Enhancing Numeracy Skills for Learners at the Margin Utilizing Concrete Manipulatives: A Community-Based Participatory Action Research

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ABSTRACT

The current research utilized a community-based participatory action research (CBPAR) approach to explore and enhance the learners' numeracy skills. The active involvement of the community members is crucial in designing and developing learning strategies. Four groups of participants collaboratively work together to attain the research goals: mathematics education students forming the research team, community members providing insights on local resources for teaching numeracy, school mathematics teachers, and the learners themselves, who were evaluated through pre- and post-intervention assessments. Data were collected through interviews, Numeracy Skills Assessments, focus group discussions, and reflective journals to identify learners' numerical gaps and design contextualized learning activities. The introduction of concrete manipulatives such as *taklong*, stones, banana leaves, *uhay*, and *bolo* played a significant role in teaching numeracy. The learners showcased low initial proficiency in certain numerical competencies. Learning activities enriched with concrete manipulatives led to increased engagement and understanding of mathematical concepts, reflecting improved numeracy skills despite initial gaps. Integrating local materials into the curriculum resulted in a contextually rich learning environment that enhanced numeracy understanding and mastery. The study advocates for the continued use and development of localized learning tools to raise numeracy skills, recommending that education authorities support curricula incorporating community-generated resources. Furthermore, collaboration between educational institutions and local communities is suggested to create transformative materials that connect academic learning with real-life experiences, providing a template for best practices in localized teaching strategies.

Keywords: Numeracy skills; concrete manipulatives; Community-Based Participatory Action Research; contextualization, instructional materials

INTRODUCTION

For learners at the margin in culturally diverse contexts in the Philippines, enhancing mathematics education requires an in-depth understanding of the unique challenges and environments these students face. Persisting education disparities, especially among marginalized communities across the globe, have remained one of the main concerns for UNESCO under the "Education for All" global initiative since 2015 (UNESCO, 2015). In a country like the Philippines, which is culturally rich with over 100 language groups and diverse

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knowledge systems, students encounter numerous hindrances to accessing appropriate education in their cultural context and responding to their needs (UNICEF, 2018).

Academic and social exclusion for marginalized students is more often than not caused by such factors as language barriers, educational content that does not resonate with the lived experiences of students from diverse backgrounds, and systemic disparities (Castagno & Brayboy, 2008). However, it is always a struggle for such communities to get educational support that acknowledges their unique cultural context and integrates it into the curriculum.

Localized and contextualized learning opportunities are important to address these educational problems. However, failure to provide customized education can lead to loss of identity among learners, negatively affecting their self-esteem (UNICEF, 2018). Programme for International Student Assessment (PISA) results show that, on average, Filipino students perform worse than other countries' learners in numeracy, thus necessitating localizing and contextualization-oriented educational policies (Department of Education, 2023).

The low performance and poor representation of math students from diverse cultures in the curriculum, coupled with differences in the quality and support of education provided to them against the majority of students, imply that educational approaches must be sensitive to their specific contexts (OECD, 2017; Sicat & David, 2016). In Barangay Lipata, Barotac Viejo, Iloilo, for instance, Atis stands out as a unique community that explores what goes on regarding education. Even though they have deep cultural roots, little attention has been paid to whether this can improve educational results by making learning processes consonant with cultural values or knowledge (Jundos & Aldon, 2021).

This research work employs community-based participatory action methodology in developing learning activities utilizing local materials available in the learners' community that served as concrete manipulatives for enhancing numeracy skills among learners. This approach makes sure that mathematics lessons are made readily accessible and also aligned to culture to empower learners by incorporating how they see things based on their backgrounds into the fabric of instruction. Regarding diverse cultural backgrounds among Filipino learners, this study tries to contribute towards attaining a more inclusive education system by addressing particular challenges the youth faces and meeting specific needs.

The current research aimed to enhance learners' numeracy skills (number and measurement skills) in Sitio Nagpana, Brgy. Lipata, Barotac Viejo, Iloilo, Philippines. The researchers, community members, and mathematics teachers collaboratively designed and implemented learning activities in mathematics, emphasizing participatory methods and principles of place-based education. The research team collaborated with the community members to identify materials available in the community that can be utilized as concrete manipulatives in teaching numeracy.

Specifically, the current research aimed to attain the following research objectives:

1. Identify local materials available in the learners' community that can be used as concrete manipulatives in teaching numeracy;
2. Determine the learning gaps in learners' numeracy;
3. Design learning activities that utilize concrete manipulatives to enhance learners' numeracy;
4. Document learners' notable experiences during and after implementing learning activities involving concrete manipulatives; and
5. Gather evidence of learners' development of numeracy skills after implementing learning activities involving concrete manipulatives.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

METHODOLOGY

A. Research Design

The study employs the design of community-based participatory action research (CBPAR) to explore and improve numeracy among learners. This method builds up a collaboration between researchers and community members, leading to a more collaborative and empowering research framework that enhances inclusiveness and respects the community's point of view (Lewin, 1946; Duke, 2020). It entails involving the community throughout every investigation stage, from initial inquiry to designing and producing instructional materials for use during implementation. It represents CBPAR's foundational principles as described by Burns et al. (2011), referring to an approach that is culturally inclusive, empowering, and responsive with efforts directed at integrating culturally relevant materials within the learning process. Ensuring that there is active engagement from the community during this research process not only makes these strategies applicable but also directly benefits students by addressing their unique educational needs.

B. Research Participants

This study aimed to investigate and enhance learners' numeracy proficiency by innovatively deploying concrete manipulative materials available within their community context. This investigation was structured within the Community-Based Participatory Action Research (CBPAR) framework and encompassed four distinct groups of participants.

The first entity was the research team, comprised of mathematics education students. The team consisted of three members, with one leading the group. Collaboration is the essential element of this team, as it is at the heart of the action research process.

The second group consisted of community members interviewed to identify local resources for teaching numeracy. The researchers used purposive sampling to select the two participants in this phase, allowing them to choose sample members based on their knowledge and experience. Purposive sampling is especially efficient when the research needs more profound insight and details from known or expected knowledgeable informants (Etikan et al., 2016). Furthermore, these participants were chosen using specific criteria as follows: (1) Self-identification, (2) Traditional and language knowledge and practice, (3) Willingness to share own culture with others, (4) Ability to communicate well, (5) Participation in learning activities, and 6) Cooperation.

The third set consisted of three secondary mathematics teachers selected through purposive sampling. They served two essential purposes. First, they determined the students' arithmetic ability level and established the areas where they required additional support. Second, they appraised instructional interventions designed by the research team for their suitability for quality and alignment with educational standards.

Ultimately, learners who demonstrated low numeracy skills, as determined by a numeracy skills assessment, were selected through purposive sampling to participate in this investigation. Their learning experiences were rigorously evaluated using pre- and post-intervention tests and self-reflection exercises. The outcomes from these assessments and self-reported reflections offered timely insights into the impact of the study on their arithmetic proficiency.

C. Data Sources

The research used various data sources to address varied issues regarding enhancing numeracy education. Researchers have ensured that they employ a multi-method approach when collecting data to enhance

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

validity and reliability.

The first research question about materials for teaching numeracy was answered through interviews with some community members. These interviews helped identify specific objects already around whose integration could be applied as concrete manipulatives in numeracy teaching.

The quantitative and qualitative data were collected through a dual-method approach of Numeracy Skills Assessments and interviews with mathematics teachers to determine the learners' learning gaps in numeracy skills. This tactic enabled the identification of the learners' needs and difficulties.

The research team collaboratively designed and implemented learning activities that use concrete manipulatives. During this phase, creative instructional methods rooted in a collective knowledge base and collaborative wisdom evolved.

Journal writing and interviews captured learners' experiences after exposure to learning activities using concrete manipulatives to enhance their numeracy skills in numbers and measurement. The study posits that these personal narratives are a rich source for evaluating the appropriateness or otherwise of educational interventions.

Developing numeracy skills through concrete manipulatives was evidenced through pre- and post-numeracy Skills Assessments, students' journal entries, and follow-up interviews. This triangulation of data sources ensured a comprehensive evaluation of whether the learners' numeracy skills improved.

D. Data Gathering Procedure

The research was divided into two phases: project design and project implementation to achieve the research goals. The procedure was patterned after Burns et al.'s (2011) framework for Community-Based Participatory Action Research, known as CBPAR, and enhanced to best suit the context of current research.

The project design involved steps such as research question and geographic focus identification, community engagement, identification of local materials for concrete manipulatives, working with mathematics teachers, and development of learning activities. For projects aimed at improving numeracy skills, implementation was most important. This stage entailed the implementation of learning activities and the conducting of observations and interviews among the participants.

1) Identification of the Research Problem and Geographic Focus: This research commenced by pinpointing the numeracy skills of learners in Nagpana Barotac Viejo, Iloilo, as the primary focus, driven by an interest in understanding the challenges faced by these learners in enhancing their mathematics skills.

2) Identification of Local Materials as Concrete Manipulatives: During this stage, the team engaged the community to identify local materials for concrete manipulations, using observations and interviews to learn about their traditional uses and meanings.

3) Formulation of the Numeracy Skills Assessment: At this stage, the research team developed a numeracy skills assessment based on the Welsh Government's Literacy and Numeracy Framework, which is aligned with Philippine K-12 Curriculum Mathematics Learning Competencies but specifically suited for the local context.

4) Assessment of the Numeracy Skills of Learners. After the creation of numeracy skills assessments using local materials, they were administered to the learners by the research team. This process helped identify specific weak areas or learning gaps.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

5) Solicitation of Teachers' Insights to Identify Learners' Numeracy Learning Gaps: The research team interviewed these students' mathematics teachers to learn more about why these learners had difficulties in some specific aspects of numeracy.

6) Development of Learning Activities: The research team integrated community–identified materials into the curriculum by developing learning activities to enhance learners' numeracy skills. Mathematics teachers have validated these activities against curriculum standards for appropriateness and correctness.

7) Implementation Learning Activities: During the implementation stage, the team and teachers made the learning activities exciting and relevant to students. They were also refined over time-based on feedback and assessments to cater to individual learning needs.

8) Post-Intervention Assessment of Learners' Numeracy Skills: Afterward, a systematic post-intervention assessment was undertaken concerning the learners' numeracy skills to establish whether the intervention had caused any impact. The better numeracy skills of the learners can thus be calculated from this since it shows that they improved their performance.

9) Documentation of Experiences: Extensive documentation of experiences in each stage enhances our understanding and insights from problem identification to post-intervention assessment of learners' numeracy skills.

10) Data Analysis: In this line, Braun and Clarke's thematic analysis framework was used to analyze qualitative data gathered during various stages of the study. In contrast, descriptive statistical tools such as mean and percentage calculations were used to analyze quantitative data, giving both qualitative insights and quantitative outcomes.

E. Ethical Considerations

In educational environments, the research team emphasized ethical research practices, especially by creating information materials in local languages and obtaining permission from participants. The team consulted community experts to make the research relevant to the context of the learners. The team sought permission from the communities it was working with to use local materials, respect intellectual property rights, and acknowledge them appropriately in all research publications. Confidentiality of all participant data was maintained while community members actively participated in each phase of the study to ensure their input influenced the study's outcomes. The researchers, therefore, tried to bring about positive impacts on educational research and, at the same time, maintain high ethical standards by making sure that cultural sensitivity was embedded throughout their work.

RESULTS AND DISCUSSION

A. Local Materials as Concrete Manipulatives for Teaching Numeracy to Learners

This section discusses the results of the research objective to identify local materials available in the learners' community that can be utilized as concrete manipulatives for teaching numeracy. The research team worked with the *Nagpana* community to identify local materials that can be used as concrete manipulatives in implementing learning activities that enhance learners' numeracy skills. The thematic analysis served as a fitting qualitative analytical instrument for this study, as it allowed for the identification and interpretation of patterns within the data pertaining to the local resources used as manipulatives.

1) Taklong: Snail shells or taklong were emphasized by Nancy and Raquel as one of the main resources

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

used in the *Nagpana* community for teaching numeracy. According to Nancy, taking helps students count and memorize numbers, especially when taught that "The snail shell is used for counting and memorizing numbers." Consequently, researchers included these as concrete manipulatives during mathematics lessons for indigenous learners. Similarly, Raquel seconded Nancy's observation on *taklong*, noting its seasonal availability primarily during rainy and cold seasons, illustrating a natural variation in pedagogy depending on what local means provide.

2) Stones: In addition, both Nancy and Ma'am Raquel pointed out rocks' usefulness, which can be employed as concrete manipulatives while teaching Mathematics with cultural resources interwoven into it. For example, she often uses small stones available within their locality for counting purposes that encourage critical thinking and number sense, where children may estimate stacks of quantities using familiar things. She mentioned, *"Bato, kuha ka sang gagmay nga bato tapos tumpukon, tapos kung ano isipon kag kuhaon dayon isipon mo kung pila na".*

3) Banana Leaves: In the Nagpana community, banana leaves have diverse cultural applications, as Ma'am Nancy and Ma'am Raquel described. Ma'am Nancy recounted their use for writing, saying, *"Sang una, gakwa kami dahon ka saging kay ang sa likod na ka saging maputi, kundi testingan mo maagi na siya, himo ka sang matarom kag isulat dira."* Ma'am Raquel, however, noted their role in garment design and measurement, particularly for festivals: *"Kung mag measure kami sang isa ka bagay sang una, Ang dahon saging isa nana sa ginagamit namon. Ginagamit mana namon sa mga designs kung may festival".* Researchers observe that banana leaves have evolved to become culture-based tools in teaching mathematics, facilitating learning of numerical concepts through a medium intrinsically connected to the learners' cultural practices.

4) Uhay: The Nagpana community historically utilized oway/uhay, a strong and versatile material, for various purposes. Ma'am Raquel acknowledged its utility for measurement and adaptability in tasks requiring length and sturdiness, stating, *"Kung mag measure kami sang una, Ang uhay pwedi gid kagamit Kay medyu malaba sya nga daan kag pwedi gid magamit kung mag takos".*

5) Bolo: In the Nagpana community, traditional educational practices utilized local resources, such as "bolo" (bamboo sticks), to teach early mathematical concepts like counting and basic addition. Ma'am Nancy noted, *"Gakwa kami bolo kag pasid-pasidon kag muna nagamit namun sa pag isip kag pagtakos".* Further, Ma'am Raquel reinforced this viewpoint by stating, *"Isa sa mga materials namon nga ginagamit sang una kung mag count is ang bolo,"* which highlights the role of *bolos* in the community's numeracy.

Figures 1 and 2 show the various traditional educational resources used in the Nagpana community, including *"taklong"* or snail shells, stones, banana leaves, *oway/uhay*, and bolo (bamboo sticks).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

Fig. 1. Taklong or Snail Shell (left), Stones (right)

Fig. 2. Banana leaves (*left*), Oway (*right*), Bolo (*bottom)*

B. Learning Gaps in Learners' Numeracy Skills

This section examines the findings of the research objective focused on determining the learning gaps observed within the learners' numeracy skills. The researchers found that learners had gaps in their numeracy skills, as identified through assessments and interviews with teachers, which led to the development of focused teaching strategies.

1) Low Numeracy Skills of Indigenous Learners Before Intervention: The learners' numeracy skills were very low before intervention efforts, as evidenced by Table 3 data showing weaknesses in various competencies. The learners demonstrated poor performance in operations with integers and rational numbers, having mean raw scores of 1.53 (10.20% achievement) and 0 (0% achievement), respectively. However, there was some improvement in ordering real numbers and estimating measurements since these had mean scores of 5.27 (34.70% achievement) and 7.6 (58.56% achievement), respectively. However, significant gaps were observed, particularly in unit conversions, where the students attained an average rating of 3.47, equivalent to 19% proficiency. Data presented in Table I shows the mean and percentage scores of the numeracy skills of the learners.

Table I Leaners' Numeracy Skills Before Intervention

Learning Competency	Highest Possible Score	Mean Raw Score	Percentage
1. Performs operation on integers	15	1.53	10.20
2. Performs operations on rational numbers	15	0	0.00
3. Arrange real numbers in increasing and decreasing	9	5.27	58.56

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

4. Approximate the measure of quantities, particularly length, weight/ mass, volume, time, angle, temperature, and rate	40	7.6	19.00
5. Solves problems involving conversion of units of measurement	10	3.47	34.70

Mathematics teachers observed that indigenous learners experienced difficulties in various aspects of mathematics.

2) Learners' Difficulty with Sign Usage and Fundamental Operations: Kevin points out that the learners faced challenges with sign usage in mathematical operations due to a fundamental misunderstanding, specifically in division and multiplication. Calculation mistakes result from this misinterpretation and impede their ability to apply mathematical ideas when they encounter diverse situations correctly.

3) Learners Faced Conceptual Challenges with Rational Numbers: Sir Kevin and Sir Rolex believed that learners have difficulty understanding rational numbers, especially fractions and decimals. Because of this abstract idea, solving problems involving fractions becomes tough. Mathematically, improving their conceptual understanding of rational numbers is central to their success.

4) Measurement-related Challenges: According to Ma'am Angie, using protractors is confusing among learners, leading to wrong measurements of angles. Incidentally, these learners lack knowledge of different units of measurement, making it harder for them to solve conversion questions. She has stressed the need to address how these students comprehend measurement tools and conversion factors.

5) Lack of Conceptual Understanding of Integer Operations: Sir Rolex identified a lack of knowledge of integer operations among learners due to disparities in their understanding of language, including cultural diversity in mathematical terms.

6) Limited Exposure to Standardized Units: Ma'am Angie reveals challenges related to insufficient exposure to standardized measurement units, affecting learners' ability to measure and compare quantities effectively.

7) Lack of Memorization of Mathematical Concepts: Sir Kevin notes that learners struggle with memorizing units and their conversions, suggesting a crucial focus on memorization techniques to enhance understanding and problem-solving efficiency in measurements.

8) Difficulties in Problem Solving: Sir Rolex depicts challenges to problem-solving that have resulted from failure to understand the objectives of the questions.

C. Learning Activities Utilizing Concrete Manipulatives

This section presents the results of learning activities that were designed and developed using concrete manipulatives. The study developed seven lesson plans integrating concrete manipulatives identified in the community to enhance learners' grasp of numeracy.

1) Lesson 1: Addition of Integers: Researchers integrated *taklong*, *bolo,* and stones as concrete manipulatives to elucidate the rules governing the sum's sign through addition, enhancing learners' understanding of integer addition.

2) Lesson 2: Subtraction of Integers: In the Subtraction of Integers lesson, *taklong, bolo,* and stones were used as concrete manipulatives to demonstrate the standardized rules and inverse nature of subtraction

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

relative to integer addition.

3) Lesson 3: Multiplication of Integers: In the lesson on Integer Multiplication, the integration of *taklong, bolo,* and stones as manipulatives illustrated how integer signs interact during scaling, aiding in understanding multiplication rules and sign determination.

4) Lesson 4: Division of Integers: In the lesson on the Division of Integers, *taklong, bolo,* and stones were effectively utilized as concrete manipulatives to teach the rules governing how signs interact.

5) Lesson 5: Addition and Subtraction of Rational Numbers: In the lesson on Addition and Subtraction of Rational Numbers, banana leaves were concrete manipulatives to illustrate adding and subtracting fractions and decimals as equivalent ratios grounded in established integer rules.

6) Lesson 6: Multiplication and Division of Rational Numbers: The sixth-lesson plan on Multiplication and Division of Rational Numbers used *bolo,* banana leaves, and snail shells to depict operations as ratios, fractions, and decimals, reinforcing procedures analogous to integer multiplication and division.

7) Lesson 7: Measurements and Conversion: On Measurements and Conversion, *Uhay* and *Bolo* were employed as concrete manipulatives to facilitate understanding various units for quantifying physical attributes.

The mathematics teachers reviewed the lesson plans to ensure their adherence to mathematical standards and cultural suitability, adjusting based on their feedback to teach numeracy to learners effectively.

D. Learners' Notable Experiences During and After Implementing the Learning Activities

Following the learning activities, the learners reflected on their experiences with mathematical concepts and skills. Several common themes emerged from their reflection journals regarding challenges encountered and key lessons gained.

1) Mastery of fundamental mathematical operations and concepts: The learners' reflections emphasized significant mastery of core mathematical operations, such as *"addition, subtraction, multiplication, and division." One of the learners (Learner 1) specifically stated*, *"I learned how to add, subtract, multiply, and divide numbers. I initially struggled with multiplication, but in the end, I learned how to use it."*

2) Understanding of key mathematical concepts: Learners showed a deep understanding of integer operations, as evidenced by their ability to explain concepts like *"changing the signs when adding,"* which indicates a shift from mere memorization to meaningful comprehension of mathematical logic and procedures.

3) Relevance of mathematics to real-world problem-solving: Learner 2 realization that *"math and world problem[s]"* are interconnected shows that the activities helped bridge the gap between mathematics and practical, real-world applications, which enhances engagement and highlights the subject's relevance to everyday experience.

4) Importance of problem-solving skills: Learner 3 recognized the *"significance of problem-solving and expressing a desire to enhance their problem-solving skills,"* indicating an understanding of its importance beyond math toward critical thinking and innovative solutions in various life aspects.

5) Importance of Materials and Hands-On Learning. Several learners pointed out that the absence of concrete learning materials, such as manipulatives for illustrating mathematical concepts, severely hindered their understanding. Learners 2 and 3 specifically noted the problem, stating, *"wala pa sang mga materials,"*

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

signifying that the lack of tools for visual and tactile engagement and Learner 1 mentioned, *"kung hindi mag-gamit sang materials mabudlay,*" that not using hands-on resources made it challenging.

E. Evidence of Developing Learners' Numeracy Skills Using Concrete Manipulatives

After the intervention utilizing concrete manipulatives, the team assessed the impact on the numeracy skills of the learners.

1) Understanding of Mathematical Concepts: The learners showed progress and an understanding of mathematical concepts; Learner 4 spoke of overcoming struggles with multiplication through practice, while Learner 3 aimed to tackle problems with larger numbers, stating their goal to *"Magdugang sang integers nga taas ang mga numero."* Learner 2 showcased a command over basic operations like addition, subtraction, multiplication, and division.

2) Impact of Concrete Manipulative Materials: The learners highlighted the significant role of concrete manipulatives in enhancing their mathematical understanding; Learner 1 noted these materials "*have helped me understand better,"* and Learner 4 recognized their long-term impact with *"Dahil ang ibat-ibang ginagamit na material ng mga guro kung magturo sila noon sa mga bata na ngayonay matatanda na."* Learner 3 affirmed the practical assistance of such tools in mastering *"the process of adding and subtracting fractions",* demonstrating the tangible benefits of incorporating cultural context into learning.

3) Mastery of Skills and Concepts: The learners showed mastery in mathematics; Learner 1 persevered to understand multiplication, Learner 4 aimed to tackle advanced addition and Learner 2 reflected proficient understanding of basic operations, and Learner 3 effectively recalled the steps for multiplication.

4) Motivation and Engagement: The learners' enthusiasm and motivation for mathematics were evident in their eagerness to explore new topics. Learner 1 expressed a desire to discover "many more things and different topics*"* and Learner 2 looking to understand "*Iban paguid nga unit sang measurement."* This shows their curiosity to learn. Learner 3's confidence in mastering division, noting it *"was not hard,"* further exemplifies their positive engagement in tackling complex subjects.

5) Areas for Future Development: The learners identified specific areas for improvement, showing their intention to progress; Learner 3 aimed to discover *"other methods for finding the least common denominator,"* while Learner 2 focused on learning to multiply higher numbers "*Magmultiply sang tag-as nga number."* This illustrates a clear understanding of their learning needs. Learner 4 showed a similar dedication, "*Kung paano mag add kag mag-buhin sang numbers,"* demonstrating a resolve to enhance their mathematical skills.

6) Appreciation for Teaching Approaches: The learners appreciated their teachers' varied teaching methods, with Learner 1 expressing gratitude for exposure to *"different topics that you teach"* and the use of diverse materials. This highlights the importance of well-rounded and tactile learning experiences.

7) Improved Numeracy Skills of the Learners After Intervention: Following an intervention with concrete manipulatives aimed at improving numeracy among learners, a quantitative analysis revealed varied levels of mastery across five competencies. The assessment showed a 63.13% mastery in operations on integers and 48% in operations on rational numbers. Mastery was higher in arranging real numbers, at 72.56%, but lower in approximating measurement quantities (46.82%) and solving unit conversion problems (52%). These results highlight the intervention's impact on enhancing the learners' numeracy skills across different numeracy areas, indicating areas of both strength and needed improvement.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue VII July 2024

Table 2 Improved Numeracy Skills of the Learners after Intervention

Learning Competency	Highest Possible Score	Mean Raw Score	Percentage
1. Performs operation on integers	15	9.47	63.13
2. Performs operations on rational numbers	15	7.20	48.00
3. Arrange real numbers in increasing and decreasing	9	6.53	72.56
4. Approximate the measure of quantities, particularly length, weight/ mass, volume, time, angle, temperature, and rate	40	18.73	46.82
5. Solves problems involving conversion of units of measurement	10	5.20	52.00

CONCLUSIONS

The study underscores the transformative impact of integrating localized materials like *taklong* (snail shells), stones, banana leaves, *uhay* (a type of grass), and *bolo* (bamboo sticks) into the curriculum, which enriches learners' numeracy skills by intertwining their community's context into education and fostering a contextually rich learning environment. However, gaps in operations with integers and rational numbers pinpoint the necessity for contextualized responsive instructional strategies to augment mathematical understanding and proficiency.

RECOMMENDATIONS

Integrating concrete manipulatives tailored to local contexts has significantly improved understanding and mastery of numeracy concepts despite the hurdles of foundational knowledge gaps and the pandemic's impact. This demonstrates that hands-on education strategies, which are locally relevant, can help address educational inequalities while enhancing learner participation and performance.

Students might find localized instructional materials such as *taklong* and *bolo* applicable to deepen their understanding of mathematical concepts and connect learning to life experiences. Mathematics teachers are encouraged to incorporate these local objects into their pedagogy, making learning more involving and connected to the learners' lives. In this regard, the Department of Education should focus on supporting and promoting curricula that employ such local inputs to raise numeracy skills for all learners.

Moreover, educational institutions can partner with local communities by producing transformative local materials that bridge everyday experiences with academic learning. Similarly, avid researchers should study how the use of localized materials in educational practice impacts it, and they could refine these materials, leading to widely adopted local teaching practices.

Further research is warranted to explore the long-term effects of local materials like *taklong*, stones, and bamboo on students' numeracy skills across different educational settings and cultural contexts. Comparative studies examining standardized versus localized teaching methods could yield insights for refining pedagogical practices and developing scalable, context-sensitive education models.

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