

Numeracy Readiness of SNED Learners Through Interactive Learning Towards an Inclusive Education

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Abstract—This quantitative study assessed how teachers use interactive learning strategies to support the numeracy readiness of SNED learners. Four forms of interactive learning were examined: sensory-based activities, audio-visual approaches, gamified activities, and the use of manipulatives. Numeracy readiness was examined through four skill areas: number sense, basic operations, functional skills, and shape recognition. A descriptive survey approach was used to examine the association between the study variables. Data were obtained from one hundred one (101) teachers in private and public elementary schools within the Schools Divisions of Padre Garcia and Lipa City. The mean ratings indicated that teachers viewed sensory-based (3.69), audio-visual (3.53), gamified (3.47), and manipulative (3.61) strategies as “More Effective.” For numeracy readiness, number sense received a “More Developed” rating (3.43), while basic operations (3.36), functional skills (3.41), and shape recognition (3.41) were rated “Developed.” Correlation analysis showed a statistically significant association between teachers’ use of interactive learning and their perceived extent of SNED learners’ numeracy readiness.

Index Terms—Numeracy Readiness, SNED Learners, Interactive Learning, Inclusive Education.

1. Introduction

Inclusive education calls for learning environments in which learners with disabilities can participate meaningfully and access instruction responsive to their needs. In the Philippine basic education context, policy initiatives have emphasized inclusive programs, identification of learners who require support, and appropriate educational provisions. These commitments place practical demands on teachers, who must adapt learning activities, materials, and classroom support to varied learner profiles.

Numeracy is a foundational competence that supports school learning and everyday participation. Number recognition, counting, basic operations, shape recognition, and the use of numbers in practical contexts can contribute to learners’ independence in activities involving money, time, measurement, schedules, and problem solving. For learners in Special Needs Education (SNED), instruction may need to make mathematical ideas more concrete and provide repeated opportunities for supported practice.

Interactive learning offers one approach for supporting this work. Sensory-based activities provide tactile and other perceptual experiences; audio-visual resources combine images, sound, and demonstrations; gamified activities use structured play and feedback; and manipulatives allow learners to represent mathematical concepts through objects. These approaches can be adapted to different levels of readiness, but their implementation may be constrained by limited materials, teacher workload, training needs, and the challenge of differentiating instruction.

The present study examined teachers’ ratings of interactive-learning approaches and their perceptions of SNED learners’ numeracy readiness in selected elementary schools in Lipa City and Padre Garcia, Batangas. It also explored whether ratings varied by teacher profile, whether interactive-learning ratings were associated with perceived numeracy readiness, and what challenges teachers reported. Because the study relied on teacher reports rather than direct learner testing, its findings describe perceived readiness and instructional practice, not independently measured learner performance.

2. Review of Related Literature

Research on interactive instruction emphasizes active participation, guided practice, and opportunities to explore ideas rather than relying exclusively on teacher explanation. For numeracy learning, learners may benefit when abstract symbols are linked with concrete objects, visuals, spoken explanations, and meaningful contexts. Multisensory approaches can provide different routes into a concept, while manipulatives can help learners represent quantities and operations in visible, tangible ways (Cuturi et al., 2021; Maningo et al., 2021).

Game-based and gamified approaches can introduce repeated practice, immediate feedback, and clear goals. Their value depends on alignment with the learning objective and on appropriate scaffolding; games should support the intended mathematical skill rather than function only as entertainment (Bado, 2019; Lukman et al., 2023). Audio-visual materials may also clarify ideas and sustain attention, although their usefulness depends on accessibility, relevance, and the learner’s opportunity to engage with the material.

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Inclusive education literature further stresses the need to respond to learner diversity through appropriate instructional support and continuing teacher development. A strategy that works for one learner or setting may need adjustment in another. For that reason, information about teachers' current practices, perceived learner readiness, and barriers to implementation can help schools plan support and identify areas requiring further investigation.

A. Statement of the Problem

The study primarily examined how interactive learning is used by teachers and how ready SNED learners are in selected areas of numeracy. It addressed the following research questions:

1. How may the participating teachers be described according to:
 1. age;
 2. sex
 3. position; and
 4. grade-level assignment?
2. How effective are the interactive-learning approaches used by teachers in terms of:
 1. Sensory-based;
 2. audio-visual;
 3. gamified; and
 4. manipulatives?
3. What level of numeracy readiness do teachers perceive among SNED learners with respect to:
 1. Number sense;
 2. Basic operations;
 3. Functional skills;
 4. Shapes recognition
4. Do ratings of interactive-learning effectiveness differ significantly across groups defined by the teachers' profile?
5. Is teachers' interactive-learning effectiveness significantly associated with their perceived numeracy readiness of SNED learners?
6. What difficulties are reported by teachers when working with SNED learners?
7. Based on the findings, what interactive-learning intervention may be proposed for SNED learners?

3. Methodology

A. Research Design and Participants

A quantitative descriptive-survey design was used. The participants were 102 teachers from selected public and private elementary schools in Lipa City and Padre Garcia, Batangas. They included SNED teachers, regular teachers handling mainstreamed SNED learners, and teacher aides supporting SNED or regular teachers. Purposive sampling was used because participants had experience relevant to teaching learners who require additional educational support.

B. Instrument and Data Collection

Data were collected using a researcher-developed questionnaire. The instrument covered teacher profile,

interactive-learning practices, perceived numeracy readiness, and challenges in teaching SNED learners. The questionnaire was reviewed by the research adviser and experts for relevance, clarity, format, and language, and it was pilot-tested before full administration. The researcher obtained the required permissions, explained the study to participants, and collected responses through available communication platforms, including Google Forms, email, and Facebook Messenger.

C. Data Analysis

Frequencies and percentages described participant characteristics and reported challenges. Weighted means summarized ratings of interactive-learning effectiveness and perceived numeracy readiness. Kruskal–Wallis tests were used to compare ratings across teacher-profile groups. Spearman's rank correlation was used to examine the association between interactive-learning effectiveness and perceived numeracy readiness. Statistical decisions were evaluated at the .05 significance level.

D. Ethical Considerations

The study reported that participant responses were treated confidentially and that research information was handled with reference to the Philippine Data Privacy Act of 2012 (Republic Act No. 10173). Electronic files were password-protected and access was restricted to the researcher and, when academically necessary, the adviser or panel. Participation was arranged to avoid disrupting teachers' professional responsibilities.

4. Results and Discussion

A. Participant Profile

The study included 102 teacher-respondents. The largest age group was 21–30 years (36.3%), followed by ages 31–40 (33.3%), 41–50 (23.5%), and 51 years and above (6.9%). Most respondents were female (75 of 102; 73.5%). Teacher I–VI was the largest position category (50 respondents; 49.0%), and 69 respondents (67.6%) were assigned to Grades 1–6. These characteristics describe the respondent group and should not be taken to represent all teachers in the two school divisions.

B. Ratings of Interactive-learning Approaches

All four approaches received ratings within the study's "More Effective" range. Sensory-based activities received the highest mean ($M = 3.69$), followed by manipulatives ($M = 3.61$), audio-visual approaches ($M = 3.53$), and gamified activities ($M = 3.47$). The pattern suggests that participating teachers viewed hands-on, sensory-supported activities particularly favorably. Manipulatives may help learners connect number symbols with quantities, while audio-visual resources and games can offer additional ways to present and practice mathematical concepts.

The ratings were positive but did not reach the study's "Highly Effective" category. This indicates room to strengthen the consistency and intentional use of interactive strategies. For example, activities can be selected according to a specific numeracy goal, adjusted to learner readiness, and followed by guided practice that helps learners connect concrete experiences

with mathematical language and symbols.

C. Perceived Numeracy Readiness

Number sense received an overall mean of 3.43 and was interpreted as “More Developed.” Basic operations received a mean of 3.36, functional skills 3.41, and shape recognition 3.41; each was interpreted as “Developed.” These results indicate that teachers perceived a comparatively stronger foundation in number sense, while the other areas remained in need of continued support.

Within number sense, identifying numerals in ascending and descending sequence received a mean of 3.53, while matching numerals with number words received 3.30. In basic operations, performing addition and subtraction accurately with objects or manipulatives received 3.48, while selecting the correct operation for a simple or picture problem received 3.27. For functional skills, sorting common household objects received 3.53, whereas measuring ingredients, lengths, or weights using objects received 3.32. In shape recognition, matching shapes to real-life objects received 3.54, while interpreting basic graphs or charts received 3.26.

The lower-rated indicators point to the value of extending instruction beyond recognition and routine performance. Teachers may provide supported practice that connects numerals with number words, develops selection of operations in simple problems, applies numbers to measurement and everyday routines, and builds interpretation of visual information. These interpretations are based on teacher perceptions; direct assessment would be required to establish learners’ actual proficiency.

D. Differences by Teacher Profile

The Kruskal–Wallis analyses did not show significant differences in sensory-based effectiveness ratings by age ($p = .549$), sex ($p = .600$), position ($p = .209$), or grade-level assignment ($p = .434$). For audio-visual approaches, significant differences were reported by position ($p = .008$) and grade-level assignment ($p = .003$), but not by age ($p = .564$) or sex ($p = .128$). For gamified activities, grade-level assignment was significant ($p = .020$), while age ($p = .512$), sex ($p = .166$), and position ($p = .186$) were not. For manipulatives, differences were significant by sex ($p = .003$) and position ($p = .019$), but not by age ($p = .715$) or grade-level assignment ($p = .185$).

These findings suggest that ratings were not uniformly different across all teacher characteristics. The significant comparisons may indicate that professional roles and the grade levels served relate to how some strategies are used or evaluated. However, the analyses do not establish why these differences occurred. Follow-up research could examine access to materials, professional development, teaching assignments, and actual classroom practices to clarify the patterns.

E. Association Between Interactive Learning and Perceived Numeracy Readiness

Spearman’s rank correlation showed a positive association between interactive-learning effectiveness ratings and perceived numeracy readiness ($\rho = .564$, $p < .001$). Teachers who gave higher ratings to interactive-learning approaches

tended also to give higher ratings to learners’ numeracy readiness. The association was statistically significant at the .05 level.

The result supports further consideration of interactive learning as part of inclusive numeracy instruction. Nevertheless, the study was correlational and used teacher perceptions for the relevant measures. It cannot establish that interactive learning caused improved numeracy readiness, and the results should not be interpreted as a direct measure of learner achievement.

F. Challenges in Teaching SNED Learners

Limited availability of instructional materials was the most frequently reported challenge, accounting for 84 recorded selections (19.0%). Lack of training for SNED learners accounted for 76 selections (17.2%), classroom-management challenges for 74 (16.7%), pressure to address diverse learning needs for 66 (14.9%), and heavy workload related to differentiated activities for 64 (14.5%). The least frequently reported challenge was limited skill in assessing SNED progress, with 10 selections (2.3%).

The results point to practical constraints that can limit teachers’ capacity to sustain differentiated, interactive instruction. School-level responses may include developing reusable and low-cost manipulatives, organizing teacher collaboration and professional development, and providing planning time and practical guidance for adapting activities. These actions are proposed implications of the findings and would need to be implemented and evaluated within local school conditions.

G. Proposed intervention: Project NUMERIC

The dissertation proposed Project Numeric Nurturing Understanding Through Multisensory and Engaging Interactive Curriculum for SNED Students as a structured intervention framework. It combines sensory-based numeracy activities, audio-visual reinforcement, gamified practice, and manipulative-based problem solving. Its stated objectives include strengthening basic operations, developing the ability to identify and work with common shapes, and building teachers’ capacity to plan differentiated interactive numeracy instruction.

The proposed framework can be organized around learner needs, available materials, teacher capacity-building, and ongoing monitoring. Low-cost objects can be used for counting, grouping, comparing, and simple operations; everyday scenarios can support functional numeracy; visual resources can reinforce concepts; and games can provide structured practice. As presented in the dissertation, Project NUMERIC is a proposed output rather than an intervention whose effectiveness was established by this survey. Its implementation should therefore include monitoring and evaluation before claims are made about its impact.

5. Conclusion

The following conclusions were drawn from the analyzed findings:

1. The profile results show that many participants were relatively young teachers in the early part of their careers and were working with pupils during the foundational years of schooling.
2. Teachers generally perceived sensory-based, audio-visual, gamified, and manipulative approaches as effective ways of supporting interactive numeracy instruction. The results indicate that active and concrete learning experiences are already being used, although some approaches still have room for stronger and more consistent implementation.
3. Teachers perceived SNED learners as having an established but still developing foundation in numeracy. Number sense emerged as the strongest area, while basic operations, functional skills, and shape recognition still require reinforcement. Continued scaffolded practice may help learners perform operations more independently, apply mathematics in everyday contexts, and handle more complex shape and visual-information tasks.
4. Differences in the reported effectiveness of interactive learning were associated with selected teacher characteristics, suggesting that experience, role, assignment, and other profile factors may influence how particular strategies are applied in practice.
5. The statistically significant association between interactive learning and perceived numeracy readiness indicates that stronger use of interactive approaches tends to occur alongside higher teacher ratings of SNED learners' numerical preparedness. Because the study is correlational and based on teacher perception, this finding should not be interpreted as direct evidence of causation.
6. Insufficient instructional resources remain a major barrier to effective SNED instruction. Limited materials can restrict the range of differentiated and interactive activities available to teachers and learners.
7. Project NUMERIC (Nurturing Understanding Through Multisensory and Engaging Interactive Curriculum for SNED Students) was proposed as an organized framework for strengthening numeracy instruction through multisensory, engaging, and accessible activities aligned with the needs identified in the research.

6. Recommendations

- Provide or develop low-cost, reusable instructional materials that support counting, operations, measurement, shape recognition, and functional mathematics.
- Offer professional development and collaborative planning opportunities focused on differentiated instruction and practical interactive numeracy strategies for SNED learners.
- Use structured activities linked to clear learning objectives, with appropriate scaffolding and opportunities to move from concrete representations toward symbols

and independent application.

- Pilot Project Numeric in participating or comparable schools and evaluate implementation, feasibility, and learner outcomes before wider adoption.
- Conduct future studies with direct learner assessments, broader samples, and longitudinal or intervention designs to examine changes in numeracy skills and the conditions under which interactive strategies are most useful.

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