is improved by implementing and reflecting on learning through a cycle of redesign based on the students' learning (Bakker & Van Eerde, 2015; Plomp, 2013).

The integration of local cultural context into mathematics teaching is seen to promote meaningful learning, as students can associate mathematical concepts with social practices. Cultural context functions as a tool that helps students capture problem situations and initiate the process of mathematization (Mendrofa et al., 2024; Prahmana, 2022). In this regard, the Sedekah Rame context provides a familiar and meaningful situation in which numerical ideas naturally emerge through activities such as sharing, distributing, estimating quantities, comparing numerical values, and evaluating the reasonableness of results. These activities enable students to translate real-life experiences into informal numerical strategies, supporting horizontal mathematization, which can later be developed into formal mathematical understanding through vertical mathematization with appropriate instructional guidance (Fauzi et al., 2022). However, previous studies have shown that the use of cultural contexts alone does not automatically support the development of proportional reasoning and rational thinking without a structured conceptual framework (Rosa & Orey, 2024; Vanluydt et al., 2020). Furthermore, socially rich contexts may create an imbalance between affective and quantitative elements, requiring teachers to intentionally direct students toward evidence-based and quantitative decision-making (Naresh & Poling, 2015). Therefore, while Sedekah Rame and other cultural contexts hold strong potential for supporting number sense learning, their effectiveness depends heavily on well-designed learning activities and the teacher's role in integrating social values with formalized mathematical thinking.

CONCLUSION

The research outcomes show that the Sedekah Rame context can offer significant mathematical situations and stimulate students to estimate, perform mental calculations, evaluate the order of numbers, and determine results rationally. However, students' number sense development is not uniform. There are still students whose number sense is poor, and they are stuck on algorithmic procedures and have problems understanding relative sizes and problem-solving in calculations. These results show that contextual learning needs to be augmented with powerful ideas, the varied frameworks, and clear questions that guide the learning activities. In theory, this research will contribute to a local theory of learning that describes the learning pathway on number sense developed from the synthesis of PMRI and ethnomathematics, and will also provide junior high school mathematics teachers with a relevant and meaningful mathematics teaching design. Therefore, while Sedekah Rame and other cultural contexts hold strong potential for supporting number sense learning, their effectiveness depends heavily on well-designed learning activities and the teacher's role in integrating social values with formalized mathematical thinking This study contributes to a local learning theory within the PMRI framework by demonstrating how the Sedekah Rame cultural context supports the development of students' number sense. The findings highlight the need for structured tasks and explicit teacher guidance to connect contextual activities with mathematical reasoning. Future research is recommended to refine the learning trajectory through iterative design cycles and broader implementation contexts.

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